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Introduction

Cultural geographers have a long research tradition of interest in settlement processes and settlement forms, particularly as they express and define the contemporary landscape. Most studies have pertained to settlement features such as house and barn types, location analyses, and agricultural patterns. These geographic studies have most often focused on the rural landscape, but recent work has also investigated the nature and distribution of settlement forms in urban areas.

Research accomplished by cultural geographers to date has emphasized the importance of the spatial arrangement of types of buildings in both rural and urban regions. In fact, Kirk Stone's comments on the nature of settlement geography narrowly defines the discipline to a study of "the analysis of the distribution of buildings"; but, as Terry Jordan suggests in his criticism of Stone's limited concept, it is also important to remember to study field patterns, house and barn types, and even the spatial arrangement of fences as they relate to the settlement landscape as a whole.

We agree that fence types and fence distribution is an important, but often overlooked, aspect of both the rural and urban scene; therefore, cultural geographers need to pay close attention to fencing as a functional part of any landscape analysis. Although anthropologists and even sociologists have spent considerable time researching the nature and significance of fences, cultural geographers have shown little interest up to this time.

The primary focus for the study of Settlement Geography has been concerned with structures other than fences as tools for analyzing and categorizing culture areas. Our research indicates that fencing plays a much more important role in settlement analysis than has been previously recognized. The shear

*Ms. Smith is a Cultural Geography student and photographer and Ms. Hardwick is a Cultural Geography instructor at Cosumnes River College in Sacramento.*
diversity of fence types makes the strongest statement on cultural variation within a region—shelterbelts, redwood barriers, picket, wrought iron, barbed wire, rock walls, chain link—these represent only some of the fence types available for study. Equally important, and offering an even broader base of study, was our investigation of the functions of fencing. Beyond the more obvious uses of fences for privacy, protection, and property enhancement, fences are also indicators of societal values, restrictions and laws, as well as of socioeconomic status and ethnicity.

A fascinating example of the importance of fencing in the settlement process occurred in the western United States. Consider the Great Plains "wars" between farmers and cattlemen. These battles were literally caused by fences... and later solved by fences. As people settled closer and closer together, first in small towns and later in larger communities, fencing became even more accepted in this peacemaking and peace-keeping role.

Research Questions

Our study focused on fences as important features in the urban landscape using a typical northern California city as a case study. We investigated several questions concerning the nature and distribution of fence types as settlement forms, including:

1. What historical and cultural factors have led to the use of fencing in our modern urban landscape?
2. What was the earliest type of fence used in California cities and what was the original purpose of fencing?
3. What other factors have led to the large-scale fencing now popular in urban neighborhoods in California?

Study Area

To answer these research questions concerning fence types and fencing functions, the city of Sacramento, California offers an excellent example for use as a case study. Sacramento's urban area provides a fine example of a pioneer California city that has been influenced by many diverse outside cultures. Because of its location at the confluence of two major rivers and at the entrance to one of the Sierra Nevada major pass routes, Sacramento developed into a major crossroads and focus for people migrating west. With them came some of the cultures which have influenced the settlement patterns in this western city.
Sacramento also was influenced by the influx of diverse cultural groups with the discovery of gold at nearby Coloma, and later by the completion of the transcontinental railroad to the city. Additionally, Sacramento has a rapidly expanding residential pattern of settlement in the modern landscape, thus offering an excellent location for the study of residential fencing of all types.

**Methodology**

Our earliest awareness of the variety of fence types in the Sacramento area began with field observations including map interpretation and photography. The wide variety of fencing was immediately evident especially in the area's residential neighborhoods. To understand these areal variations, we began with the earliest American settlement in our study region prior to the Gold Rush in 1848.

This early townscape analysis involved not only field work, but also archival research via old newspapers, journals, historical books, census data, and city directories. We also conducted interviews among leading authorities in the field of landscape design and with those who remembered the early days in our study area. Interviews with local fencing companies tied together the data.

**Fence Types and Functions in Early Sacramento**

In our observation of historic neighborhoods in Sacramento we noted variations in fence types according to the chronological settlement period of each area. Certain types of fencing were evidently most popular in pioneer Sacramento and were frequently associated with particular house types. For example, large Victorian homes were often surrounded by wrought iron, decorative fences, especially in the front yard,\(^7\) while smaller clapboard houses usually had low, picket fences.\(^8\) (Figure 1)

Fences mean different things to different people. They were used to keep things out, or simply as a decorative trim for a house. Some fencing was erected as a physical barrier either for protection or for privacy or as a boundary marker. These fences were usually thick, live hedges or narrow picket styles, and functioned to keep children and animals in or out. (Figure 2) The latter was an important function in early Sacramento since the city had many slaughter yards nearby. This necessitated driving animals through the city streets to the slaughter yards daily. Since the city was also a major railroad and agricultural processing town, sheep were frequently driven through town to the rail station or docks for export, thus making strong, front yard fencing important in residential areas.\(^9\)
Figure 1

Figure 2
Front yard fences serve important social and psychological functions. In the early days, wrought iron fences were a definite status symbol and added to the beauty and value of property. According to our local historical society, many owners of Victorian houses in Sacramento paid local artists to depict their property in a more architecturally complete manner by adding nonexistent fences to their renderings. Picket fences seemed to balance a bare front yard and also added a feeling of security and privacy to a small lot. Robert Frost's "Good fences make good neighbors" certainly was appropriate in the early days in Sacramento, especially as privacy became an issue of real concern for its crowded residents.

Fences also functioned as obvious boundary delineators in a crowded city where property was expensive and lots were small. (Figures 3 and 4) Privacy was at a real premium in residential areas of the city. The spatial closeness of neighbors in Sacramento must have made fencing almost a psychological necessity.

As an example of this neighborhood crowding factor, our field work took us to one of Sacramento's original residential areas, Alkali Flat. This region contains a good sampling of many types of Victorian homes, some still retaining their front yard fencing. One notices immediately that the homes are very close to the street; however, this factor seems to have very little to do with either the presence or absence of fences since the streets were widened considerably in the early days of settlement.

Widening the streets was only the beginning of the changes affecting Sacramento's residential front yards. In 1910, there was a drive by the Sacramento Chamber of Commerce to remove all front yard fencing for the purpose of urban beautification. And later, in 1942, Governor Olsen ordered the removal of decorative iron fencing from the third floor of the Capitol Building as well as from around many of the state gardens. This action showed his support for the war effort, and he encouraged many residents of Sacramento owning wrought iron fences to do the patriotic thing and join him in his efforts.

Front Yard Fencing in Sacramento's Contemporary Landscape

Our study of front yard fencing in modern Sacramento began with a photographic analysis. We then supplemented this general visual information with specific data gathered through interviews with local fence building companies. As the work progressed, it became evident that there seemed to be a direct correlation between fence types and factors such as age of neighborhood,
deterioration rates of particular areas, income, and even ethnicity.

Initially, front yard fencing is not common in the newer residential areas. This may be due to their location since new neighborhoods are primarily located in the suburbs where security is not usually perceived as a major issue. Where crime rates are highest, front yard fencing increases. Therefore, established older neighborhoods have more front yard fences in more varieties. Types of fences vary from live hedges to low brick or stone walls. In these areas, deterioration rates vary and evidences of deterioration seem to correlate with the larger use of front yard fences.

Income levels also contribute to the distribution of fencing in particular areas of the study region. Lower income neighborhoods rely almost exclusively on front yard fences, especially chain link. In larger, more affluent areas, however, we observed little or no use of fences in front yards. This was particularly noticeable in neighborhoods such as Old Land Park, McKinley Park, and parts of Fair Oaks. Where front yard enclosures were observed in these older areas, their purpose seemed to be "for architectural or landscape enhancement", rather than as a purely status oriented statement.

Neighborhood ethnicity plays a large part in the distribution and functions of fence types in Sacramento. In the small, older suburb of Bryte, for example, Russian immigrant houses are distinguishable from others by the always-present front yard hedge or fence (with a gate, usually locked, in the center of it). Italian and Portuguese owned homes in Bryte do not have front yard barriers as frequently. Perhaps Old World political conditions caused Russian immigrants to build from fear strong barriers around their property. Cultural attitudes do seem to have an effect on fence types and functions. Architect Bud Sauble, journalist and author Joel Garreau, and Roy Crenell, have all noted the importance of the Asian influence in North Pacific Coast fence styles. Screens and fence baffles that are commonly used in modern Sacramento in front yard gardens, atriums, and court yards all suggest this Asian influence.

The most obvious ethnic fence connection in our study area was based on early Spanish styles. Stucco walls are common throughout the city's residential areas, reflecting a fence building technique used throughout the Spanish world, both for outdoor and indoor privacy and protection.

Summary and Conclusions

Through field observation, photography, interviews, and archival research, we drew some conclusions concerning fence types in Sacramento and their
functions. First, the West Coast obsession with redwood as a building material has gradually changed due to increased costs. An example of this change is the "Good Neighbor" fence popular in the 1950's. This style of heavy board redwood front yard fence has almost entirely disappeared in modern Sacramento residential areas. Additionally, redwood is almost never used in front yards in any style fence. According to a recent article in Sunset magazine, the use of solid board redwood fencing is no longer popular in West Coast cities mainly for aesthetic reasons. Streets would necessarily take on the appearance and flavor of back alleys; board fencing is simply too restrictive in a culture that values a feeling of open space in residential areas.¹⁷ (Figure 5)

Chain link fencing was by far the dominant type of fence in our study. (Figure 6) We were astonished to find heavy use of chain fences in different parts of the city including older Victorian neighborhoods where small, twenty foot lots are very conducive to fencing; in rehabilitated, older neighborhoods; and even in block after block of middle income tract homes. Areas with a high percentage of minority groups were also included in this diverse group. The number one reason for the use of heavy fencing in these neighborhoods given by Sacramento fence companies was for security.¹⁸ Heavy chain link fencing seems to make a strong "Do Not Enter" statement on the modern landscape, certainly indicative of the rising crime rates in the urban region. Cost is another factor to consider in the increasing use of chain link fences in Sacramento.

We expect to see a transition in middle and upper class neighborhoods, where crime prevention is desirable, from no fencing or live hedges to the use of ornamental iron fences.¹⁹ Iron fences serve a function for security but are more aesthetically appealing than chain link. In Sacramento there are nearly as many iron work companies today as there were at the turn of the century. Modern iron fences are hollow rather than made of solid iron and compare more favorably in cost to chain link.

According to our research the demand for chain link fencing, as well as decorative iron fences, is increasing, and there appears to be no evidence that this will lessen in the near future. Most people will continue to build fences as high as building codes will allow it seems, and even will occasionally exceed Sacramento's three foot limit.

These local ordinances concerning the height of fencing in front yard areas emerged after World War II when California's urban areas exploded with growth. More stringent local ordinances were developed and implemented relating to the location and type of residential structures. Included in these
Figure 5

Figure 6

9
ordinances were strict guidelines concerning front yard fencing, and each city developed its own, individual height requirement. Sacramento was no exception, and the three foot limit was put into effect as tract developments spread throughout the urban area.\textsuperscript{20}

The limitations inherent in these ordinances are well explained by Crell:

How you landscape the area between the street and your house is up to you--and it isn't. This is a special residential precinct, a privately owned space traditionally treated as public in character. Its development is controlled by local restrictions and by social expectation.\textsuperscript{21}

In conclusion, local ordinances, social attitudes, ethnicity, income, and age of neighborhoods all contribute to the distribution of types of fences in the Sacramento urban area. The need to maintain some degree of privacy is also of prime importance in an urban area where properties are close together and diverse types of people co-exist. This last observation on privacy raises one final question for future research. Did the spatial closeness of neighborhoods in these crowded areas of Sacramento create a real need for fencing or simply a perceptual need? Did the earliest settlers, with their primarily European backgrounds, perceive a need for fencing because of some inherent, inborn cultural tradition? Did their heritage call for all property to be fenced as an integral aspect of the finished settlement product? Coming from a cultural background where order and organization are the accepted and ingrained norm, perhaps these early settlers and builders in Sacramento were simply acting on their cultural-historical values for spatial order and harmony.

Whatever the cause and function of fencing in urban Sacramento, a great variety of fence types exist in our study area. Unanswered research questions, such as the ideas posed above, certainly indicate a lack of data on fences in the Settlement Geography literature. We offer this research on the city of Sacramento as a beginning.
NOTES


6. Sociological researchers on this theme include Oscar Handlin, Suzanne Keller, and Stanley Lieberson; anthropologists include Stanford Gerber, Mark Leone, and Robert Schuyler.

7. These wrought iron fences typical of Victorian front yards were probably popular in Sacramento because of the iron foundry in the city and in nearby Sutter Creek; iron fencing also exposed the carefully pruned and well kept front yard of such a house.
8. Picket fences appear to have originated with German immigrants in Sacramento. This ethnic group constituted the majority of early Sacramento residents.


10. Interview with Dr. Joseph McGowan, Sacramento historian, March, 1981.

11. Paula Boghosian, (interview, March 18, 1981); Ms. Boghosian also suggested that artists usually did not include outhouses in their paintings of homes even though such structures were common on most Sacramento properties. Examining Thompson and West's History of Sacramento County reveals pictures of early homes with no outhouses and almost always fences!


