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THE AVOCADO INDUSTRY IN SOUTHERN CALIFORNIA, A STUDY OF LOCATION, PERCEPTION, AND PROSPECT

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THE AVOCADO INDUSTRY IN SOUTHERN CALIFORNIA, A STUDY OF LOCATION, PERCEPTION, AND PROSPECT

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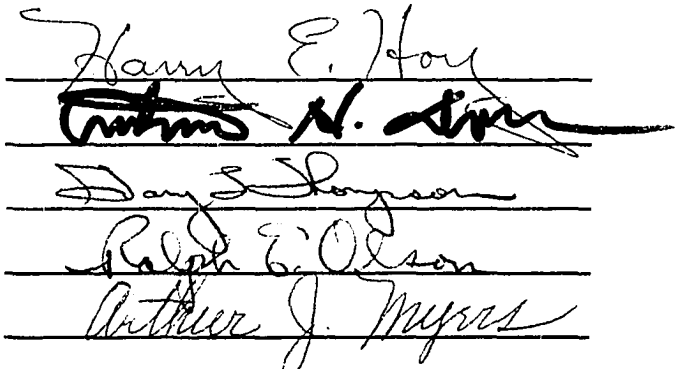

DISSERTATION COMMITTEE

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CHAPTER I

INTRODUCTION

Along a narrow semiarid (BShs) and Mediterranean (Csa) climatic belt in the South Coast Region of California, the avocado, Persea americana, thrives as one of the nation's most unusual horticultural crops. This subtropical fruit of probable Mexican and Central American highland origin is grown in small clusters of groves trending in a northwest to southeast 220-mile arc from Santa Barbara to San Diego (Figure 1). The avocado groves are situated, in most cases, on the slopes of rolling foothills and alluvial fans only a short distance from the Pacific Ocean. In this narrow ribbon of land, the environment is characterized by a low percentage of cloudy days, a moderate yearly temperature range, and daily temperatures that seldom drop below 32°F in the winter, nor exceed 95°F in the summer. In contrast to the tropical savanna (Aw) and the tropical monsoon (Am) locations of Florida avocado production, where most of the

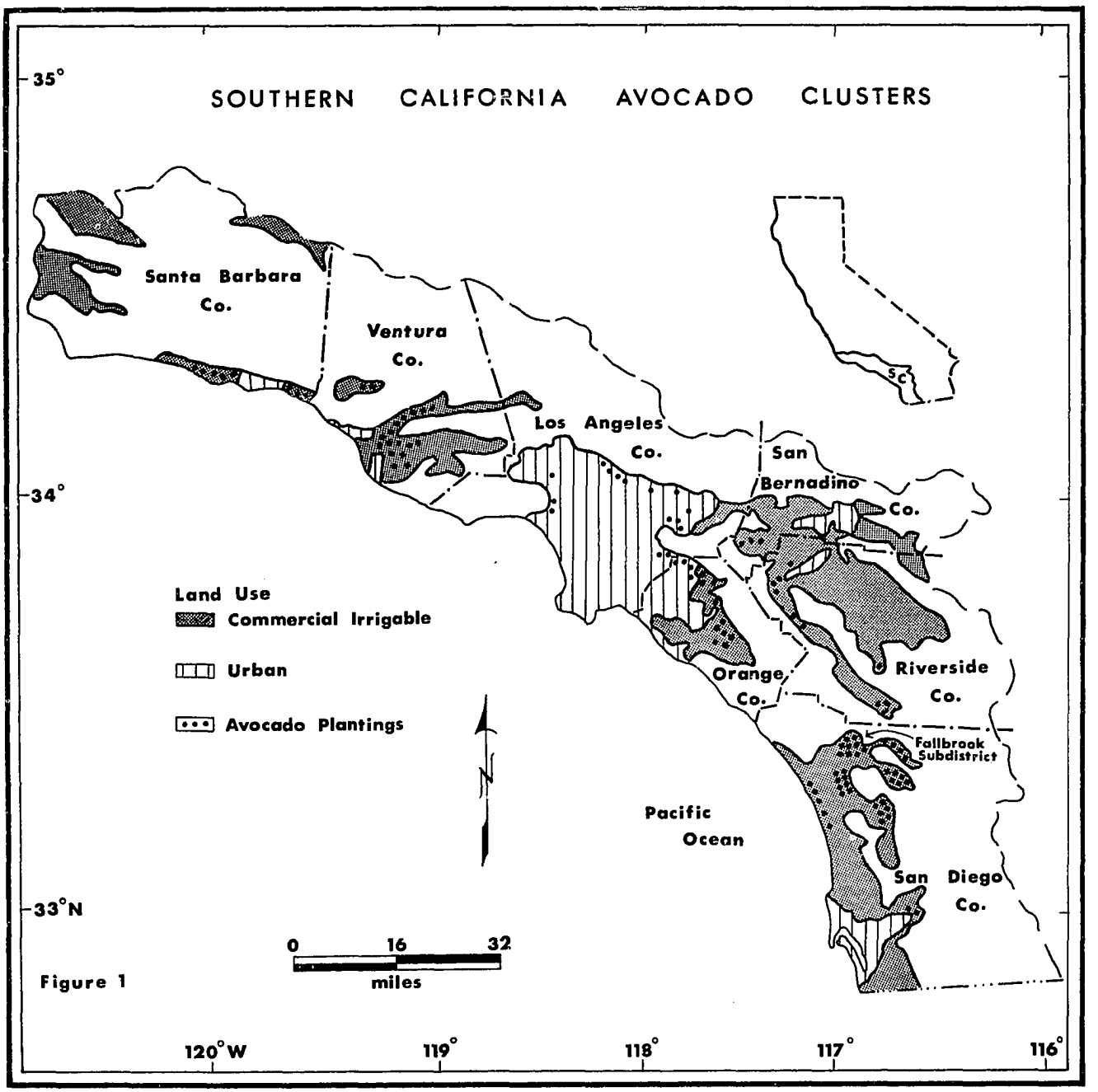
SOUTHERN CALIFORNIA AVOCADO CLUSTERS
35°
34°
33°N
120°W
119°
118°
117°
116°
Santa Barbara Co.
Ventura Co.
Los Angeles Co.
San Bernadino Co.
Orange Co.
Riverside Co.
San Diego Co.
Fallbrook Subdistrict
Pacific Ocean
SC
Land Use
Commercial Irrigable
Urban
Avocado Plantings
N
0 16 32
miles

Figure 1

crop is grown in the vicinity of 25° 30'N, California avocados are grown between 33°N and 35°N.