17. Interview with Roy Crell, landscape architect, May, 1981.


19. Ibid.


Those who teach courses in resource conservation are aware that what they teach and what occurs in the "real world" are often at odds. Even competent and authoritative texts are outdated by a year or more before dissemination, and the increasing backlog of articles makes professional journals ever less responsive. Where correction for time lag involves updating statistics which do not substantially alter general interpretations, the problem is not particularly important to most of us. If an erroneous interpretation, based on conditions of some years ago, persists, the disparity is more serious. One example of the latter situation is in the field of conservation. Most students of resource management are familiar with the Pacific Salmon; the history of human use of the genus is known in broad outline, if not detail. The most affluent of pre-European North American societies owed much of their economic success to the salmon. The fish effectively harvested the productivity of the sea and carried it back to their natal streams on the spawning journey. Northwest Coast peoples lived well in a land offering little in the way of terrestrial resources, mostly because they took large numbers of salmon. In spite of heavy predation extending over millenia, early written accounts testify to the astonishing abundance of the fish. That population levels remained high was probably because freshwater spawning areas were not damaged.

This era of balanced predation ended with European settlement. Large scale commercial fishing, associated with canneries, began in the Sacramento River in the 1850's. As the runs in the Sacramento dwindled, intensive commercial fishing moved northward, tapping the resources of the Columbia, the Fraser, and

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*Jerry C. Towle is a member of the faculty at California State University, Fresno.

A Faculty Research Grant from California State University, Fresno aided the development of this paper. A number of busy people graciously took time to answer my questions, chief among these Robert Hager of the Washington Department of Fisheries. Mr. Hager and Bill Hopley, also of the Washington Department of Fisheries, reviewed this paper and made many helpful comments.
finally, Alaskan rivers by the end of the century. Early fishing methods emulated those of the Indian in that fish were taken as they entered the rivers to spawn. Unlike the Indian, commercial fishermen were working to supply a world market rather than local subsistence needs. As footloose entrepreneurs on a frontier, they paid little attention to conservation. In some cases, nets stretched entirely across rivers allowed no upstream escapement of spawners.

At the same time that fishing pressure increased, freshwater habitat deteriorated. Dam construction blocked access to many miles of spawning beds. Some dams had no fishways to carry the salmon around the obstruction. If fishways were incorporated, the loss was not total; yet mortality of spawners, and of juveniles migrating downstream inevitably increased. A number of other activities stressed the salmon. Hydraulic mining blanketed spawning gravels in the Sacramento system with thick layers of silt. Water diversion for agricultural and urban use so reduced the volume of some streams that returning adults could not navigate the shoals to reach their spawning beds.

Logging injures the fish in several ways. Storage of logs in estuaries produces an accumulation of toxic bark residues that can virtually eradicate marine life. Logging debris blocks upstream migration paths. Removal of trees alters erosion and sedimentation rates, so that spawning and rearing areas are subject to siltation or scouring floods. Dredging, pollution, and the expansion of port facilities have all diminished the utility of the estuarine nursery areas. In short, virtually every activity associated with economic development of the Pacific drainage has damaged the salmon runs. Even in British Columbia, where the extent of environmental modification is not great by U. S. standards, the number of adult fish returning to spawn each year was halved between 1860 and 1960. The losses experienced in Washington, Oregon, and California have been considerably more severe.

Current Assessments

The Pacific Salmon has come to epitomize the incompatibility of modern man and the natural order. Anthony Netboy notes that compared to the Atlantic Salmon: "...Pacific Salmon are much more numerous, but this abundance is bound to diminish under present policies, despite conservation programs in existence." He concludes: "Only a deceleration of industrial activity, coupled with something like the Indians' awe and veneration of the wondrous animals who supply us with food can ultimately save the salmon." A more recent text in the field of man-environment relationships states:
The Pacific Salmon is not ecologically extinct, but is perilously close to endangered status....Salmon have already been reduced by overfishing. If their spawning territory continues to be disturbed by logging, pollution, increased water temperatures, power dam construction, and other human interference, they will certainly become extinct in an ecological sense, if not in a biological one.

These are representative of the pessimistic assessments available to the layman. Given the unlikelihood of an economic and spiritual metamorphosis such as that proposed by Netboy, there will be, it is suggested, a sad, inevitable decline ending in extinction. Balanced exploitation has been supplanted by a terminal era of destructive predation, the end of which will be the end of the salmon.

This vision of the future cannot be totally disregarded; yet, there is considerable optimism in professional circles that the salmon will not be a twentieth century successor to the bison or the passenger pigeon. In 1975, the Canadian government undertook a Salmonid Enhancement Program, the goal of which is to restore the salmon to their pre-European levels of abundance within fifteen years. If successful, this will involve a doubling of current numbers. Commitments to increase numbers have since been made in Alaska, Washington, and California. We are at a point when destructive predation may be supplanted by a new era, one in which man will not only arrest, but reverse, the long process of decline.

A question which occurs is, "Why now?" Salmon numbers and range have been shrinking for more than a century, so that concerted action has started quite late. One reason for change is that management of salmon populations--both production and harvest--has been, until quite recently, the exclusive domain of the state. Those who are charged with allocation of a public resource face a growing number of claimants demanding their share of a dwindling supply. This problem is especially severe in the state of Washington, where a federal court ruling in 1974 awarded up to half of the annual allowable catch to treaty Indian fishermen.9 Government agencies confront the problem of mediating among trollers, net fishermen, sport anglers, and conservation groups, generally to the satisfaction of no one. Certainly, increasing the number of fish is the most obvious and important step in solving the allocation problem.

Economic considerations are also important. At a large scale, commercial salmon fisheries have been criticized as wasteful and inefficient, in that too many people have invested too much capital, when the harvest could be
accomplished with far less effort and gear. Yet the salmon, in most years, support North America's leading fishery by value. At the local level, fishing is the economic base of many small, isolated resource communities, particularly in Alaska and British Columbia. Saving the fishery by increasing numbers is, at present, more practical than finding alternative industries.

Biological Characteristics

The will to restore the salmon and the public concern over maintenance of the fishery are not recently developed attitudes. Ability to carry out enhancement projects is the second necessity, and this ability depends on recent advances in propagation technology. Some knowledge of the salmon's life history is necessary to the appreciation of these advances.

Although the salmon problem is often discussed as if there were only one species, the genus Oncorhynchus is represented by six species, five of which are native to North American waters. These are: the chinook, or king (O. tshawytscha), the coho (O. kisutch), the chum (O. keta), the sockeye (O. nerka), and the pink (O. gorbuscha). All species spawn in fresh water. All die after spawning. Juvenile salmon migrate downstream to the sea and attain their growth in salt water. As adults they return to their natal streams to perpetuate the process. All cease feeding upon entering fresh water.

There are, from a conservation and management perspective, significant differences among the species. Length of time spent in fresh water and freshwater habitat requirements vary. Chum and pink salmon begin their migration to the sea almost immediately upon hatching; they make little demand on the food resources of the stream. Coho and chinook may spend up to two years in fresh water; sockeye, three. At some time during their stream residency, coho, chinook, and sockeye undergo a series of physical and behavioral changes which readies them for survival in the sea. This process is called "smoltification", and the downstream migrants are smolts. Sockeye reproduce only on rivers which have lakes along their courses. Upon emergence, the young migrate to the lake and remain there for up to three years before descending to salt water.

Oceanic life histories also differ. Pink salmon have an unvarying cycle in that all adults return to spawn after spending slightly more than a year at sea. The others show more variability. Chinook generally return after two or three years at sea but may remain in salt water for up to five years. Chum ocean life spans range from two to six years. Coho generally spend 1½ years and sockeye two or three.
Feeding habits vary; coho and chinook are carnivores while chum, pink, and sockeye are planktivores. This affects fishing methods because coho and chinook are taken by trollers and sport fishermen and the other three do not readily strike lures.

In addition to differences among species there is considerable genetic variation within each species. Because salmon have a strong (though not absolute) tendency to spawn in their natal streams, the fish of each river system comprise a closed reproductive population. It is estimated that the five species are thus subdivided into as many as 10,000 ecological subspecies, or "stocks", which vary in such traits as size, time of spawning, or oceanic migration routes.12

Enhancement Strategies

Restoration of salmon populations, then, must depend on an array of techniques and strategies, each suited to species, stock, or environmental differences. Some are designed to rebuild natural stocks by improvement or expansion of freshwater spawning or rearing habitats, others to create artificial environments (Table 1).

Table 1
Major Facilities Considered for Canada's Salmonid Enhancement Program

<table>
<thead>
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<th>Type</th>
<th>Number</th>
<th>Maximum Annual Output (000)</th>
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<td>Fishway</td>
<td>4</td>
<td>347</td>
<td>pink</td>
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<tr>
<td>Lake Fertilization</td>
<td>9</td>
<td>1,815</td>
<td>sockeye</td>
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<td>Spawning Channel</td>
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<td>23,482</td>
<td>sockeye, pink, chum, coho, chinook</td>
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<td>Hatchery</td>
<td>28</td>
<td>4,882</td>
<td>chinook, chum, coho</td>
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<td>Rearing Pond</td>
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<td>264</td>
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<td>Box</td>
<td>22</td>
<td>2,419</td>
<td>chum, coho, pink, chinook</td>
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Source: Fisheries and Environment Canada, Fisheries and Marine Service, The Salmonid Enhancement Program (Vancouver: Salmonid Enhancement Program, 1978). This is a candidate list of projects, some of which may not be constructed.
Fishways and stream clearance projects aid migration of spawners by providing a route around barriers or removing obstructions in the stream bed. Where such barriers have denied access to otherwise suitable spawning grounds, salmon may colonize and extend their range in a stream system. In economic terms these projects are very practical; maintenance expenditures are low, and eighteen of the twenty fishways constructed on the Pacific Coast since 1954 have paid for construction costs by increased contribution to the fisheries.

Flow and temperature controls can aid the salmon in several ways. Where water levels impede or delay upstream migrations, release of water from reservoirs at critical times reduces mortality of spawners. The same practice may aid downstream movement of juveniles. Stream temperatures can be modified by releasing water from different levels in a reservoir. During the upstream migration of adults, colder water is desirable because it can hold more dissolved oxygen. In streams where coho and chinook juveniles are resident, warmer water can, up to a point, increase growth rates.

Lake fertilization is a recent innovation applicable to sockeye enhancement. The lakes in which juvenile sockeye reside are typically nutrient-poor oligotrophic bodies. Addition of nitrogen fertilizer—a sort of mild, deliberate eutrophication—increases primary productivity of the lake, and ultimately increases salmon growth and survival rates. Ocean survival rates correlate positively with size of smolts, so that the fishery should harvest more adults. Testing this technique in British Columbia and Alaska indicates that large returns can be expected from modest investments.

In-stream feeding is a variant of this technique used to increase carrying capacity for juvenile coho and chinook. In some ways, both lake fertilization and in-stream feeding are less manipulations than restoration of original conditions. The carcasses of spawners were an important source of aquatic nutrients, and helped to provide food for the next generation. Where salmon runs had declined, the productivity of lakes and streams likewise diminished. All of these strategies allow the salmon to spawn under natural conditions; humanity intervenes to increase survival rates of wild fish in fresh water.

Other techniques demand creation of new environments and more direct control of reproduction and early life. Spawning channels are, essentially, man-made streams in which ideal spawning conditions are maintained. The salmon spawn naturally, but control of gravel quality, flow, and the density of fish increases egg-to-fry survival by as much as four to eight times over natural settings.
Hatcheries involve complete human control of reproduction. A portion of the returning adults are directed to holding ponds where they remain until ready to spawn. Eggs and milt are taken and mixed artificially, and the fertilized eggs are kept on trays until hatching. After emergence, the young salmon are typically kept in ponds or rearing channels and fed until the optimal time of release. Length of retention time varies with the natural life history of the species; coho and spring chinook generally remain for over a year before release, fall chinook for about three months to a year depending on stock, and chum and pink anywhere from a few days to three months. Few sockeye are produced in hatcheries, mostly because of persistent disease problems.

Hatcheries, though increasingly efficient, have some drawbacks; they are expensive to build, demand considerable labor, and require large amounts of water which, ideally, does not experience great seasonal fluctuations. A large expanse of level land is necessary for construction of facilities. The incubation box needs less space, water, and labor. Eggs are taken in the same manner as in standard hatcheries and placed in trays or in layers alternating with layers of gravel. Water enters the box at the base and percolates upward to flow out near the top. Upon hatching, the fry may follow the outflow and enter the stream. An incubation box measuring 12 x 5 x 5 feet has a capacity of 500,000 chum eggs and, under ideal conditions, will produce 400-450,000 fry. Their greatest utility is in bolstering populations in streams which are too small, too remote, or lacking in level land sufficient for hatchery construction.

The problem of restoring the salmon, then, may be attacked in diverse ways; proposed major facilities in the Canadian Salmonid Enhancement Program employ most of these strategies. Rebuilding natural populations is an important aspect of all programs; however, because hatcheries represent the fastest (and most controversial) method, ensuing commentary focuses on hatchery technology.

**Early Efforts**

Hatcheries are not recent innovations. Artificial propagation of salmon on the Pacific slope dates back to 1872, and a number of hatcheries were constructed before 1900 in an effort to restore dwindling populations. They were generally unsuccessful in arresting the decline. The reason for their inefficiency was that mortality rates at the egg and fry stages were equal to, or greater than, those in natural populations. Diseases related to temperature
or density were common in hatchery ponds. Where young fish were held for a time before release diet was a persistent problem. Most commonly, juvenile salmon were fed ground fish scraps consisting largely of the caracasses of their parents. Whatever the economic efficiency of this arrangement, the diet was not only nutritionally inadequate, but probably helped to pass on diseases from one generation to the next. Decomposition of uneaten food lowered oxygen levels and further stressed the fish. Development of a satisfactory diet was not accomplished until 1959.18

In other cases, lack of knowledge of the salmon's life history or environmental requirements hindered restoration work. The first hatcheries were built at a time when it was not yet known that all Pacific Salmon die after spawning. Sockeye raised in early hatcheries were often released in places where they had no access to lakes; in these cases, mortality rates were probably 100 percent. Cannery operations in Alaska were, at one time, required by law to operate hatcheries of sufficient capacity to produce four salmon for each one caught.19 Even if this law could have been enforced, it showed no understanding of the low survival rates of juvenile salmon; in some modern hatcheries, an adult return of five percent is considered adequate.

Early hatcheries often released fish as unfed fry immediately after emergence so that few survived the journey to salt water. In short, although most streams of any size had hatcheries along their courses at one time or another, and although large numbers of eggs were taken and young released, there is no evidence that all of this activity contributed much to the number of returning adults until about 1960. The fact that most public hatcheries were built only in response to specific losses of spawning water also lessened their effectiveness. Such mitigation projects, in theory, replaced the number of fish lost when, for example, a dam denied access to upstream migrants. Even if these facilities had been up to their stated task, they could not have kept pace with losses caused by overfishing, logging, or other less place-specific processes.

Modern Improvements

Modern hatcheries are not only more efficient than their predecessors but considerably more efficient than nature. The basis of success is greatly reduced mortality at the egg-fry stage. In Japanese rivers, egg-fry survival is about eight percent in natural spawning beds and 79 percent in hatcheries.20 North American figures are comparable.21 Although subsequent mortality rates
are somewhat higher in the hatchery stock they are proportionately much less significant than the original tenfold gain.

Improved diet and the practice of feeding for extended periods before release have reduced early mortality and accelerated growth rates. Young coho and spring chinook are held at hatcheries until they become smolts and are physically equipped to enter salt water. The smolting process depends on time as well as size. Fish not released upon smolting tend to revert to the previous stage, and will then not readily migrate to the sea when liberated. If the salmon attain a larger size before smolting, they will better withstand the rigors of their downstream migration and contribute more to adult populations. Ideally, fish released at the proper time and size will move quickly to salt water, avoiding the danger of stream predators and putting little pressure on food resources in the stream. Because egg-fry survival has probably reached the limits of improvement, current research is concerned largely with identifying optimal size and time of release.

Successful adaptation to salt water is dependent on release time, and survival of smolts could be increased if hatchery fish were released at the time of maximum readiness to migrate. Mortality rates of those which enter salt water before the optimum time may be as high as 50 percent, with many of the survivors stunted. A recent study has linked capacity for salt water survival of coho smolts with high levels of the hormone thyroxine. Further, the study indicates that maximum thyroxine levels occur within a day of a new moon in March or April. If this is correct, release time can be calculated precisely without time-consuming blood tests, and survival of smolts increased to well over 90 percent.

In some cases smolts are transferred directly to the estuary by truck, completely bypassing the downstream migration. This is done if there is a critical barrier to migration, or if loss to predators is potentially very high. Chinook and steelhead stocks of the Snake River and its Idaho tributaries have declined precipitously in recent years. Juvenile migrants must negotiate eight dams and reservoirs on their way to the Pacific; the attendant high mortality at this stage is responsible for the decline. Survival of these stocks may depend on transportation of smolts past the obstacles. An experimental study indicates that survival rates measured by the number of returning adult spawners increased from 11 to 15 times as a result of transportation, and that there is no significant loss of homing instinct. In California, a number of chinook
smolts in the Sacramento River system are released in the estuary each year. Fish liberated upstream move down toward the sea at the same time that striped bass migrate upstream; the result is heavy predation on the young salmon. A more laborious means of accomplishing the same thing was attempted in Alaska; Arctic char, a major predator on sockeye juveniles in the Agulouok system, were netted and held in captivity until the seaward migration was completed.

If all the techniques available to increase fresh water survival are applied, hatchery advantages over nature are enormous. In the Sacramento system it is estimated that 100,000 chinook, held for a year and released in the estuary, will yield the same number of returning adults as 40 million eggs in a natural spawning bed.

Modern hatcheries date from approximately 1960. Those constructed much earlier either closed or adopted new methods. There has been considerable construction of new facilities since 1960, particularly of holding and rearing ponds (Figures 1 and 2). The number of juvenile fish released from hatcheries has likewise increased. Estimated releases from all hatcheries in the Pacific drainage of North America have grown from slightly less than 150 million fish in 1960 to more than 400 million in 1980. Moreover, because of the widespread practice of holding juvenile salmon for extended feeding periods, the average size of the smolts at release is considerably larger than in 1960. The increase measured in pounds is more impressive.

**Private Producers**

Technological advances have been paralleled by other innovations in salmon production, chief of which is the re-emergence of private hatcheries. Facilities operated by individuals or corporations were among the earliest developed, but public agencies assumed control of propagation by the 1920's. The state of Oregon authorized private sea ranching operations in 1971 and has since issued twenty permits for release of salmon by private concerns. Maximum permitted releases total 180 million fish annually; actual numbers released are considerably less. In 1978, about 12 million juveniles were produced. Sea ranching is a process in which private hatchery operators turn young salmon out to sea and are permitted to sell the adults which return to the release facility. The fish are common property while in the sea and may be taken by commercial and sport fishermen. Losses during the oceanic free-wandering phase are expected to be high; at current prices, however, an adult return of one to two percent is enough to insure a profit. Sea ranching operations range from small
Salmon Propagation Facilities of North America 1976

Figure 1
Salmon Propagation Facilities of Alaska 1976

Figure 2
individual endeavors to highly capitalized subsidiaries of major corporations; the largest, Oregon Aqua Foods (Ore-Aqua), is a part of the Weyerhauser Corporation. Ore-Aqua hatchery and rearing ponds are located well inland at Springfield, Oregon. Heated water from a Weyerhauser paper plant is mixed with cool river water to provide ideal temperatures. One benefit of temperature control is that the rate of maturation of coho may be accelerated; smolts are produced in six months rather than the customary fourteen to eighteen. The smolts are then trucked to coastal release facilities and held for several weeks to habituate them to salt water. Chemicals added to the water in the holding ponds "imprint" the site on the fish so that they will return as adults. This operation represents the greatest degree of human control over salmon populations yet achieved. Even the need for a river flowing to the sea is eliminated.

However, sea ranching is not yet well established. Most of the authorized establishments have not released fish, and returns from the first large Ore-Aqua coho release occurred in the fall of 1979. This first return was disappointing; only about 0.5 percent of the smolts were recaptured as adults. Fall, 1980 returns improved to 0.8 percent, and 1981 to about 1.3 percent. It is likely, however, that this low rate of return will not be a permanent liability. Accelerated smolts, whatever the advantage in feeding costs, do not survive well at sea compared to those which have spent the normal length of time in fresh water. The improvement in return witnessed in 1981 may well be due to release of fish in 1980 which had experienced a longer rearing period. Presumably, increasing precision of release timing will result in higher returns. Too, Ore-Aqua has been purchasing surplus eggs from Washington State hatcheries on Puget Sound, and introduced stocks generally have low survival rates for the first year of return. Development of indigenous stock will, in theory, also lead to higher returns.

Lack of eggs is an important limiting factor to expansion. At present, all private operations purchase surplus eggs from public hatcheries. State laws regulate importation of eggs from other regions so that diseases will not spread to wild stocks or so that hatchery fish will not endanger local stocks through competition or genetic contamination. Thus, Columbia River coho cannot be released along the Oregon coast because of genetic and disease concerns. Chum salmon are not yet raised in sufficient quantities in North America to permit large diversions to private hatcheries. Importation of chum eggs from the Soviet Union has been authorized but only small quantities delivered.

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Chinook, the most valuable species, cannot be imported. Oregon coastal stocks are genetically different from those of the Columbia and Puget Sound so that accidental hybridization could reduce the fitness of wild populations. State authorities have encouraged a system which will develop sea ranching stocks from local wild chinook populations. Wild fish are captured and spawned in hatcheries. Some of the fingerlings are returned to their native streams; the remainder are reared in the hatchery. Because hatcheries have a much higher egg-to-fry survival rate it is possible to build wild populations and hatchery stocks at the same time. This procedure overcomes the problems of introducing foreign stocks but does not encourage rapid expansion.

Political opposition has slowed growth as well. Sea-ranching is essentially confined to Oregon; California has granted one special permit but there is no general authorizing legislation. Washington, British Columbia, and Alaska have not yet granted any permits. Opposition quite naturally comes from commercial fishing organizations who fear competition. In Oregon, an appeal from fisherman's groups effectively blocked plans of the Crown-Zellerbach Corporation to begin sea-ranching on Tillamook Bay. The court ruling stated that the company must first prove that release of salmon would not unduly alter the ecology of the bay. 33

In 1980, the Oregon Department of Fish and Wildlife announced a five-year moratorium on granting new licenses and froze the release quotas of authorized firms. The basis of this decision was the observation that, after 1967, increasing numbers of hatchery produced coho did not result in increasing numbers of returning adults. One interpretation is that the carrying capacity of the oceanic feeding grounds has been reached and that further competition from artificially produced smolts will stress the already depressed wild stocks.

Alaska has encouraged the establishment of private non-profit hatcheries. These differ from sea-ranching operations; fish returning to the facility may be sold only if the money is used for salmon-related research or hatchery expansion. Profits stem from increased oceanic catches rather than recapture at the place of release. Native American groups and fishermen's co-operatives, long severe critics of state and federal policies, are thus involved in production as well as harvest.

In addition to large scale private projects, there has also been an increase in voluntary activity aimed at salmon restoration. Many small stream clearance and rehabilitation projects have been carried out by volunteer
groups. Actual production of salmon by non-professionals has expanded since development of the incubation box. Scout troops, school science classes, and prisoner's volunteer work groups have all maintained incubation box projects in British Columbia. Although the total number of fish produced is small incubation boxes are valuable in preserving salmon runs in small streams. Too, public involvement is important in establishing support for restoration programs at a larger scale.

Pen rearing of salmon is another recent innovation although different in intent from the others. There is no free oceanic phase in this system; rather, the fish are confined in estuarine net enclosures and fed until they reach a weight of approximately 3/4 pound. They are then marketed to compete with pond-grown rainbow trout. There are currently three such operations in North America--two in Washington and one in British Columbia.

Humanity has been very successful over the past twenty years in increasing the survival rate of the salmon in fresh water. The sea life of the fish is still outside the realm of human control; short of slaughtering seals little can be done to protect salmon from predators. Yet, knowledge of oceanic migration routes and survival rates has grown appreciably. The coded wire tag, developed in 1963, was instrumental in allowing efficient tagging and retrieval of marked fish. A short piece of wire marked with a unique color or binary code is inserted into the snout of the young salmon before release. The adipose fin--which has no role in swimming--is clipped to identify the fish as bearing a tag, and the tag is retrieved when the salmon is caught or returns to the spawning area. Analyses of returns are used to establish migration patterns of different stocks and to evaluate their contribution to the various fisheries. The results of experimental manipulation in hatcheries may be ascertained by tag recoveries; fisheries managers can learn the effect of, e.g., delayed release or dietary modification on oceanic behavior and survival rates.

In theory, then, the question of survival is answered affirmatively. Given the series of successful innovations summarized above, salmon will not become extinct and may well increase in numbers and range. Operations such as Ore-Aqua show that the genus can be maintained even if fresh water spawning and rearing areas continue to deteriorate. At least one fisheries biologist is of the opinion that given the availability of fresh water rearing sites, the carrying capacity of the sea is the only remaining natural limit to restoration.
Problems of the New Era

Although the possibility of extinction seems remote there are new problems which transcend the question of survival. The most obvious of these is preservation of wild stocks in an age of increasing hatchery production. An animal whose existence depends on human intervention, especially in reproduction, is at least on the way to being domesticated. As hatchery production comes to be a dominant mode some would argue that the salmon will be saved in the same sense that the aurochs lives on in modern dairy cattle. The effort to preserve wild stocks is essentially concentrated on the Pacific drainage of North America; Japan and the Soviet Union, both large scale producers of hatchery fish, place little importance on the restoration of natural runs.