In this suitable California environment, early pioneers established the Mexican and the Guatemalan ecological avocado groups (races).[1] The growing of avocados began as a novelty and expanded to a full-fledged speculative venture when several varieties proved tolerant to the coastal Southern California climate.

From a few backyard seed and budwood plantings, California became the major avocado producing area in the United States and the world. Southern California production in the 1967-1968 season was 143,700,000 pounds, which is more than 12 times the production in Florida, the only other avocado-producing area of significance in the nation. Overseas producers are even less significant.

Israel's industry probably ranks second behind the United States in acreage, technology, and marketing efficiency, yet its production was only 8,000,000 pounds by the end of the 1967 crop year. Other avocado producing countries of importance in the world commercial scene include the Republic of South Africa, Chile, Mexico, and possibly Cuba.

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[1] The term "race" is a rather nebulous botanical term which occupies a taxonomic position between species and variety. An avocado race is probably best described as a subspecie whose characteristics are associated with an avocado group originating in Mexico, Guatemala, or the West Indies.

A Synthesis With a Three-Part Problem

This dissertation deals with the location, arrangement, and man-land relationships of the avocado industry in the South Coast Region of Southern California. What physical and cultural factors have given rise to the current spatial arrangement and areal differentiation of the avocado industry? What factors have coordinated the small efficient avocado clusters, nurtured by an unusual farmer motivation, into an integrated whole? How will the industry overcome a series of complex physical and cultural variables which, if left unsolved, could lead to an unfavorable prospect for the future? The inherent variables within these questions will undergo rigorous examination. Moreover, the findings are examined in an effort to reject the null hypothesis that the physical, cultural, and psychological milieu makes no significant difference to the establishment and survival of the avocado industry.

Field Approach to Date Collection

The dissertation investigation consisted of field observation and library research, as well as other sources of information. Field endeavors, utilizing the participation-observation approach, included living and working in an avocado district until it was possible to be accepted as a member of the community. A more accurate comprehension of the actual conditions was acquired through this familiarization with the regional avocado environment. This period of

residence made possible personal observation of many avocado groves and motor vehicle travel through hundreds of miles of avocado districts with exceedingly able county farm advisors and professional field representatives. Airplane reconnaissance, in addition to various remote sensing techniques such as infrared photography, complemented the first-hand observation.

Personal interviews, interspersed with observation of every aspect of the industry, were held with grove owners and with city and county planning officials. Several interviews were obtained with leading avocado researchers at the University of California at Riverside so that an up-to-date understanding of the kind and intensity of avocado research could be ascertained.

Library research included use of the Fallbrook town library, county planning libraries, the main and agricultural libraries at U.C.R., and the State Department of Water Resources, Southern Division, Library. In addition, every effort was made to acquire the abundant information on avocados available through agricultural cooperatives, the California Agricultural Extension Service, and various County Agricultural Commissioners' offices. The various research efforts provided meaningful insights into the relationships between the complex variables of the avocado clusters as a study in agricultural geography. Despite considerable information disseminated by the California Crop

and Livestock Reporting Service, no statistical data has been compiled and made available on avocado acreage and number of plantings at the district level. It is impossible, therefore, to construct an accurate map of avocado plantings based on numerical data.

Dissertation Design

Traditional descriptive and analytical studies of agricultural geography, such as those of J. Russell Smith, O. E. Baker, Derwent Whittlsey, Edward Higbee, and Leslie Symons, are largely concerned with physical, economic, horticultural-agronomic and other spatial factors. Although culture is mentioned by these scholars in terms of descriptive land tenure, marketing, transportation, and labor, for example, little academic research has dealt with cultural causation. Minimal efforts have been put forth, heretofore, on the analysis of the processes, especially farmer decisions,[2] by which a crop industry is initiated in an environment, as well as current and future transformations. Thus, the ideas of agricultural man as a causal force expounded upon by Spencer and Horvath are expanded

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[2]The need for more geographic research on decision making and human behavior was emphasized by Julian Wolpert at the Association of American Geographers' Conference in 1963. The paper was entitled, "A Spatial Behavior Analysis of Decision Making in Middle Sweden's Farming."

herein to include an analysis of the future, in addition to a description of past and present conditions.[3]

Spencer and Horvath approach the study of an agricultural region's origin, development, and change from the point of view of six cultural processes: political, historical, technological, economic, agronomic (or horticultural), and psychological. This dissertation will incorporate the six factors into each problem as a method of better understanding man's influence on the location, development, and future of the avocado industry. The cultural factors, as envisioned within the avocado territory, are: (1) political, involving state and county controls on land and labor; (2) historical, an examination of the temporal elements contributing to an understanding of the genesis and evolution of the current complexities in the avocado industry; (3) technological, demonstrating the processes through which innovations can increase farmer efficiency, thereby requiring less time and effort expended in the orchard; (4) economic, portraying land use patterns and the effects that grove establishment and crop production expenses have on man's decision to invest in the industry; (5) management or operation of the grove, as influenced by a highly efficient field and experimental state agricultural

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[3]J. E. Spencer and Ronald J. Horvath, "How Does An Agricultural Region Originate," Annals Association of American Geographers, 103 (March, 1963), pp. 74-92.

extension service and an educated grove owner element;[4] (6) psychological or "farmer mentality," envisioned not only as a cultural factor but also as an important aspect of environmental perception.

The environmental perception of space or territory, such as that occupied by the avocado industry, lies to a significant degree in the interrelationships between physical, cultural, and psychological dimensions. Most geographic studies have emphasized the interaction of man and land. But to understand the regional character of a group of farmers in an environment, it is necessary to incorporate a third dimension, that of social values or group behavior. In other words, it seems appropriate to extend beyond the cognitive world of observable facts or data to an operational environment. The perceived or operational environment is man's awareness of what the real world is like, because man's decision-making process is based to a considerable degree on how he envisions the world, rather than how it actually exists.[5] Therefore, a significant proportion of the dissertation is devoted to a study of how the avocado industry's population views its environment, combined with the writer's perception of how the growers are aware of the avocado landscape. The investigation includes an analysis

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[4] Ibid., pp. 511-514.

[5] Jan O. M. Broek and John W. Webb, A Geography of Mankind (New York: McGraw-Hill Book Company, 1968), pp. 30-31.

of physical and cultural systems as well as of personality factors, with regional development overtones.

Overall, the dissertation is an attempt at a socio-cultural synthesis, with some attention to physical considerations, in studying a highly localized agricultural industry. In sequence, the following topics are considered, i.e. a brief summary of the industry including botanical factors, cultural practices, processing, and marketing. It was early grower utilization of basic botanical principles and general horticultural and marketing knowledge which helped institute commercial avocado activity. Physical tolerances of the two California avocado races and their varieties, for example, play an important role in the micro-climatic limits of specific varieties.

A temporal study involves the development of the avocado from its introduction in Florida and Southern California through its establishment as a commercial crop. Avocado location shifts and marketing reorganization, illustrates the diversity, intensity, and complexity of the industry. Such a survey is essential to an understanding of the importance of outstanding individuals, and of the decision-making which has helped to amalgamate the industry.

An examination and analysis of the physical variables, including physiography, micro-climate, short-term weather hazards, and soils as they relate to root rot (Phytophora cinnamomi) are portrayed as determinants of

avocado location. Along with such physical description, the avocado environment is approached from the viewpoint of how man sees and understands hazards.

An examination of the influence of organizations within the industry and the integrating forces inherent therein, provides a more thorough understanding of the spatial interaction of the noncontiguous avocado clusters. This approach involves an analysis of the marketing agencies, private and state administrative coordinating agencies, the Avocado Society, and the Agricultural Extension Service facilities--all as factors which have helped amalgate the industry into a whole.

Rather than using the conventional geographic technique of examining areal differences of the avocado industry, the three avocado regions (Mid-Counties, San Diego County, and North Counties) are studied in terms of how local grove owners perceive regional territory. This approach represents an attempt to offer insights into the perception of group values, preferences, and attitudes of avocado grove owners. Moreover, it is an analysis of regional differences in social values as well as of the agricultural products which result from distinct behavior and attitudes toward avocado grove development.

An important aspect of the dissertation involves a detailed examination of the factors which affect the future of the industry. The future spatial patterns of the three

avocado regions will surely reflect past and present labor, root rot, and urbanization problems. The projection of the future of the industry to the year 1990 A.D. also involves a survey of available land remaining for avocado planting. Furthermore, the feasibility of developing improved varieties which can tolerate greater climatic extremes is considered in terms of the possibility of shifting avocado acreage to other locations. The potential of Florida and Mexico as future avocado regions is studied in the light of projected decline patterns in Southern California. Finally, the relationships between the avocado industry of Southern California and that of certain developing nations are explained.

Objectives and Dissertation Direction

In summary, the objective of the dissertation is to provide an analytic synthesis of the avocado activity in Southern California via an examination of pertinent variables. It appears that the industry functions as a unit despite a widely scattered pattern of fruit growth. To understand how the system works it seems necessary to reconstruct the inherent factors which, when combined into a whole, regulate a well developed primary industry. Little attempt is made to uncover the intricacies of horticultural and complex marketing factors, largely because highly qualified authorities in both fields have already performed an admirable task in these areas. On the other hand, social

scientists, especially pragmatic geographers who are synthesis-minded, have before them an area of study in the socio-cultural framework which has hardly been researched.

Within this synthesis approach, four objectives receive special attention: (1) to analyze agricultural environmental perception which deals with man's role as a decision-maker in agricultural location, economic conditions, and attitudes toward environmental hazards; (2) to expose and analyze spatial and location patterns which have not been previously reported in the avocado industry; (3) to provide an extrapolative analysis and projection of the industry's future, with special emphasis on regional trends which may serve as a guide to investors; (4) to construct a synthesis of the entire commercial and human operation as an in-depth source of information for developing nations which are advancing their own modern agricultural systems.

No attempt has been made to uncover the inner workings of particular avocado districts. The avocado crop is usually grown in close proximity with citrus, and only as a separate crop when it is not considered to be the primary activity of the owner. Moreover, data which could be related to economic impact at the local level are not available due to the small size of the plantings (groves average 4 acres). In any case, the variables at the district level appear to be so complex that they are beyond the purview of a dissertation aimed at examining the industry in its entirety.

CHAPTER II

GENERALIZED OVERVIEW OF THE AVOCADO INDUSTRY

Although the dissertation is more concerned with locational determinants, factors which have led to an integration and coordination of the agricultural industry, and with a projection of the avocado's future, there is need for a preliminary descriptive summary. The complexity of the industry would be extremely difficult to comprehend without some knowledge of the botanical character of the avocado, knowledge of locational factors, and a rudimentary knowledge of the crop's agricultural characteristics.

Avocado consumption in the United States is dominated by production from Florida's 5,120 acres, a sporadic importation from a few Antillean islands including Puerto Rico and the Virgin Islands, and Southern California's production from approximately 22,000 acres.[1] Before 1961, moderate quantities of the fruit were shipped from Cuba during the summer months, but importation from this country

[1] Personal interview with Jack Shepherd, President, California Avocado Society, July 17, 1968.

is no longer permitted as the result of strained diplomatic relations. There is a small production of relatively poor quality fruit for local consumption in the Hawaiian Islands, but no Hawaiian avocados are sent to the mainland (Figure 2). Approximately 98 per cent of Florida's avocados are grown in Dade County southwest of Miami. Florida is not a serious competitor with California because of stabilized acreage since the mid 1960's and a crop which is highly variable from year to year.

There is no significant competition in the United States from other areas of the world, but Israel, the Republic of South Africa, and Morocco compete for the West European market. Egypt, Greece, Mexico, Venezuela, Brazil, Argentina, Australia, New Zealand, and the Philippines also produce a limited commercial supply for domestic consumption (Figure 3).[2]

Location of the Southern California Industry

Most of California's commercial production is situated in the South Coast Region of Southern California along the southern coast of Santa Barbara County, in southwestern Ventura County, in scattered urbanized segments of Los Angeles and Orange County, and in northwest San Diego