Animal domestication is often followed by extinction of the wild form. This is a distinct possibility in the case of the salmon even with the best intentions of preserving wild fish. The very efficiency of modern hatcheries poses a threat to naturally spawning populations. Because of the high egg-to-fry survival rate in hatcheries few adult spawners are needed to maintain population levels. Hatchery stocks can withstand exploitation rates of 90-95 percent without serious difficulty. Presumably, if recent experiments to determine the optimum release time of hatchery smolts prove successful this figure would be even higher. Wild stocks, with much lower juvenile survival, need more spawners to produce the same number of adults. Maximum sustained exploitation rates are, accordingly, lower; 60-65 percent is the critical upper limit. Under current fishing regulations most salmon are taken at sea when fish from many rivers and from both hatchery and wild origins are mingled. If the allowable catch is calculated to reach hatchery exploitation levels wild populations suffer fishing pressures heavier than they can bear. If, as is presently the case, catch levels are calculated to preserve wild stocks hatcheries are used inefficiently. Spawners often return to hatchery racks far in excess of the number needed to produce the next generation. These fish are not necessarily wasted; surplus eggs may be sold to private concerns or used to bolster populations in other streams. The adults may be sold on the market although physical deterioration suffered during the upstream migration reduces their value. Ideally, however, state agencies would prefer to leave harvest and marketing to the private sector. Too, relations between fishermen and management agencies became strained when fishing seasons are severely curtailed in the name of conservation and hatcheries retake huge surplus numbers of fish.
The biologically rational solution is to delay harvest until stocks have separated and entered their home streams. If this were done hatchery fish could be taken more efficiently and natural stocks protected assuming that there were no hatcheries on a wild-stock stream or that the hatchery stock returned to the river at a different time than the wild fish. Ocean fishing is the despair of fisheries managers. Even apart from the mixed stock problem critics point out that sea fishing takes salmon before they have reached maximum size and that imposition of size limits is no real solution; a high percentage of undersized fish die after release.

In economic terms, the expenditure of capital, energy, and labor is far greater than necessary; there is no need to pursue a fish that is, predictably, going to return to the river. One critic said:

The native people who preceded the Europeans on these Pacific shores had the good sense to build live traps in the river mouths and wait for the salmon to swim into them. Managing such a system is quite simple—so many for the cooking pot, so many released alive for seed to maintain the stock.

It is time to take a tip from our predecessors on these shores and try to set up a management system that will allow us to handle this magnificent resource in a sensible manner. To do this, we must first recognize the foolishness of fishing for salmon on the high seas and agree to stop it!

The economic and biological rectitude of this argument seems unassailable; yet social and political pressures militate against abolition of ocean fishing. Resources are allocated to preserve ways of life as well as to promote economic efficiency. The right of Native Americans to take salmon in ways and places denied to other fishermen derives from ancient cultural and symbolic importance accorded the fish. Something of the same supra-economic legitimacy may be granted to a third or fourth-generation salmon troller. Too, trolling replaced a system where salmon were caught by net in rivers. Wealthy entrepreneurs gained virtual monopolies by purchasing land on both sides of the stream near the mouth. The evolution of ocean fisheries democratized the industry by allowing more people to harvest the fish. A return to terminal fishing equates fishing rights with property rights, and once again allocates the resource to the wealthy.

Thus, while ocean fishing may be phased out gradually no one expects it to happen quickly. The problem of managing a mixed stock fishery and, therefore, the threat to wild populations will remain.
Conclusion

Advances in hatchery technology over the past two decades would seem to insure the survival of Pacific salmon in sufficient numbers to remain economically important. Presumably, hatcheries could go on producing if every stream became unfit for spawning. The crucial issue, at least in North America, is how to accommodate this increase in artificially produced salmon while retaining wild stocks. For many people the salmon is only secondarily a resource to be exploited and preservation a hollow victory if wild fish no longer ascend the coastal rivers.
NOTES


3. Fullerton, E. C., "Statement Made at the Joint Legislative Hearing Regarding SB547", Walnut Creek, California, October 24, 1979.


17. Wahle and Smith, op. cit., footnote 2.


20. McNeil, William J., "Potential for Salmon Aquaculture in Alaska", in Rosenberg, op. cit., footnote 1, pp. 25-68; reference on p. 31. These are from 1966; egg-fry survival in hatcheries may be as high as 90 percent now.


23. Portland (Oregon) Sunday Oregonian, August 9, 1981.


26. Schafer, William, California Department of Fish and Game, personal communication, April, 1976.


Introduction

In 1966 this author wrote a paper for The California Geographer titled "A Modified Köppen Classification of California's Climate According to Recent Data", complete with a multi-color map delimiting the various climatological regions of the state. Mainly due to a scarcity of data at that time no attempt was made to classify the climate of Southern California's offshore islands. Through Faculty Research Grants and Geography Department funding, while a member of the University of California, Santa Barbara faculty (1966-68), and later through unfunded research, the author was involved with meteorological studies of the Santa Barbara coast and Channel Islands. Initially this involved the establishment of two weather stations (recording temperature and precipitation, and in one case, evaporation) on the immediate Santa Barbara shoreline plus three others on Santa Cruz Island. Collection of data from these stations continued sporadically until the mid-1970's. Analysis of this data coupled with studies of meteorological information from San Nicolas, Santa Catalina, Anacapa, and San Miguel Islands has led to a better understanding of Southern California's Island Climates. It was also found that in the case of the largest offshore island, Santa Cruz, due to local topography, the interior isn't very "Maritime" at all!

This paper will briefly discuss the temperature regime of the Channel Islands and include them, and the remainder of Southern California's offshore islands, in a revised "Modified Köppen Classification of California's Climates" map patterned after the original publication in 1966. The map, a portion of which is included herein, was printed by the California Department of Water Resources in a special publication in 1975. This entire topic was the subject

*John W. James is Adjunct Professor in the Department of Geography, University of Nevada, Reno, Nevada 89557, and President of Mtn. West Weather Service, Meteorological Consultants, Reno, Nevada.

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of a paper presented at the Annual Meeting of the California Council for Geographic Education in Redding in May, 1980.\textsuperscript{3}

\textbf{Some Notes on the Temperature Regime of Southern California's Channel Islands}

Prior to the mid-1960's the only climate information available for the Channel Islands (from west to east: San Miguel, Santa Rosa, Santa Cruz, and Anacapa) (Figure 1) was sporadic records of precipitation and temperature from San Miguel (1894-1917, 1940-42, and 1945-46), and Anacapa (1946-55).\textsuperscript{4} Official records indicate no measurements on Santa Rosa or Santa Cruz, although cattle ranches on both islands have maintained off-and-on precipitation records from unofficial gauges for many years.

In 1966 three climate stations were installed on Santa Cruz Island - at Chinese (Prisoners) Harbor (temperature), in the Central Valley (temperature and precipitation), and on South Ridge (precipitation). (Figure 2) These stations were maintained by persons taking care of University of California research at the Central Valley Field Station. Charts were changed weekly (or bi-weekly) until the mid-1970's when data collection ended. However, during this roughly ten year period of existence, many blanks occur in the records due to equipment problems, neglect, and general lack of interest. There are enough data, though, to give some insight into a very unusual "interior" climate unknown except to the local ranch owner and workers and to island experts. This "interior" climate is generally devoid of the maritime influences that characterize the California coast and the other offshore islands, especially during the summer half-year.

Santa Cruz Island, largest California offshore island, is oriented west-east, approximately 23 miles long and 7 miles wide at its widest point (Figure 2). The highest elevation on the islands is also here in Picacho Diablo, at a height of 2,450' (Figure 3). Santa Catalina reaches only 2,125', San Clemente reaches 1,965', and Santa Rosa reaches 1,574'. All others have summits less than 1,000'. Santa Cruz Island also has a topographic anomaly not found in the other islands - an interior valley surrounded by summits generally over 1,000' and over 1,500' in the western half of the lowland. This graben, or Central Valley, as it is called (Figures 4 and 5) was caused by the same kind of tectonic forces that at one time isolated the Channel Islands from the onshore Santa Monica Mountains of which they were a part. Thus, with some geomorphic assistance, a climatic oddity was created.

In the early 1960's the owner of most of Santa Cruz Island granted the
Figure 1.
Figure 2. Santa Cruz Island Weather Stations (circled)
1. Prisoner's Harbor
2. Central Valley
3. South Ridge
Figure 3. View west of Santa Cruz Island. Picacho Diablo is high point in background.
Figure 4. View east down the Central Valley Graben on Santa Cruz Island. U.C. Field Research Station is located in trees in valley just over ridge in foreground.
Figure 5. View from South Ridge northwest across Central Valley of Santa Cruz Island toward 2,450' Picacho Diablo, highest point of Southern California's Islands. U.C. Field Research Station is located in trees in valley in lower right hand corner of photo.
University of California the right to conduct various types of scientific research on the island. This research right also included the use of one of the many ranch buildings on the island, in this case in the middle of the Central Valley. The author became involved in coastal research when, arriving in Santa Barbara in 1966, he was told about the hot summers at the Santa Cruz Island research field station as compared to the immediate coastal region. Thus, in the Fall of 1966 hygrothermographs were installed in thermometer shelters at the field station in the Central Valley (Figure 6) and at Chinese Harbor on the north side of the island (Figure 7) about 3 air miles northeast of the Valley station. In addition, recording precipitation gauges were installed at the Central Valley site and at the 1,500' level on South Ridge just southwest of the field station site (Figures 6 and 8).

Although data collection at the Valley site was sporadic it was sufficient to indicate very pronounced temperature differences between the Chinese Harbor and Central Valley sites, especially during the summer half-year. In fact, the climate of the Central Valley (at least the western half where topography isolates the area from marine influences) can be rated as Csa (Mediterranean with a warm summer) as the average temperature of the warmest month, July, is over 73°F. This is greater than the 71.6°F average used by Köppen to separate the "a" and "b" climates and about 11°F higher than that measured at the Chinese Harbor site (62°F). Even in September, normally the warmest month on California's beaches, the Harbor site averaged 64°F (average maximum, 70°F; average minimum, 52°F). Table I summarizes the summer temperature regions for the two sites for the period of record, 1967-74.

| TABLE I |
| Summer Temperatures (°F) at Two Locations on Santa Cruz Island, California, 1967-74 (all months do not have complete data) |

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Figure 6. View southwest toward U.C. Field Research Station (in grove of Eucalyptus Trees) in Central Valley of Santa Cruz Island. Weather Station is circled. South Ridge is in background.
Figure 7. View west overlooking Prisoner's Harbor on north side of Santa Cruz Island. Weather Station is circled.
Figure 8. South Ridge recording rain gage. View south. Elevation 1,500'. Rough wooden barrier is to prevent cattle from damaging gage.
At the Central Valley site 100°F or greater was reached at least once during each July and August of record but during only about half the Septembers; while at the beach site, the mercury passed 90°F only twice during the period of available record and that was during September. In addition, diurnal ranges in the Central Valley occasionally exceeded 60°F (e.g., June, 1968--high of 99°F and low of 38°F; and July, 1971--high of 105°F and low of 44°F). Such diurnal ranges are more common in elevated valley bottoms in dry interior locations but are not common near marine influenced coastlines. However, similar large-scale diurnal temperature ranges were found only 14 miles inland from the central California coast where topography was also the main factor in creating "continental" temperature ranges near the shoreline.5

Available temperature data from now nonoperative weather stations on Anacapa and San Miguel Islands show them to be completely marine in temperature. In part, the latter station, even though not contemporary with Chinese Harbor on Santa Cruz, showed similar characteristics, especially during summer.

A Revised Modified Köppen Classification of California's Climates Map

A portion of the original Climates of California map published in The California Geographer is repeated here as Figure 9 with the addition of the classification of Southern California's islands. For discussion purposes they can be divided into Southern and Northern Groups with the Channel Islands forming the Northern Group and, from west to east, San Nicolas, Santa Barbara, San Clemente, and Santa Catalina forming the Southern Group (Figure 1).

Uninhabited San Miguel Island, the westernmost of the Channel Islands, does not show on the climate map (nor did it on the 1966 map), but it is just 3 miles west of Santa Rosa Island across the San Miguel Passage. Data from a weather station located here many years ago, plus the fact that the island has the lowest elevation of all the islands (high point is 831'), except tiny Santa Barbara, puts it entirely into the Csb category. Nearby Santa Cruz is somewhat more complex due to the higher interior elevations (high point is 1,574') that do not have the frequency of fog that would qualify for the "n" classification. Thus, the island is shown as Csb (outer portions of the island) and Csb (interior area, generally above 1,000'). As discussed earlier, Santa Cruz Island is unique among the offshore islands in that a Csa, or warm summer, climate is found in at least the western half of the interior Central Valley. With that exception, Csb and Csb climates make up the major portion of the island.

Uninhabited Anacapa (Figure 10), too small to show on the Climate map and about
Figure 9. A Modified Köppen Classification of Southern California's Islands.
Figure 10. View east, of Anacapa Island(s). U.S. Navy site and weather station was located here.
5 miles east of Santa Cruz Island, has a Csbn climate.