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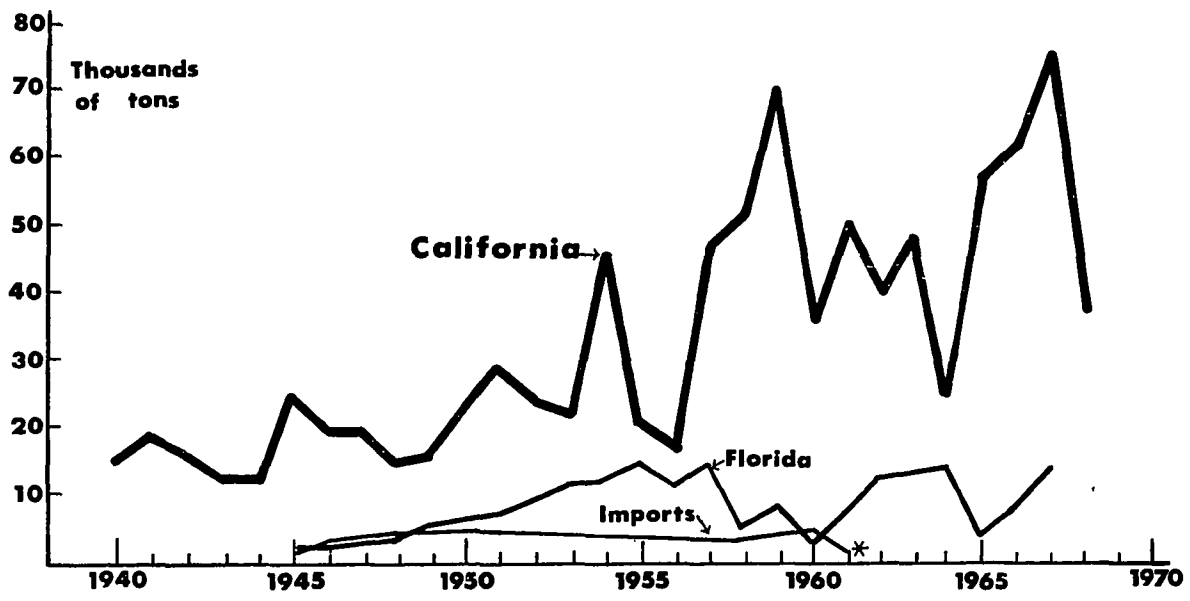
[2] California Avocado Society Yearbook (1965), pp. 19, 27, 29, 35, 37, 43, 37, 49, 55, 73.

Avocado Production and Imports in the United States



* Nearly all foreign importation ceased in 1961 except for a few small Antillean Islands.

Compiled from Rock and Platt, Economic Aspects of Marketing California Avocados, 1968.

Figure 2

World Commercial Avocado Distribution

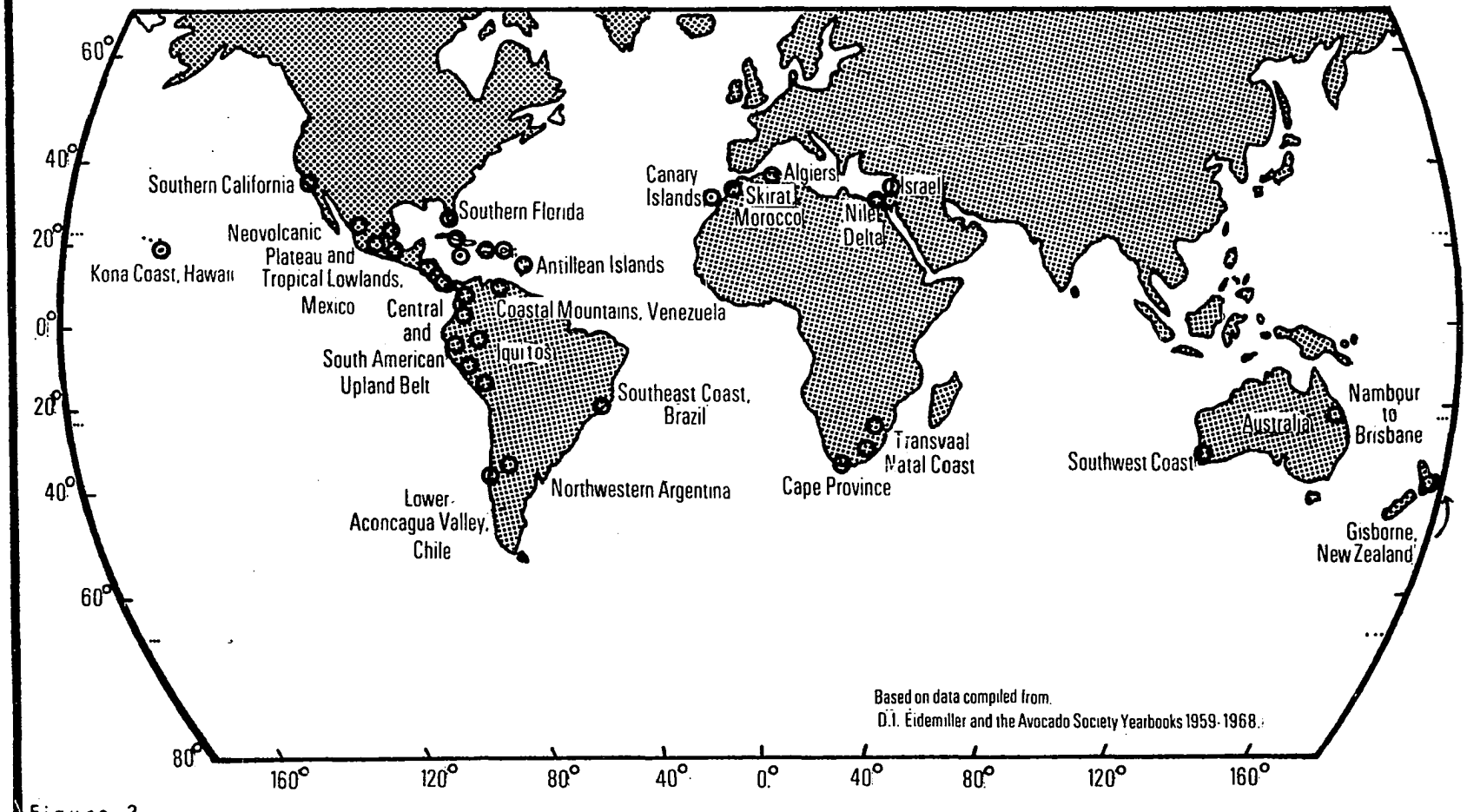


Figure 3

County.[3] A small production, however, does occur in the two inland counties of San Bernadino and Riverside (Figure 1).[4] Fresno and Tulare counties of the southern San Joaquin Valley, southwestern San Luis Obispo County, and the Santa Maria area of Santa Barbara County have limited avocado acreage. These last areas are insignificant to overall commercial production in California and currently have little more than experimental importance.