The westernmost of the Southern Group of Southern California islands, San Nicolas, has a climate that is probably borderline between Bshn and Csbn. Precipitation data collected by the U. S. Navy on the island tends to put it in the former category. However, too much missing data make it difficult to assess the true average precipitation at this site. In addition, although it is a very windy location, no windshield was placed on either the non-recording or recording gauge further depleting the precipitation gauge catch. On the map, San Nicolas is shown as Csbn but could easily be Bshn in the Modified Köppen scheme.

Tiny, uninhabited Santa Barbara Island is probably in the same category as San Nicolas – either Bshn or Csbn climate and probably the former due to lack of elevation (less than 100' above sea level at the highest point compared to 905' on San Nicolas) sufficient to generate orographic precipitation during the winter wet season.

No official weather data have ever been collected on San Clemente Island, southernmost of the California Islands; so the climate there is only supposition. Precipitation is probably lower than on Santa Catalina due to location west and south of that island in a drier region and higher than on San Nicolas due to greater elevation (1,965'). In fact, the entire island is a long NW-SE tilted fault block with the gentle slope facing west. As much as one third of the island is above 1,000'. This abrupt elevation increase from sea level encourages winter orographic rainfall and should make the island wet enough to qualify for the Csb category with enough foggy days on the island fringes to receive the Csbn classification.

Santa Catalina has the longest weather record of the islands, data having been collected at Avalon since 1909. Records do not indicate any other data collection points on the island, but considering the Avalon data and the island topography, it is thought to have a Csbn climate with Csb in the interior at higher elevations. Although no large interior valley exists, such as the Central Valley on Santa Cruz, the eastern portion of Middle Canyon, west of Avalon on the western slope of the island, may be topographically isolated enough (ridges between 1,000' and 2,000' surround it on 3 sides) to have also a Csa climate.

Conclusion

Climate classification of Southern California's islands is a challenge due to the lack of weather data. Only one island, Santa Catalina, has had a weather record long enough to have great validity. Of the other islands, only
3 (San Miguel, Anacapa, and San Nicolas) have ever had official weather stations, and in all those cases the period of record was short with much missing data making it difficult to assess the climate. Due to a "rumored" unusual "hot summer" interior valley, weather stations were installed on Santa Cruz Island to compare the shoreline and interior climates. These stations operated about 7 years, and although plagued with missing data, indicated that the contrast between the marine and interior locations was great (about 11°F for average monthly temperatures during summer months) due to topographic isolation from the summer marine influence.

The data also showed that a true Mediterranean with a warm summer climate (Csa) existed in a portion of Santa Cruz Island's Central Valley.

Although some question exists as to the exact climate classification of San Nicolas and San Clemente Islands and portions of the interior of Santa Catalina Island (due to lack of data) these areas were included in the revised California Climate map included in this study.

Further research into the climate of Southern California's islands would be an important addition to our understanding of both California's and the Eastern Pacific's physical geography. Such research could lead to further revisions of the California Climates map.
NOTES


2. James, John W., Climates of California, California Department of Water Resources Special Publication, 1975.


Machine space is a topic that first received attention in the geographic literature in the works of Horvath and Bunge. Like earlier divisions of the world into the inorganic, organic, and superorganic realms, Bunge categorized things into mankind, machinekind, and nature. He then discussed the kinds of space occupied by various species within these taxonomic kingdoms. Such things as streets and railways were identified as examples of machine space. Horvath also wrote of machine space and introduced the notion of automobile territory. In East Lansing and Detroit he provided an example of how this kind of space expands and eventually comes to dominate the landscape.

Another form of machine space, which is very much like automobile space and railroad space, is computer space. Bunge alluded to this kind of space when he described missiles and computerized bombs being safely buried beneath our cities while we leave our children exposed to danger at the surface. Bunge's image is not without basis. For example, at one time banks and insurance companies were fond of displaying newly acquired computer equipment in their front windows. Then, after a few were destroyed during urban riots, they were hastily removed to basement locations, deep within the earth, safe from harm.

In his discussion of machine space, Horvath pointed out that although this space, exemplified by such things as rails and asphalt, may be occupied only occasionally, it is clearly allocated for full-time use by machines. The same description might apply to computer space as well, except that human beings cannot occupy computer space in quite the same way. Instead, elements of culture (messages and ideas) occupy it for infinitesimal units of time.

Until recently, computers existed in small, discrete, geographically insignificant parcels of territory. At this scale computer space was beneath the notice of geographers, although it did occupy the attention of industrial engineers and scholars interested in such things as crowding and the proximate environment. Today these isolated units of machine space are increasingly being...
joined together into unified grids called computer networks. What used to be a geography of minuscule points is rapidly becoming a geography of routeways visible at the continental scale.

**Computer Networks**

There are three levels of computer organization. These include individual computer systems, distributed computer systems, and computer networks. An individual system consists of a central computer, called a mainframe or host processor, connected to a number of interactive terminals by telephone or by permanent lines. These terminals, which do nothing more than communicate with the host processor, are called "dumb" terminals. A distributed computer system also contains a single mainframe processor and a number of interactive terminals. Unlike an individual system, however, it also contains a number of interactive terminals that are small autonomous computers themselves. These machines, which are called "smart" terminals, can perform many small processing functions alone without having to engage the mainframe system. This is a great advantage in many instances because it frees the main computer for more important tasks. Autonomy is what separates a distributed system from an individual system. For a computer system to be truly distributed its component devices must be autonomous and must be capable of operating independently. At various times a number of peripheral units may interact with each other or with a more powerful host processor, but they must perform at least some of their processing functions alone. Although these peripheral units augment the host processor, they do not replace it, and a single host computer remains the most important part of a distributed system. Today, distributed computing is rapidly growing in popularity and about 10% of all newly installed systems fall in this category.

A computer network is a collection of computers and computer terminals connected together by a communications system. Within the network are central mainframe computers and smaller peripheral computers located at remote sites. Computer networks are larger than distributed systems and they usually contain more than one mainframe processor. These large computers are connected to interactive terminals, small autonomous computers, and other mainframe processors devoted to network control. All the machines of the network constantly interact with one another and thus form a spatially distributed electronic entity.

Computer networks are sometimes referred to as distributed data processing systems, although it is often argued that networks and distributed systems are completely different technologies. For example, it is sometimes held that
networks are less specialized in function and have fewer processing capabilities at remote sites than distributed systems. At the same time, there are many instances where a single central processing unit connected to dozens of interactive terminals is called a network. As a general rule, however, a network is anything that links up different mainframe processors and operates over great distances.

Computer networking got its start in the mid-1950's when programmers began transmitting digital data from one computer to another over telephone lines. The early 1960's saw the rise of several small data processing networks but it wasn't until the early 1970's that this new technology began to have much of an impact on the nation's business and research communities.

Networks grew in importance as they provided solutions to two major problems encountered by the computer using community. The first involved access to and control of information necessary for the running of a business. Originally, corporations tended to maintain single mainframe processors at central locations. These monolithic, remote, and frequently overburdened setups were often denounced by their users as being unresponsive to their needs. The introduction of networks overcame this problem and gave many users direct access to data that had previously been denied them. Although many data processing managers strongly opposed the decentralization that resulted, field managers in remote locations welcomed it since it provided them with better information about business operations in less time. Networks thus enabled corporations and other operational concerns to decentralize and move many of their operations from a central office out to remote field locations where business is actually being transacted.

The second problem involved the transfer of information over great distances. Before the advent of computer network technology, whenever it was necessary to transfer digital data between different metropolitan areas it had to be recorded on magnetic tape or cassettes and either shipped through the mail or hand carried from one city to another. This process took a great deal of time and was highly inefficient. Later, such transfers could be made instantaneously via the computer network.

**Machine Space Networks**

Computer networks are large extended regions of machine space but they are not unique. There are other kinds of machine space that exhibit network properties and their geometric form is similar if not identical to that of computer networks. Through the years geographers have described and analyzed many such
machine space networks. Among these are railroad networks, airline networks, highway networks, pipeline networks, power transmission networks, and television networks.\(^{18}\)

Although the literature on these other forms of machine space is extensive, there is nothing in the geographic literature on computer networks. They are apparently so new that no one has yet considered them as spatial phenomena. It is also rare to find computers in general treated as legitimate objects of geographic study.\(^{19}\) There are, however, a great number of articles dealing with the use of the computer as a tool. For example, many papers and monographs deal with the use of computers in cartography and drafting.\(^{20}\) There are also many publications that deal with computers as aids in teaching. These works describe various sorts of computer games and simulations of geographic processes.\(^{21}\) There is also a great amount of material dealing with the use of computers in data manipulation and statistics.

The lack of material on computer networks is unfortunate. Computer networks are economic tools and major elements in the rapidly expanding information industry. This industry is not only becoming one of the most important sectors in our economy, but it also has the particular ability to shrink and eliminate space. For this reason, as well as the fact that computer networks form spatial patterns in the landscape, computer networks should be of special interest to geographers. As Leighly might have put it, computers and the transmission lines that link them together are examples of cultural immobilia in the landscape and are thus worthy of geographic study.\(^{22}\)

Like other geographic phenomena, machine space can be approached in several different ways. It can be treated descriptively, it can be treated ideologically, or it can be treated analytically. Analytical approaches can take three different forms: the genetic, the mathematical, or the functional. In genetic, or historical, explanations, the evolution and the diffusion pattern of a network is usually described and various factors pertaining to why it spread in some directions and not others are discussed.

Machine space networks have also been subjected to geometric analysis. This has been very popular in the past and it will continue to be in the future. Most geographers have at least a passing interest in the geometric regularities that these networks possess and in most cases networks are useful in revealing the geometric form of a nation's urban hierarchy. In this country the urban hierarchy has manifested itself through such evolving phenomena as highways and canals, railroads, telegraph and telephone lines, and finally airlines and

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television networks. All of these systems share a family resemblance. In all of them, things move between cities and the pathways are marked by lines on a map. Computer networks are extending this evolutionary trend. New linkages are being formed between cities and these connections are bringing cities together in different ways than before. Places that heretofore had little importance in the nation's hierarchy are assuming higher positions by virtue of their newly forged information links with other places. As Pred has pointed out, these between-place information links are highly important in the formation and growth of urban systems. Attempts to measure hierarchical relationships among cities on the basis of computer networking is premature, however. At present the networks are simply changing too rapidly for such relationships to have any meaning. Nevertheless, several places are beginning to stand out as centers of activity within the networks of many different companies. In the west, the Los Angeles and San Francisco areas have become prominent as have Chicago and Dallas in the midwest. Out east, important network nodes include Atlanta, Washington, New York, and Boston. Several new places have also emerged with names that were unfamiliar only a decade ago. Just as places like Ypsilanti, Idlewild, and Inglewood acquired prominence during the air age, so also do we now find places like Silicon Valley and Research Triangle entering into the lexicon on the computer age landscape.

Machine space networks have also been analyzed functionally, that is to say, how do they work and how are they used by human beings? Technical descriptions of a phenomenon are part of this approach. There are several reasons why geographers should be interested in functional explanations of how computer networks operate. In the future, more and more geographers will be getting jobs in the computer field and it will be important for them to understand how computer networks function. Similarly, geographers in business and in planning agencies will find an increasing need to use computer networks in their work. Academic geographers as well will find access to this new technology opening up new research opportunities. Many functional aspects of the computer network industry will be of interest to individuals wishing to use them and to teach about them just as some of the technical aspects of the airline and travel industry have been of interest to the geographer-­layman wishing to use this information in teaching and in personal travel. Other examples of how geographic phenomena have been functionally treated are endless.
There are many terms that describe the different kinds of networks currently in existence. Some describe ownership, some describe services that the network provides, and some describe how the network functions electronically. All networks can be divided into two types: resident and external. A resident network is composed of a number of interconnected computers of the same make (such as IBM, Hewlett Packard, or Burroughs). Machines made by the same company can communicate with each other without any software modifications. Machines made by different companies cannot. An external network is programmed to accept and pass on information between computers made by different manufacturers. An external network contains within it special processors called nodes. These processors concentrate entirely on operating the network. A node receives a message from a user's computer and translates it into the language of the network using a coding procedure called a protocol. The message is then sent to another node which translates it into the language of the receiving computer. An external network is, therefore, more flexible than a resident network since it is independent of the kind of computer attached to it.

In both resident and external networks there are five primary components. The first of these is a central computer. Most networks have readily identifiable central site processors called host nodes. These host nodes are mainframe systems (like an IBM 370, a DEC 10, or a UNIVAC 1106) used for such things as network control, the management of data, and large-volume batch processing. All computer networks have at least one of these mainframe computers and many have more than one. When they are available to all users they are called dedicated central processing units.

The second, third, and fourth components include devices that control the communication lines between the elements of the system, devices that supervise the terminals operated by the users, and the terminals themselves. These relatively low cost remote terminals are placed at many different geographical locations throughout the system. These remote terminals are often small computers themselves (called micro-processors and mini-computers) and they process many transactions independently of the mainframe computers. Many of them are as powerful today as host processors were fifteen years ago. Remote terminals also transmit information to the mainframe computers over a communication network. In most networks remote terminals have access to the entire range of devices existing within the system.

The fifth component of the computer network is the linkage pattern. This
is the most visible part of the network and the one that interests geographers the most. The linkage pattern of the computer network shows how data is transmitted between the different places in the system. The most universally used medium of transmitting data is the telephone line, but information is also being transmitted through communication satellites like Western Union's WESTAR I. Other forms of transmission include microwave radio, undersea cable, television cable, and the still experimental optical fiber.

In most cases the companies that own the means of transmission are not the ones operating computer networks. There is a separation between computer networks and electronic communication networks, although outwardly they appear to be the same thing. Companies like Bell Telephone, General Telephone, Western Union, and Southern Pacific, which own public service transmission lines, are called common carriers. Common carriers can lease their electronic communication lines directly to customers wishing to transmit data between their own computers. Common carriers can also lease lines to large customers who in turn sell space on these lines to small customers. These customers can interface their own computers with the common carrier network either through dial-up phone lines or through permanently wired connections.

An individual business can build its own private computer network by purchasing node processors from a manufacturer and permanently leasing telephone lines. These networks are often called single purpose networks and include such things as airline reservation systems and the electronic funds transfer systems of the banking industry. Private networks are often economical when there is a large volume of traffic. However, if a company has many offices and its volume of traffic is low, a private system can be prohibitively expensive.

When the computer traffic of an individual company is not great enough to warrant the expense of leasing a transmission line from a common carrier it is usually cheaper to connect its computers together through a previously established public network. Public data networks cater to such companies by offering both temporary and permanently leased circuits between branch offices. These public data networks themselves lease lines directly from the common carriers. They then sell time on their permanently leased lines to customers wishing temporary or limited access to network facilities. In addition to data transmission, many of these companies make available specialized computer related services like image transmission, electronic mail, and computer related consulting services. Such companies are called value-added networks, or VANs. Most customers of value-added networks use them to get inexpensive services in areas
where their own inhouse networks don't reach. This is a great advantage for a small company that needs to utilize a nation-wide computer network but lacks the financial resources to build its own system. VANs are particularly useful when data volumes are low.

**Computer Network Applications**

Computer networks have many current and future applications and are presently being utilized in such widely diverse fields as the insurance industry, government, health care delivery, banking, manufacturing, and retailing. Organizations and businesses often link computers together in order to share workloads. This is one solution to the problem of owning or having access to a number of different computers that are not in the same location. It also solves the problem of inadequate capacities at individual sites. Linking many different kinds of computers together is expensive and difficult. However, there are many advantages to such a strategy. Linking many small systems together creates a giant that has great economic and technical advantages over all of the smaller systems operating alone. For example, each computer in a system might specialize in some specific function that no other computer in the system can do quite as well by itself. One machine may contain a specialized data base such as a computerized planning library. Another may have a large storage bank of unique computational routines or a compiler for a highly specialized or powerful computer language. Another may have an enormous memory capacity or an unusual input-output device.

The reliability of a network is also higher than its components are individually. If a given machine is down, for example, programmers at that location need not wait until it begins working again. Instead, they can feed their programs into the network and run them at other locations. Similarly, during network failures, satellite processors can continue to work independently. Networks also allow workloads to be shared. If the work at one location is too much for its machine to handle, the excess can be sent to another location where the activity is not as great. This advantage is highest when a network spans many different time zones. In California, for example, programmers are still busy running programs three hours after their counterparts on the east coast have gone home. Other advantages include faster turn around time for certain problems and lower costs to the members of the system.

In recent years the cost of computer hardware has been falling more rapidly than the cost of communication services. For this reason it has become cheaper
for a business to locate small computers at remote sites where they can handle some of the less complex chores than to transmit all its raw data over expensive phone lines to a central site for processing.\textsuperscript{38} This has led to increasing amounts of within-network autonomy throughout the industry. Line costs and direct satellite communication with city centers may in fact eventually eliminate the need for land lines altogether and computer networking will undergo yet another technological revolution.\textsuperscript{39}

\textit{Some Representative Networks}

During the past decade many new public data networks have appeared throughout much of the industrialized world. At present there are several hundred of them with names like CYBERNET, ARPANET, SWIFT, DATAPAC, INFOSWITCH, TRANSPAC, EURONET, TYMNET, and INFONET. Their network configurations change quite rapidly as new links are added and as the connections between nodes are altered or discontinued. It is often difficult even for people in the industry itself to keep track of the spatial transformations they undergo from one month to the next.

Today, the computer network field is exactly like the airline industry during the late 1920's and early 1930's. It is expanding rapidly and new companies are entering the field every few months. The networks of several of the larger companies now in existence are shown in Figures 1-3. These maps constitute a partial record of this industry as it looked during its infancy, much as a similar record of the airline industry during its adolescence appeared in an article by Robert Platt over thirty years ago.\textsuperscript{40}

The first of these networks, TYMNET (Figure 1), was founded in 1969 and has its corporate offices in Cupertino, California, right in the heart of Silicon Valley. Its main regional headquarters are in Santa Clara, California and Vienna, Virginia. TYMNET currently supports over 500 network nodes and is expanding at a rate of more than 20 nodes per month. It has 50,000 geographically dispersed users and over 300 customer host computers. Its network includes nearly 534 lines representing over 86,000 circuit miles. Users can connect to the network with a simple inexpensive local telephone call in nearly 250 domestic and international metropolitan areas.\textsuperscript{41} TYMNET's customers include oil companies, banks, hospitals, libraries, research firms, and universities. The network provides such services as timesharing, credit card processing, inventory control, accounting, statistical analysis, data base management, computer aided instruction, word processing, geological research, and electronic mail. TYMNET allows its customers to interconnect fully terminals, computers, and even entire
Computer Network of Tymeshore Inc. (TYMNET)
(After Edwards and Broadwell 1979)
networks. A local phone call will connect a customer's computer outlet with a local TYMNET node. If a customer is located outside of a major metropolitan area, services to the nearest TYMNET node can be provided with a WATS line.

The second network shown is INFONET, the computer network of the Computer Sciences Corporation (Figure 2). The company is headquartered in El Segundo, California and has other major facilities in Chicago, Washington, Houston, Cape Canaveral, Huntsville, Sacramento, and Moorestown, New Jersey. The company was founded in 1959 and its Information Network Division, which is responsible for INFONET, was formed ten years later.

INFONET serves users throughout the world with communication lines extending over 150,000 circuit miles. The network currently consists of leased circuits interconnected by processors in North and South America, Europe, and Australia. Access from other points is provided through links with other systems. INFONET's host processors, located in the United States, are accessed by customers located in more than 50 different countries.

INFONET clients range from large corporations to small businesses and include many government agencies at the federal, state, and local levels. In addition to networking facilities the company provides its customers with many computer related services. These include data storage, pre-developed computer programs, the preparation of tax returns and payrolls, and a number of other general accounting services. The company also provides consulting services in the fields of environmental science, oceanography, and physics.

The third network shown is the MARK III system operated by General Electric (Figure 3). This network is available from local telephones in over 600 cities in 24 different countries. It provides both interactive and batch processing as well as computer support services like customer training, access to program libraries, and consulting services in programming and system design.

The system's domestic host computers are located in Cleveland and in Rockville, Maryland. In Europe there is another host computer located in Amsterdam. Tying the host computers and their peripheral subsystems together is a set of network lines operated by the General Electric Company. These are not voice lines and they are maintained separately from conventional Bell System lines since they are owned by General Electric.

Prospects

As computer networks expand, the realm of machine space also expands. This can be viewed in several different ways. Horvath and Bunge have taken an
Computer Network of The Computer Sciences Corp. (INFONET)
(After McGlynn 1978)
Computer Network of The General Electric Co. (MARK III)
alarmist view. Bunge, for example, recoils in horror from "radioactive computer bombs" that threaten to destroy mankind and advocates the dismantling of various forms of machine space. Horvath, on the other hand, simply advocates the "monitoring" of certain kinds of machine space. Bunge also calls for such things as the "separation" of machine space and children space, the "protection" of children from machine space, and the "conversion" of machine space to people space. Both Bunge and Horvath specifically advocate the mapping of machine space as a preliminary to any other discussion, as if to say that when the true extent of machine space is exposed, there will be a reaction. In this paper three examples of a new kind of machine space have been mapped. However, a more sanguine view will be taken as regards its future. The expansion of machine space is value neutral. It is neither good nor bad. It simply is. Just as domestic corn cannot survive and reproduce itself without the aid of man, so also has man domesticated himself to the point where he can no longer survive without the aid of his machines. In this and the next century machine space will continue to expand. Computer networks will increasingly be used by the nation's colleges and universities. Today, research libraries are being linked via networks to hundreds of data bases. Eventually, entire libraries will be tied together into one large data retrieval system. Each college, no matter how isolated, will then have immediate access to all the resources available in, say, the Library of Congress. It may then come to pass that another form of space called Academic Siberia will gradually disappear.
NOTES


16. Ibid., p. 32; McGlynn, op. cit., p. vii; Edwards, op. cit., p. 166.


42. Furlong, James, "Fact Sheet on Computer Sciences Corporation", (El Segundo, California, Computer Sciences Corporation, 1981, Mimeo.).


46. Horvath, op. cit., p. 186.


48. Bunge, "Geography of Human Survival", op. cit., p. 291; Horvath, op. cit., p. 188.
WHERE IS SOUTHERN CALIFORNIA?

Willis H. Miller

Southern California is one of the best known and least well defined regions of the United States. The purpose of this paper is to establish the boundaries of an area which merits identification as an important part of the nation.

Where is Southern California?

California is big—158,693 square miles (Fig. 1). This compares with 116,303 square miles for Italy and 142,726 for Japan. The state extends about 625 miles from north to south, and has an average width of approximately 200 miles. However, since it is shaped rather like a banana, its maximum east-west extent is some 570 miles. Because of this situation, Los Angeles is 235 miles east of San Francisco and even is 85 miles east of Reno, Nevada.

California is variform. The Central Valley extends from just north of Los Angeles County to Redding in Shasta County. The Sierra Nevada and associated mountains reach from Los Angeles County to Oregon, and the Coast Ranges stretch from Mexico to Oregon. Much of southeastern California is desert, but so is the San Joaquin Valley almost to Stockton, and a portion of eastern Lassen County has less than 10 inches of annual precipitation (1:27,30). By contrast, parts of northwestern California have over 100 inches. The highest and the lowest points in the continental United States are only about 100 miles apart. There are redwood forests and drifting sand dunes, rushing rivers and dry washes, lush farms and expanses of virtually unproductive land, two major metropolitan centers, and vast areas where places of human habitation are few.

History and Types of Regionalism.

It is not surprising that a state as large and diverse as California has a history and a variety of regionalism. Seven Indian language families and more than 30 Indian tribes occupied recognizable areas in what is now California, but none of them had much geographic validity (1:43-44).

*Dr. Willis H. Miller is San Diego County Director of Planning Emeritus.
Figure 1. The Miller Line, proposed as the north boundary of Southern California, and the location of selected places in California.
The California coast north to Cape Mendocino was explored in 1542-43 by Cabrillo and his lieutenant, Ferreló, but the Spanish made no move to establish settlements until 1769 when Portola and Serra built a presidio and a mission in San Diego. By 1823 a chain of 21 missions, four presidios and two pueblos--Los Angeles and San Jose--were functioning along the coast between San Diego and San Francisco. These outposts, strung out along El Camino Real, were divided into four districts: San Diego, Santa Barbara, Monterey, and San Francisco (Fig. 2), (1:52). They were coast-oriented and had some degree of regional quality.

During the Spanish and Mexican periods, the south central area was the most populous. However, the gold rush starting in 1849 changed this situation rapidly. San Francisco became a city of dominant size and influence. Gold fields in the Sierra foothills and intervening portions of the Sacramento and San Joaquin Valleys also attracted thousands of new people.

Between that time and about World War I, San Francisco truly was "The City", and Northern California ruled supreme. Southern California then was referred to with considerable but decreasing truth as the cow counties.

An even increasing flood of new people from the east gradually reversed this imbalance. Southern California now has almost two-thirds of the population of the state (2:11-15). San Francisco trails Los Angeles and San Diego as the third largest city, and is being hard pressed by San Jose to maintain that position (2:11-15). Northern California relinquished its statewide economic, political, and social hegemony bit by bit and with extreme reluctance. However, metropolitan San Francisco is the capital of Northern California, and it can be expected to remain so.

Although the north-south division is the overwhelmingly most important regional feature in California, there are lesser ones. For example, San Diego resents being overshadowed by Los Angeles, and San Francisco considers itself unique. The central coast counties feel some bond of common interest, as does the territory east of the Sierra Nevada. The Sacramento Bee still has a section called "Superior California New", both to whet local ego and to distinguish its area from communities to the south. Imperial County is somewhat isolated and introspective, and people in the San Fernando Valley talk about splitting off a piece of Los Angeles County for themselves.
Figure 2. Spanish administrative districts in California.
West, South, and East Boundaries

The southern part of California is bounded on the west by the Pacific Ocean, on the south by Mexico, and on the east by Arizona and Nevada. For purposes of this paper these lines are considered firm although this assumption is not entirely true.