California avocados are being grown at the poleward limit of their environmental temperature tolerance between latitudes 33° and 35°N. Only a small proportion of the South Coast Region (30 to 40 square miles) is microclimatically suited to the profitable growth of the fruit. For this reason, avocado trees are confined to a narrow belt of land on the coastal marine terraces, alluvial lowlands, and foothills of the Transverse and Peninsular ranges. It is in these highly selective areas that the fruit is protected against temperatures which may descend below freezing during cool, clear winter nights or below temperatures in the mid-50's during the flowering period. The avocado

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[3]R. C. Rock and R. G. Platt, Economic Aspects of Marketing California Avocados (Riverside: University of California Agricultural Extension Service, May, 1968), p. 4.

[4]The avocado industry is subdivided into three regions: (1) North Counties of Santa Barbara and Ventura; (2) Mid-Counties comprising Los Angeles, Orange, San Bernadino, and Riverside; (3) San Diego County (the South). These regional terms are commonly used by agricultural economists, especially when the avocado belt is categorized according to county acreage.

industry is not confined within a contiguous area; rather, it is located in widely spaced clusters dominated by those of San Diego County, which contains a total of 12,600 acres, and the North Counties of Ventura and Santa Barbara which have a combined avocado area of 5,900 acres (Table 1).[5]

Avocado Tree and Fruit Characteristics

The avocado belongs to the species Persea americana of the Lauracea family, and is a relative of the cinnamon and the sassafras trees. Although some varieties shed their leaves during the flowering season, the avocado tree is characteristically evergreen broadleaf. In California, seedling avocados may grow to heights of 75 feet or more, whereas grafted trees seldom exceed 40 to 50 feet.[6] The entire commercial production of avocados, however, is based on grafted varieties in which a rootstock of one variety is grafted with a proven budwood of another. Seedling trees retain several qualities unacceptable to the grower and the consumer, including erratic bearing habits and the production of undersized fruit which is difficult to market commercially. As a result, commercial varieties tend to be low

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[5] Ibid., p. 12.

[6] R. W. Hodgson, "The Avocado--A Gift from the Middle Americas," Economic Botany, 4 No. 3 (1950), pp. 256-257.

TABLE 1

CALIFORNIA AVOCADO ACREAGE BY MAJOR PRODUCING COUNTIES 1945, 1950, AND 1960 TO DATE

Year	South		Mid Counties			North Counties		State Total
	San Diego	Los Angeles	Orange	Riverside	San Bernadino	Santa Barbara	Ventura	
	ACRES							
Nonbearing								
1945	1,885	358	366	25	1	83	164	2,884
1950	5,591	409	953	183	24	600	691	8,464
1960	2,386	75	401	176	32	386	843	4,378
1961	1,597	110	265	112	38	294	554	3,066
1962	1,018	63	158	71	33	637	555	2,628
1963	515	27	80	33	15	609	321	1,706
1964	579	18	42	20	4	579	310	1,224
1965	1,070	6	35	70	4	602	348	2,530
1966	1,260	30	30	70	10	670	630	2,860
1967	1,360	30	20	100	10	800	600	3,000
1968	1,140	20	10	120	0	780	580	2,650
Bearing								
1945	7,650	3,098	1,829	51	66	333	343	13,403
1950	6,920	2,515	1,525	51	47	406	488	12,008
1960	11,230	2,535	2,441	335	147	1,260	2,084	20,045
1961	12,031	2,128	2,397	383	138	1,389	2,383	20,862
1962	12,610	2,097	2,257	417	137	1,349	2,314	21,194
1963	13,113	2,078	2,134	445	138	1,450	2,550	21,921
1964	13,481	2,024	1,438	404	117	1,634	2,466	21,574
1965*	10,911	2,004	1,389	357	116	1,679	2,372	18,810
1966	11,180	1,240	1,350	370	120	1,760	2,540	18,620
1967	11,350	1,250	1,280	400	110	1,660	2,610	18,730
1968	11,590	1,260	1,250	400	110	1,750	2,790	19,150

*Acreage adjusted to complete tree census in 1965. State total acreage revised.

Source: R. C. Rock and R. G. Platt, Economic Aspects of Marketing California Avocados, May, 1968.

growing, lateral-spreading trees with large fruit and minimum alternate bearing tendencies[7] (Plate 1).

Avocado fruit range in weight from four ounces to three or four pounds, have a rounded or pear-like shape, and possess a dark green to purplish black rind or skin.[8] Skin characteristics range from thin and pliable to thick and coarse depending upon the number of epidermal and stone cells. The pericarp, or edible portion which lies between the rind and a single large seed, has a buttery consistency with a light green to yellow tint when ripe (Plate 2). The best commercial subtropical varieties in Southern California are usually described by connoisseurs as having a rich nutty taste and a flavor which is derived from the high oil content.

Origin of the Fruit

Early Spanish explorers including the geographer Martin Fernandez de Enciso and Gonzalo Fernandes de Oviedo, a conquistador, first encountered the avocado in northern South America in the first two decades of the 16th Century. Through their journals and later accounts, it was determined that the fruit had been growing naturally from Mexico to Peru, but no mention was ever made of it growing in the West

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[7]An alternate bearing tree is one which usually produces a heavy crop one year, only to be followed by light production the next year.

[8]C. A. Schroeder, "Growth and Development of the Avocado Fruit," California Avocado Society Yearbook (1958), p. 115.