In November, 1853, James Gadsden, chief negotiator for the United States on the treaty which implemented the Gadsden Purchase from Mexico, was engaged in delicate conversations which he is reported to have thought probably would have resulted in the cession of Lower California (3:317). The chance for this major territorial acquisition, with its possible effect on the southern boundary of California, ended because just then William Walker made his ill-starred armed incursion into that peninsula from California. The United States Senate voted on six different lines before a final one was approved and the treaty was adopted (3:330 plus following maps). The difference between this and the "take it or leave it" Salt II approach is noteworthy.

One of the most difficult problems faced by the California Constitutional Convention in 1849 was a decision on the eastern boundary of the new state. Proposals ranged from taking in the whole Mexican Cession, to the 116th meridian, or to the crest of the Sierra Nevada (4:411-417). The present boundary ultimately was adopted. Nevertheless, in 1979 litigation was pending before the United States Supreme Court on a dispute between California and Nevada over 3,600 acres (5:A3).

The North Boundary

It is the north boundary of Southern California which is the least obvious and the most difficult to establish. California resists division into northern and southern parts, each of which has landscape and other features unique unto itself, and which are not shared by the other. Yet there is a Southern California and there is a Northern California.

The first impulse is to divide the state in two with a diagonal northeast-southwest line. A second impulse is to draw a line across the state which approximates the "break point" between the spheres of influence of Los Angeles and of San Francisco. Fortunately both lines are quite similar from the Pacific Ocean to the crest of the Sierra Nevada.

The "Miller Line", which is proposed as the dividing line between Southern California and Northern California, has represented county boundaries since 1870 (Fig. 1), (6:59). Each of these regions is a major part of an area
tributary to a great metropolitan center, and each has important characteristics which make it significantly different from the other. This line follows county boundaries because counties are important units of local government in California and because to depart from them would not result in any meaningful refinement. It is interesting that most of Mono County, here designated as part of Southern California, is north of San Francisco.

As so defined, Southern California includes 14 of the state's 58 counties and comprises 76,376 square miles, or 43.4 percent of its total area (2:1-2). On January 1, 1979, it had an estimated population of 14,354,450 which was 63.4 percent of the state total (2:11-15).

The validity of this region is tested below from numerous points of view which are considered relevant. A good many other "regional" divisions of California were inspected and discarded as not being realistic. Included were most federal and state political and administrative districts. A truly horrible example is found in the Federal Court system where the Southern California District consists of San Diego and Imperial Counties while Los Angeles County is part of the Central California District (Fig. 3), (7:278).

Topography and Drainage

Now is the time to exorcise the myth about Southern California being "south of the Tehachapi". This notion has been in the vernacular for a long time, especially in the north. It was concisely stated by Carey McWilliams, a prolific writer on California subjects, when he said, "Southern California is the land 'South of the Tehachapi'--south that is of the transverse Tehachapi range which knifes across to the ocean just north of Santa Barbara. The Tehachapi range long has symbolized the division of California into two major regions: North and South" (8:4).

The only trouble with this idea is that it is not true. By California standards, the Tehachhapi Mountains are comparatively insignificant. They are only about 40 miles long by 10 miles wide between Tejon Pass on the west and Tehachapi Pass on the northeast, and they do not knife across to the ocean (Fig. 1), (9). It would be preposterous to put the northern boundary of Southern California adjacent to the north line of Los Angeles County.

For almost 340 miles between Donner Pass, northwest of Lake Tahoe, and Tehachapi Pass, west of Mojave, the Sierra Nevada probably is the most effective mountain barrier in the continental United States (1:117, 119, 121). Its profound effect on railroads and highways is discussed later. Otherwise,
Figure 3. Federal court districts in California.
transportation in California frequently is influenced by topography but is not controlled by it. A vast majority of both population and cropland are in valley and foothill areas.

Another popular misconception is that the Central Valley drains into San Francisco Bay. This is so for the Sacramento Valley and for the San Joaquin Valley as far south as the San Joaquin River which forms most of the northern Fresno County line (Fig. 4). However, south of the divide in central Fresno County, the Kings, Kaweah, Tule, and Kern Rivers terminate in interior basins to the west (1:23). A huge area east of the Sierra Nevada also has interior drainage. Southeastern Southern California is part of the Colorado River Basin. Virtually all of the coastal portion of Southern California drains fairly directly into the Pacific Ocean via a number of relatively short rivers. The chief exception is the Salinas River which has its headwaters east of San Luis Obispo and flows in a northwesterly direction 140 miles to Monterey Bay.

**Highway Transportation**

A very large majority of California intrastate freight and passenger traffic moves by truck, private car, and bus. This is the case even on many comparatively long hauls because distances of 500 miles or more can be covered in one day. Also, in the case of trucks and passengers in private automobiles, there is the convenience and economy of door to door pick up and delivery.

To serve that enormous volume of traffic, California has an excellent but deteriorating system of freeways and major highways. This deterioration is due to recent diversions of huge gas tax revenues to subsidize passenger trains and so-called rapid transit in urban areas. State Freeway 101 generally follows the coast of Southern California from San Diego to Monterey County where it shifts to the Salinas Valley (1:121-22). A combination of freeway and major highway goes north through the Owens Valley and on to Reno (1:119-120).

Crown jewel of this system is the splendid Interstate 5/State 99 Freeway which, following the Butterfield Stage route, goes almost straight north from Los Angeles to Wheeler Ridge in the south end of the San Joaquin Valley via Tejon Pass (1:122). Replacement of the former winding Ridge Route took more than ten years and represents a major engineering and financial achievement. The maximum grade now is six percent, and that is confined to about five miles on the Grapevine Grade (10). A four percent grade is exceeded for only approximately thirteen miles. Although it reaches an elevation of 4,183 feet, it is
Figure 4. Drainage divide pertinent to the north boundary of Southern California.
closed by snow an average of only thirty hours per year (10). This magnificent facility is the chief reason the southern San Joaquin Valley is so intimately associated with Los Angeles.

The fact that Mono County and northern Inyo County are part of Southern California results from the barrier quality of the Sierra Nevada to their west, and easy access to them from Los Angeles. No road crosses this mighty range for a distance of 200 miles between State Highway 120 (which goes west from U.S. 395 at Lee Vining in Mono County via Tioga Pass at an elevation of 9,945 feet) and State Highway 178 (which goes west from Inyokern via Walker Pass at an elevation of 5,248 feet) (Fig. 1), (1:119, 121). However, Tioga Pass is closed by snow 194 days a year; State Highway 108 next to the north is closed by snow for almost 172 days a year at Sonora Pass with an elevation of 9,624 feet; and State Highway 4, which goes west from Alpine County, is closed by snow for 184 days a year at Ebbetts Pass with an elevation of 8,730 feet (10). By contrast, the Coast Ranges are crossed by five virtually all-year state highways between Ventura and the Monterey County line (1:120).

Greyhound bus fares coincide closely with highway mileage. On the coast the break point between Los Angeles and San Francisco is Atascadero, and in the Central Valley it is Selma (Fig. 5), (11). Greyhound runs through buses from Los Angeles to Reno via the Owens Valley and U.S. 395. Travelers from San Francisco, however, must change buses in Reno to get to the east of the Sierra part of California. Because of the interstate nature of this trip, fares and schedules are not competitive (11).

Who delves into truck freight rates opens Pandora's box. There now are few intrastate truck class rates, but there are countless commodity rates, one it seems for every product. In an effort to derive something useful, the author concentrated on a typical commodity—canned goods.

State Public Utility Commission rates per hundred pounds of canned goods vary approximately with distance (12). However, this distance is not actual road mileage, but is so-called "constructive mileage" which has been adjusted for variations in motor vehicle operating conditions caused by elements of highway design such as grade and alignment, and by elements of highway traffic such as congestion and controls. Constructive mileage between hundreds of California communities is published by the Commission (13).

But that is not the end of complication. The Commission quotes rates per hundred pounds based not by constructive miles, but by blocks of such miles. Examples are 15-20, 170-180, 300-325, and 550-600 (14:47.2-47.3). However, the
Figure 5. Break line for Greyhound bus fares to Los Angeles and to San Francisco.
rate increase for added uniform blocks of distance is not uniform. For instance, over 140 miles but not over 150 miles $= 75¢$; over 150 miles but not over 160 miles $= 80¢$; over 160 miles but not over 170 miles $= 82¢$; over 170 miles but not over 180 miles $= 85¢$; over 180 miles but not over 190 miles $= 88¢$; and over 190 miles but not over 200 miles $= 90¢$ (14:47.2-47.3). Despite these situations, an approximate break point line for truck rates on canned goods between Los Angeles and San Francisco has been established (Fig. 6).

Deregulation of trucking is under active consideration, and the pros and cons are being discussed with intense feeling. Under deregulation rates might be higher or lower, higher for small shipments and lower for truckloads, or who knows what. In any event it seems probable that distance will continue to be the dominant factor in determining the cost of shipping by truck, and that cargo will continue to move.

**Railroad Transportation**

Three major railroads serve Southern California--the Southern Pacific, the Union Pacific, and the Santa Fe (1:111). In addition, there are a half dozen short feeder lines chiefly to mining centers. These railroads provide access to practically all populous or productive areas including the Owens Valley to Lone Pine. Until fairly recently a narrow gauge line continued 60 miles north from Lone Pine almost to Mono County.

These railroads were dominant providers of intrastate transportation for freight and passengers in days before motor vehicles took over most of this business (15). Now no one is interested in taking several days to move a freight car from the San Diego terminal to the Los Angeles terminal. As a defense measure the major railroads now operate motor truck lines. For instance, what is perhaps the largest truck line in California, Pacific Motor Trucking, is a subsidiary of the Southern Pacific (15).

There is no breakpoint north of which it is cheaper to ship a carload of canned goods to San Francisco by rail and south of which it is cheaper to ship it to Los Angeles. This anomaly results from the fact the rate from Los Angeles to San Francisco and the rate from either city to all intermediate points is the same (15). Accordingly, it costs the same to ship such a carload from Los Angeles to Bakersfield as it does from Los Angeles to San Francisco. Conversely, the price is the same to ship it from San Francisco to Salinas as it is to ship it to Los Angeles.

This unusual rate structure obliterates what under other circumstances
Figure 6. Break line for motor truck rates on canned goods to Los Angeles and to San Francisco.
would be a substantial disadvantage for Los Angeles. Years ago, the Southern Pacific chose to dogleg its line from Los Angeles to Bakersfield some 40 miles east through Tehachapi Pass via Saugus, Lancaster, and Mojave instead of using the direct Tejon Pass route. If rail rates were based on distance and time in transit, the break point between Los Angeles and San Francisco would not be much north of the Kern County line. Instead, metropolitan Los Angeles, with more than twice the population of metropolitan San Francisco, has rail equality deep into Northern California (16:20-22).

Rail passenger service nationally was nearly extinct when heavily subsidized Amtrak tried to revive it. The San Diegan now runs down the coast to San Diego, and the Coast Starlight goes up the coast to Oakland with a shuttle bus to San Francisco (17). The Starlight makes no stop between San Luis Obispo and Monterey which puts San Luis Obispo County firmly in the Los Angeles arena. Until the recent Amtrak cutback, the San Joaquin offered service from San Francisco to Oakland by bus, from Oakland to Bakersfield by train, and from Bakersfield to Los Angeles by bus. This route, which may be continued with state subsidy, made only two stops between Fresno and Bakersfield--Hanford in Kings County and Wasco, 50 miles further south in Kern County. That gave San Francisco an advantage in most of Kings and Tulare Counties. However, even with major subsidy, this train and bus combination did not attract a significant number of passengers.

Ever dwindling supply and ever increasing cost of motor fuel could result in at least a partial renaissance of intrastate freight and passenger rail traffic. Were this to happen, its effect on the spheres of influence of the two major metropolitan centers probably would tend to favor Los Angeles.

Air Transportation

California is big enough and populous enough that intrastate passenger and freight air transport is important. This, of course, is especially true between the three major urban centers--Los Angeles, San Diego, and San Francisco.

Currently fares and service slightly favor Los Angeles (Fig. 7). Swift Aire charges $43 from Los Angeles to San Luis Obispo and $46 from San Francisco to San Luis Obispo (18). The United Airlines fare from Los Angeles to Visalia is $28, but from San Francisco to Visalia it is $30 (19). Sierra Pacific Airlines flies a daily jet from Los Angeles to Reno via the Owens Valley with stops at Bishop and Mammoth, the great summer and ski resort in Mono County (20:35). Air service to these places from San Francisco involves a transfer at Reno and is not competitive.
Figure 7. Break line for air fares to Los Angeles and to San Francisco.
Since deregulation of airlines by the Civil Aviation Board late in 1978, intrastate air service to and between smaller California communities has been in a state of flux which borders on chaos (21:26-27). The large airlines, which formerly were forced to provide service to them, have pulled out their big planes to concentrate on more profitable markets. This vacuum is being only partially filled by so-called commuter airlines at fares which are comparatively high. Their small planes, some of which have no toilet facilities, understandably are not very popular. Also, their passenger death rate is 400 times that for regular commercial carriers (21:26-27).