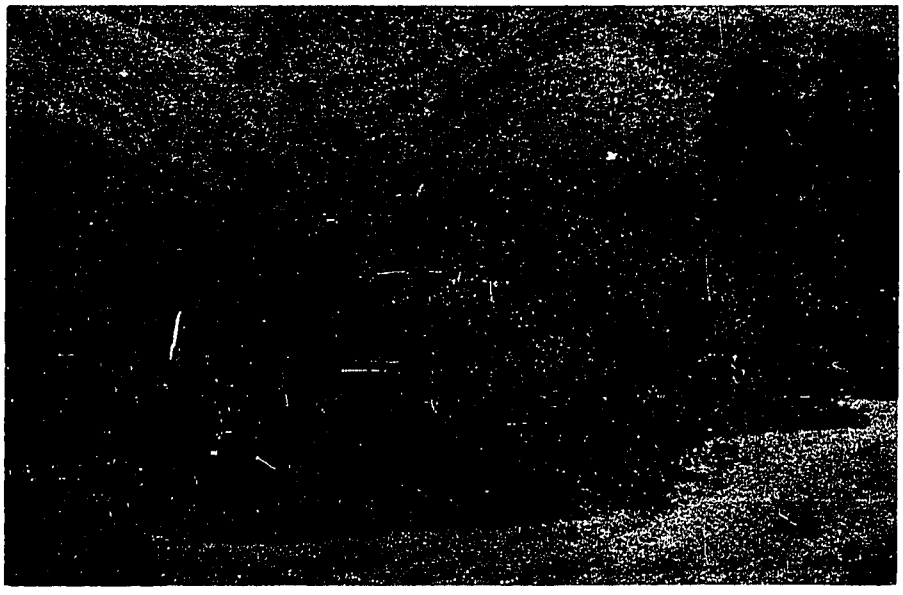
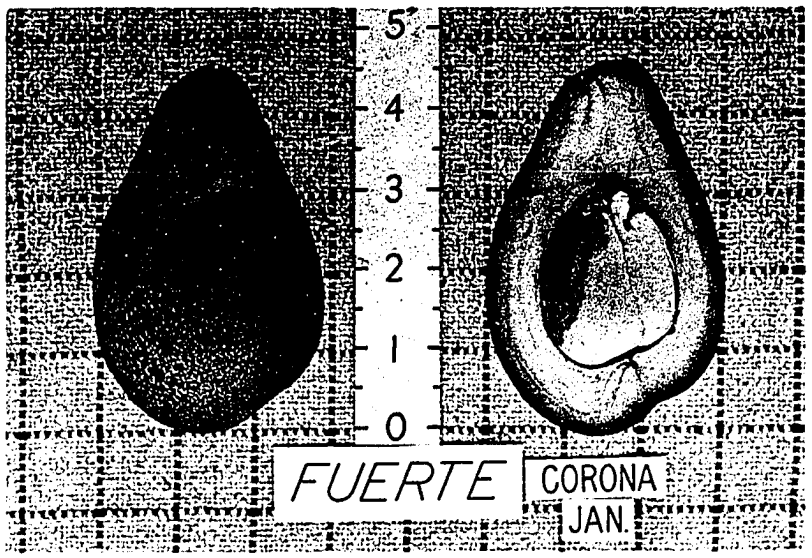


Plate 1--A portion of an avocado grove in Santa Barbara County with chapparal covered hills in the background. Of particular note is the contrast between the taller Bacon tree in the upper right corner and the lower horizontal spreading Hass variety in the center.



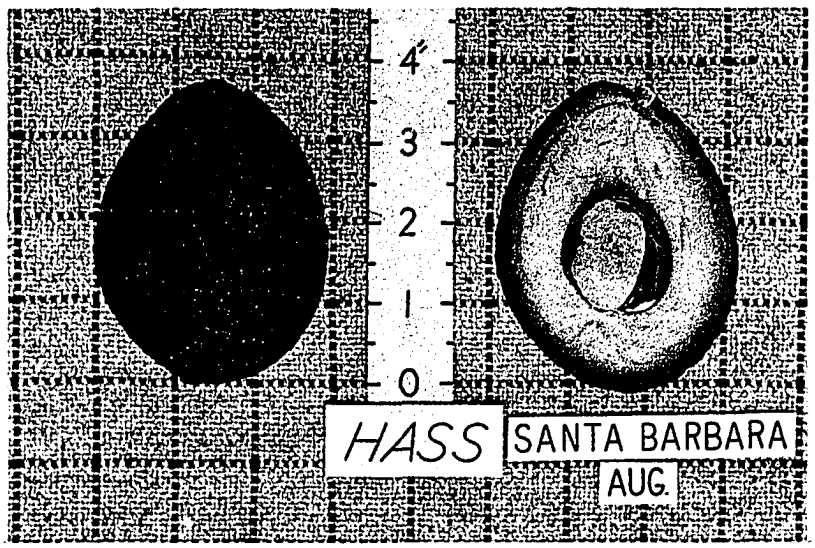


Plate 2--The two major avocado varieties, Fuerte and Hass, are shown at mature stages of development in January and August, respectively. The edible portion or pericarp of the fruit is located between the seed and the skin (rind or exocarp). (Courtesy of Robert G. Platt, Extension Subtropical Horticulturist.)

Indies. From these early accounts W. Popenoe[9] hypothesizes that the tropical avocado, currently indigenous to the Antilles, was brought from the American mainland to the islands by Spaniards early in the period of New World exploration. It has been deduced from Spanish records and tree-ring evidence that the avocado tree is probably a native of the tierra templada climatic zone (from 2,100 to 6,000 feet) in Central America.[10] The avocado was disseminated by several unknown indigenous tribes from Middle America to South America along the Andean Cordillera and eventually from Peru and Chile to Argentina and Brazil.

After years of study, horticulturists were able to divide avocado seedlings into three groups or races according to characteristics of the tree, fruit, and the regions from which the trees originated. The name West Indian was given to the cultivated seedlings found to be most prolific in Florida and the Caribbean Islands, whereas California trees were designated as Guatemalan and Mexican races because of their origin in the highlands of the respective countries.[11]

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[9]W. Popenoe, "Early History of the Avocado," California Avocado Society Yearbook (1963), pp. 19-21.

[10]W. Popenoe, "Races and Racial Origins," California Avocado Society Yearbook (1949), p. 59.

[11]W. Popenoe, "Early History of the Avocado," op. cit., p. 21.

Horticultural Botany and Avocado Varieties

As a result of climatic limitations, the Mexican and Guatemalan races predominate in Southern California, whereas the West Indian race is confined to Florida. The Mexican race is characterized by anise-scented leaves, small fruit normally weighing less than one pound, and a smooth thin dark green to purple skin. It will flower in the fall, winter, or early spring and normally matures between August and December. Perhaps its best quality is the fruit's ability to tolerate low temperatures, a characteristic probably derived from its development in the Mexican highlands. The Mexican race is important to the avocado industry because it has the capacity to produce favorable hybrids which are more tolerant to low winter temperatures in Southern California than the less resistant Guatemalan race.[12]

The Guatemalan ecotype, usually producing larger fruit than its Mexican counterpart, lacks the anise scented leaves, and is characterized by a green to black color. The skin has a woody texture and is harder, thicker, and tougher than that of the other two races. The flowering season occurs in early summer, and the fruit matures 12 to 18 months later.

Having adapted to humid tropical lowland locations, the West Indian race, is less resistant to cold temperatures

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[12]R. W. Hodgson, op. cit., p. 258.

than the two previously described ecotypes. Therefore, West Indian varieties are considered to be tropical fruit, whereas the other races, from a highland origin, are known as subtropical avocados. Commercial tropical avocado trees are characterized by a large fruit size, but the fruit has a somewhat reduced edible portion due to an enlarged seed. In addition, the West Indian type has a six to nine month maturation period and a thinner and smoother skin than the Guatemalan races.[13] West Indian race varieties and several Guatemalan-West Indian hybrids are limited commercially to Florida, because California's more northern location precludes the effective production of this race. It is from these three races that the avocado varieties have developed.

More than 700 named varieties have been recorded by the California Avocado Society in the past 50 years.[14] Many have been utilized commercially in former years, but nearly all of them have been discarded because of their unsuitability as a productive and marketable commodity. At the present time, California's production is dominated by ten varieties, although six are not recommended for further planting. These varieties include: Dickinson (G), Nabal (G), Anaheim (G), Jalna (M), Rincon (M), and MacArthur

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[13]William H. Chandler, Evergreen Orchards (Philadelphia: Lea and Febiger, 1958), p. 215.

[14]"Avocado Almanac," Citrus Leaves, Handbook for California Fruit Growers (April, 1957), p. 16.

(G).[15] The Society recommends the four other varieties for future planting (Table 2). The Fuerte (G&M) variety has been the mainstay of the industry since 1915, and in the 1967-1968 marketing season it produced 2.8 times as many fruit as the second-placed Hass (G) variety.[16] The Hass is beginning to replace the Fuerte in many locations because of its prolific bearing habits. The Bacon (M&M) and Zutano (M) varieties are also recommended for planting, but only in areas too cold for the Hass and Fuerte.[17] The Bacon, however, is somewhat undesirable because of rather low mean annual production and its vertical growth habit which results in a tree top fruit set where picking is difficult. The Zutano is also undesirable because it often develops an unesthetic corky spot, or rusty appearance. In general, it is less palatable than most varieties due to a low oil content. It would seem that the Hass is the only variety which meets most of the requirements for profitable production in future years.[18] The

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[15]The initials refer to the following remarks: G-Guatemalan race; M-Mexican race; G&M or M&M refers to hybrids of the two races.

[16]B. W. Lee, Fruit Facts for Avocado Growers (Ventura, California: University of California Agricultural Extension Service, August, 1969), p. 1.

[17]"Report of the Variety Committee," California Avocado Society Yearbook (1968), pp. 16-19.

[18]C. D. Gustafson, Avocado Varieties for California (San Diego: University of California Agricultural Extension Service, May, 1968), pp. 1-2.

TABLE 2

CHARACTERISTICS OF THE FOUR RECOMMENDED AVOCADO VARIETIES

Variety	Parentage (Origin)	Harvest					Trade Accept.	Eating Quality	Shipping Quality	Mean Size (Ozs.)	Relative Seed Size	Flavor	Shape	Comments
		S. D. Cty Coast	S. D. Cty Inland	Mid-Counties	North Counties	San Joaquin								
Fuerte	Guat. and Mex. (Atlixco, Mex.)	NR	Dec. - May	NR	NR	NR	Excellent	Excellent	Good	6-11	Medium	Excellent	Pear	Bloom & Fruit Set Sensitivities, Alternate Bearing
Hass	Guatemalan Seedling (La Habra)	April - August	April - August	April - August	May - Sept.	NR	Excellent	Excellent	Excellent	5-12	Small - Medium	Excellent	Ovoid	Frost Sensitive Orchard Prod. Consistent
Bacon	Mex. Hybrid (Buena Park)	NR	Dec. - Jan.	Dec. - Jan.	Jan. - Feb.	Nov. - Dec.	Good	Good	Good	6-12	Medium - Large	Good	Ovoid	Sets Crops in Tree Tops, Frost Tolerant
Zutano	Mex. Seedling Fallbrook	NR	NR	NR	NR	Oct. - Dec.	Fair	Good	Good	6-10	Large	Good	Pear	Susceptible to Rust & Corkiness, Frost Tolerant

NR = Not recommended for planting.

Source: Variety Committee of the California Avocado Society, March, 1968.

Fuerte, unfortunately is more limited in location for commercial planting and it has a severe alternate bearing habit.

Brief Synthesis of Horticultural, Harvesting, and Marketing Procedures

The establishment of large-scale avocado groves in Southern California began in some areas as a second crop and in others as a new agricultural activity. Many of the early groves were initiated as an intercrop between citrus rows, or as a separate orchard to replace old less productive tree crops. A second development was the creation of new avocado groves on the chaparral hillsides overlooking the fertile alluvial lowlands. After the initial experimentation with the elimination of many varieties, the grove owner learned that avocado trees are more suited to sloping terrain where cold air has little opportunity to stagnate, especially during the low sun period. Since avocado trees are more shallow rooted than citrus, with 80 to 90 per cent of the root system being located in the first two feet of soil, the crop can be grown on the thin sandy loam foothill soils of the Transverse and Peninsular ranges.[19]

At the present time, sloping terrain accounts for about 95 per cent of the total avocado acreage, whereas the bottomlands are planted in crops more tolerant of winter radiational freezes. It is quite common to observe avocado

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[19]Lecture by C. D. Gustafson, farm advisor, at a Fallbrook, California, Avocado School, June 6, 1968.

trees on a 5 to 10 per cent slope, and occasional terraced groves on slopes of 30 per cent.

Current land-clearing techniques for new groves, especially in San Diego County, involve a complex procedure mostly performed during the summer dry period (Plate 3). They entail the use of contour maps, aerial photographs, precise irrigation structure designs, and the employment of a detailed plan. The natural scrub vegetation is ripped out, large boulders are transferred to the barrancas, and mechanical contouring smooths out rough areas for mowing and general grove management. Plastic irrigation pipes with sprinklers are placed in the grove, the soil is seeded with a native barley, and the young avocado trees are finally planted in the spring according to a predesignated pattern which usually accommodates 100 trees spaced 20 feet by 20 feet.[20] Young trees are planted across the slope in a symmetrically contoured row design, usually with individual basins except for an occasional break every few rows for access roads (Plate 4). Costs per acre, once the grove has been established, are considerably higher than for most tree crops located on flat land because maintenance and harvesting are more difficult on sloping terrain.[21]

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[20]Personal interview with Joseph Kniefal, Fallbrook Irrigation Specialist, June 14, 1968.