It is not clear what the future holds. Perhaps escalating cost of equipment and fuel will result in permanently reduced air service to many relatively small but important cities. This would be a serious inconvenience, but as long as intrastate fares up and down the coast and through the San Joaquin Valley are based primarily on distance, it should not threaten the validity of the Miller Line.

Port Trade Region

The hinterland of a seaport is a good measure of its sphere of economic influence. Los Angeles-Long Beach Harbor and San Francisco Bay both are major seaports, and they compete for business generated in the central coast and San Joaquin Valley.

The Chief of Engineers, Department of Army, issues annual reports on commerce handled at all American ports and special reports on the facilities, trade, and trade regions of individual ports. As such, he is the most official source of information about United States seaports.

In 1976, The Assistant Secretary of the Army submitted to Congress a 457-page report prepared by the Chief of Engineers titled "Los Angeles - Long Beach Harbors, California". This publication places the north line of the "consumption tributary or demand area" of these twin harbors at the northerly line of San Luis Obispo, Fresno, Madera, and Mono Counties (Fig. 8), (22:94).

In addition to being approximately on the drainage divide in the San Joaquin Valley, Fresno is sort of a border city between Northern and Southern California. True, it is about 40 miles closer by highway to San Francisco, but for years the Fresno skyscraper was the Security Pacific National Bank of Los Angeles building, which then was the northern outpost of that now state-wide financial institution. However, most of Fresno County and all of Madera County seem to be San Francisco oriented.
Figure 8. Break line for areas tributary to Los Angeles-Long Beach Harbor and to San Francisco Bay ports.
Long Distance Telephone Rates

Long distance telephone calls now are standard procedure for social as well as business contacts. The same or equivalent suppliers and customers generally have offices at various locations, for example in Los Angeles and San Francisco. In such cases, the decision as to which one to telephone should be based on the cost of the call. Long distance telephone rates, therefore, are factors of consequence in determining the spheres of influence of major cities.

In California, at least, the dominant factor in setting long distance telephone rates is airline distance, not actual distance in terms of miles of telephone line involved (23, 24). This results in no particular surprises concerning the break line between Los Angeles and San Francisco along the coast or in the San Joaquin Valley; but in the east of the Sierra subregion, the rate break point is Bishop in northern Inyo County (fig 9). Here is a case where the very real barrier quality of the Sierra Nevada is negated.

Mail Distribution

The United States Post Office has bulk mail centers in a number of major cities. From these centers mail is sent to outlying Sectional Centers for distribution to local post offices in the zip code areas they serve (25). It is suggested that such an operation is an important indicator of the regional influence of cities serving as such centers.

Los Angeles is one of these centers. It distributes bulk mail to Sectional Centers in Southern California, Arizona, and southern Nevada (26:xxxiv). To the north in California it sends bulk mail to San Luis Obispo for distribution throughout zip code area 934, to Bakersfield for zip code areas 932 and 933, and to Mojave for zip code area 935 (Fig. 10), 7:281).

There also are a larger number of Mail Classification Centers which handle other than bulk mail. Such mail from the Los Angeles Center is distributed to the same California zip code areas via the same Sectional Centers noted above (Fig. 10), (26:xxxvi).

Sunday Newspaper Sales

In the central part of California, Sunday editions, with sales larger than weekday editions, of the Los Angeles Times and the San Francisco Examiner and Chronicle are equally available. The result of thousands of people making individual decisions about which paper to buy is an important factor in determining the dividing line between Southern and Northern California. Sales data provided
Figure 9. Break line for long distance telephone call rates to Los Angeles and to San Francisco.
Figure 10. Break line for distribution of bulk and general mail from the Los Angeles Center and from the San Francisco Center.
by both papers validate the Miller Line in an impressive way (Fig. 11), (Table 1), (27). Incidentally, total sales for the reported 1978 Sundays were 1,382,683 for the Los Angeles Times and 665,821 for the San Francisco Examiner and Chronicle.

**Automobile Club and Gasoline Tax Allocation**

California has two big, influential automobile clubs--the Automobile Club of Southern California which serves Southern California and the California State Automobile Association which serves Northern California. The former was incorporated in 1900 and the latter in 1907 (28). The dividing line between them, which many years ago was mutually agreed on with the American Automobile Association, follows the Miller Line except that Kings County goes with the north (Fig. 12), (28).

More than 50 years had elapsed since the Gold Rush, but this probably was Los Angeles' first successful major challenge to San Francisco as "The City" of California. It is reminiscent of a last hurrah that the northern club took the name California State Automobile Association, even though it was 7 years younger than the southern club and never had and never would serve the entire state.

Allocation of state gasoline tax funds for highway construction was the subject of a long and bitter dispute between the north and the south. Finally it was resolved by dividing the state into northern and southern parts identical with the pre-existing automobile club boundary (Fig. 12), (29:127). By statute, 40 percent of the total goes to the 45 northern counties, and 60 percent goes to the 13 more populous and more tax productive southern counties (29:128). Because this decision involved millions of dollars in obvious benefits, it is considered an unusually indigenous expression of regionalism in California at that time.

**Lane Publishing Company**

The Lane Publishing Company is based in Menlo Park about 20 miles south of San Francisco in San Mateo County. It publishes "Sunset Magazine" which is probably the oldest and most widely read western magazine. It also produces a 160-page book titled "Sunset Travel Guide to Southern California."

"Sunset Magazine" has several editions, one of which, the Southern California and Hawaii edition, goes to the 10 southern counties (Fig. 13), (30:6). Kings, Tulare, Inyo, and Mono Counties are not included. By contrast, the
Figure 11. Break line for sales of the Sunday Los Angeles Times and of the Sunday San Francisco Examiner and Chronicle.
Figure 12. Dividing line between areas served by the Automobile Club of Southern California and the California State Automobile Association, and for the allocation of state gasoline tax funds.
Table 1. Sales of Sunday Los Angeles "Times" and of Sunday San Francisco "Examiner" and "Chronicle" in selected central California counties.

<table>
<thead>
<tr>
<th>Name of County</th>
<th>Los Angeles &quot;Times&quot;</th>
<th>San Francisco &quot;Examiner&quot;/&quot;Chronicle&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monterey</td>
<td>644</td>
<td>9,557</td>
</tr>
<tr>
<td>Fresno</td>
<td>2,345</td>
<td>4,683</td>
</tr>
<tr>
<td>San Luis Obispo</td>
<td>8,273</td>
<td>2,930</td>
</tr>
<tr>
<td>Kings</td>
<td>571</td>
<td>381</td>
</tr>
<tr>
<td>Tulare</td>
<td>3,307</td>
<td>1,265</td>
</tr>
<tr>
<td>Kern</td>
<td>12,300</td>
<td>385</td>
</tr>
<tr>
<td>Inyo</td>
<td>2,450</td>
<td>40</td>
</tr>
<tr>
<td>Mono</td>
<td>1,592</td>
<td>257</td>
</tr>
</tbody>
</table>
"Travel Guide" puts these four counties and about half of Fresno County in Southern California, which it describes as "...a real place--one identified as much by personality as by geography" (Fig. 13), (31:6). Although the Lane Publishing Company has not abandoned its venerable San Francisco-oriented concept of Southern California for "Sunset Magazine", it does recognize reality in its comparatively new "Travel Guide".

Differences of Degree

The foregoing has explored the boundary between Southern and Northern California chiefly in terms of lines representing such specifics as drainage divides, rate and fare break points, and service or jurisdictional areas. In addition, there are numerous important differences of degree concerning things which exist on both sides of the line, but which predominantly are on one side or the other.

Review of various maps and charts in "California-Patterns on the Land" calls attention to many such differences (1:66, 82-84, 87, 97, 99, 103). For Example, Southern California has most of the oranges, lemons, grapefruit, avocados, cotton, commercial fishing, petroleum, natural gas, airplane manufacturing, motion picture and television production, and a "Big Game" which is USC vs. UCLA. Northern California has most of the rice, walnuts, almonds, peaches, figs, grapes and wineries, apricots, cherries, pears, plums and prunes, canneries, timber, native sons, and a "Big Game" which is California vs. Stanford.

Conclusion

It has been established beyond reasonable doubt that there is a Southern California, that it comprises essentially the 14 southern counties of the state, and that it has a high degree of regional quality.

The leadership of metropolitan Los Angeles does not appear either fully to recognize or fully to exploit the advantage it has in the northern portion of what here is designated Southern California and the potential it has for successful competition in Fresno County. For instance, the Security Pacific Bank's "Monthly Summary of Business Conditions - Southern California" shows data for 1, 2, 3, 6, and in one category for 10 counties but never for 14 or 15 counties (32). Perhaps such benign neglect results from excessive preoccupation with the huge, close-in population and market.

However, this fringe territory is worth courting. The five northern counties--San Luis Obispo, Kings, Tulare, Inyo, and Mono--have a population of over 468,000 and Fresno County, with a population of almost 480,000, is the prize of
Figure 13. Lane Publishing Company divisions of California
the San Joaquin Valley (2:11-15). They are significant producers of many commodities, as well as prosperous markets for all the goods and services required by modern society. In its own self-interest, Los Angeles should strive diligently to cement firm economic, political, and social ties with this prime area and its almost a million people. It well could be the "Margin of profit".

Finally, it should be recognized that Los Angeles is more than just the capital of Southern California. With its regnant population and resulting vast resources of facilities, services, supplies, and markets, and because of its position at a major hub of land, air, and sea transportation, Los Angeles is the metropolis of California, of the Pacific Southwest, and of the United States west of the Rockies.

San Francisco still retains residual elements of its once dominant western centrality. These include regional offices of numerous federal agencies and headquarters of major corporations like the Bank of America and Standard Oil Company of California, most of which were established there many years ago. To move such things is difficult because of massive inertia and local and employee resistance. San Francisco, Portland, Seattle, Salt Lake City, and Phoenix will continue to be centers of regional importance. However, none of them are competitive with Los Angeles as the nucleus of western America.
NOTES

13. Public Utilities Commission of the State of California. Optional All Points to All Points Table for Distance, Table 8. San Francisco, Effective July 1, 1975.
31. Ibid.
The annual meeting was sponsored by the Geography Departments of: Grossmont College, El Cajon; San Diego Mesa College; San Diego State University; and Southwestern College, Chula Vista. The opening session featured Jim Bates, Chairman, San Diego County Board of Supervisors and Tom Crandall, District Director, San Diego District of the California Coastal Commission. Mr. Crandall delivered the opening address: "The San Diego Coastline: An Overview". Awards presentations were handled by Gertrude Reith (CSU, Fullerton) and Donald I. Eidemiller (San Diego State University) delivered the banquet address "Cyclonic Systems in Southern California Climate".

**PRESENTATIONS**

Bruce Bechtol and Jerry Williams, Chico State University, **THE PERILS OF APPLIED GEOGRAPHY: ALL THAT GLITTERS IS NOT GOLD.**

Christopher H. Exline, University of Nevada, Reno, **COOPERATIVE EDUCATION PROGRAMS: A POTENTIALLY SIGNIFICANT RESOURCE OF THE INTERFACE OF ACADEMIC AND APPLIED GEOGRAPHY.**

Larry Ford, San Diego State University, **BEWARE OF NEW GEOGRAPHIES.**

Myron B. Gershenson, Jefferson Union High School Adult Division, **GEOGRAPHIC TOOLS IN THE CONVALESCENT HOSPITAL SETTING.**

Susan Hardwick and Dee Smith, Cosumnes River College, **A GEOGRAPHICAL ANALYSIS OF RESIDENTIAL FRONT YARD FENCES IN THE SACRAMENTO URBAN REGION.**

John James, University of Nevada, Reno, **TEACHING WEATHER MODIFICATION IN BEGINNING PHYSICAL GEOGRAPHY CLASSES.**

Charles L. Knapp, California State University, Dominguez Hills, **A CASE STUDY IN EQUITABLE PUBLIC LAND USE: THE MOUNTAIN HIGH SKI RESORT MASTER PLAN.**

David Lantis, Chico State University, **THE DETERIORATION OF CALIFORNIA: THE CHICO DISTRICT AS AN EXAMPLE.**

Gordon Lewthwaite, California State University, Northridge, TARO, TARO, TARO.

Peggy E. Mandel, Sequoia Junior High School, **HAVE THEY REALLY GONE?**

George Nasse, Fresno State University, **GRECO-ALBANIAN VILLAGES.**

Clement Padick, California State University, Los Angeles, **RIVER TRANSPORT ON THE LOWER VOLGA, U.S.S.R.**
Joey Perry, San Diego State University, THE STAYING POWER OF SAN DIEGO NEIGHBORHOOD NAMES.

Nick Polizzi, Bill Park, and Russ Flynn, Cypress College, SAN DIEGO'S PAINTED LADIES - A VISUAL TOUR OF THE VICTORIAN HOMES OF SAN DIEGO.

Adolph Stone, Long Beach City College, HITLER'S DEATH CAMPS: A LOCATIONAL ANALYSIS.

Margaret Trussell, Chico State University, SAN DIEGO'S AGRICULTURAL GREENBELT.

Robert N. Wallen, Mendocino College, NEW TIME AND SPACE DIMENSIONS THROUGH A TRADITIONAL DELIVERY SYSTEM.