[21]G. E. Goodall, "Planting Avocados: A Check List," The California Citrograph (February, 1966), pp. 162-163.

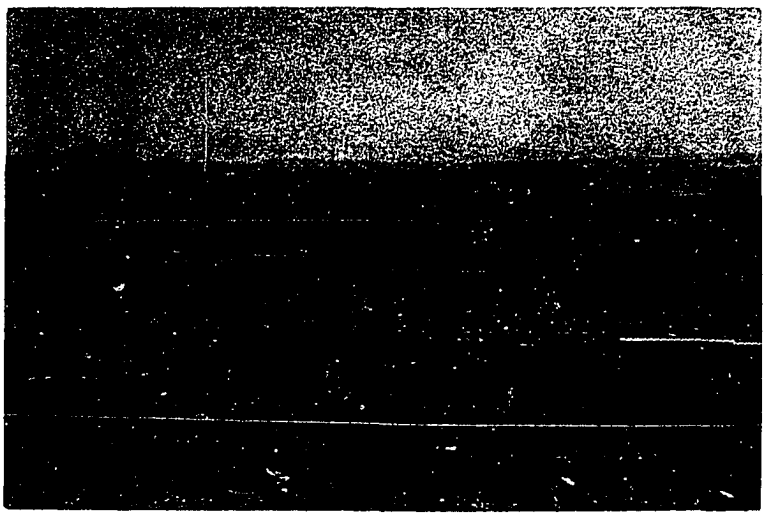

Plate 3--Rolling topography near Fallbrook, California, which has recently been cleared of scrub vegetation by an irrigation specialist. Note the plastic irrigation piping and sprinkler heads soon to be placed in the ground (a view looking south).

Plate 4--A steep hillside planting in the Valley Center area of San Diego County. The high angle of the slope requires the construction of access roads used for grove maintenance and harvesting (a view toward the southeast).

Over a period of time, the lateral branches between the young trees, eventually cross, precluding sunlight from reaching the lower branches. As the trees grow older and larger, the internal branches in the shaded area die, leaving a canopy which reduces the fruit-bearing surface. Pruning of some of the lateral limbs, as well as thinning of the crowded trees, is recommended before the condition becomes serious and reduces long term production.[22] Few grove owners actually thin their trees in time because of a psychological inability on the part of the farmer. Few growers look beyond the present economic implications of losing a tree which produces fruit each year. Yet it is known that the remaining trees maximize long term economic rewards if pruning is administered in time. One program of tree removal is to take out every other tree, and another is to remove every other row, but both methods help to provide more fruit per unit area and facilitate easier and less expensive maintenance and harvesting.[23]

Cultural Practices

One of the advantages of an avocado grove, in contrast with other tree crops, is that little labor or mechanized equipment is necessary for orchard maintenance.

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[22]R. Platt, Prune Avocado Trees Cautiously (Sacramento: University of California Agricultural Extension Service, April, 1962), pp. 1-2.

[23]B. W. Lee, op. cit., p. 1.

Disc-plowing and furrowing, once a common practice, remains only in the large lowland groves which were former citrus orchards. These large ranches, usually of corporative-type, utilize a great deal of machinery including tractors to till extensive field and tree crops. Because the small avocado plantings are often juxtaposed with tilled crops, they are also farmed in a similar manner. In San Diego County, native grasses are planted in the open spaces between rows for erosion prevention, but undesirable grasses and weeds, often allowed to grow through the wet winter months, are sprayed with contact chemical herbicides. In the Mid and North-counties tillage, cultivation, and chemicals are employed so that no grass cover prevails between rows, although much of the ground is matted with a thick leaf mulch.[24]

Fertilizer is utilized in meager quantities, a practice which limits the labor needed in maintaining the avocado groves. Nitrogen and zinc are sparingly applied, because excessive application can cause lower fruit yields, root damage, leaf tip burn and defoliation, or perhaps, eventual death of the tree.[25] Manure, once a commonly employed fertilizer, is no longer recommended by county farm advisers.

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[24]B. E. Day and C. D. McCarty, "Weed Control Methods for Use in Avocado Culture," California Avocado Society Yearbook (1959), pp. 75-78.

[25]Goodall, Embleton, and Platt, Avocado Fertilization (Sacramento: University of California Agricultural Extension Service (1964), pp. 1-9.

The limited avocado pest problem is another factor which has helped reduce labor requirements in most orchards. Early citrus men were aware of the benefits of biological control and, as a result, the avocado grove owners became aware that it was not productive to spray pesticides which would kill both the pest and its natural predator.[26] The California Agricultural Extension Service has helped to alleviate the problem through excellent biological control research. For example, the latania scale Hemiberlesia lataniae and the brown mite Heliothrips sp. once a problem to avocado trees, have been nearly eliminated due to the introduction of natural enemies.[27] Moreover, the greenhouse thrip Heliothrips haemorrhiodalis, an insect commonly found on avocado leaves in coastal Southern California, has been controlled biologically by the introduction of the Trichogrammatid wasps, Megaphragma mymaripene.[28] Special irrigation systems have been developed to meet the needs of the orchard crop.

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[26]F. A. McMurty, "Current Research on Biological Control of Avocado Insects and Mite Pests," California Avocado Society Yearbook (1961), p. 104.

[27]W. Ebeling, C. Fleschner, D. Ricker, "Some Factors that Influence Pest Population on Avocados," California Avocado Society Yearbook (1959), pp. 79-82.

[28]J. A. McMurty and H. G. Johnson, "Progress Report on the Introduction of the Ripe Parasites from the West Indies," California Avocado Society Yearbook (1967), p. 70.

Irrigation Systems

Unlike Florida's Dade County, where a rainfall of 60 inches per year is experienced, the niggardly precipitation in the South Coast Region (9.5 to 17 inches annually depending on the location) necessitates crop irrigation. Irrigation water is supplied throughout the high sun dry season and during the wetter late fall and early spring, as weather conditions dictate. Irrigation requirements range from about 1.5 acre feet per year on the littoral to 3.0 acre feet per year.[29] Water needs are greater in the interior locations due to the absence of a stratus cloud deck (advection fog) which results in a lower relative humidity, higher temperatures and, therefore, an increased evapotranspiration rate.[30] Although the water requirements vary among coastal and interior areas, irrigation systems utilized in avocado regions are determined either by individual preference or by retention of the original inexpensive citrus irrigation system rather than by the amount of water needed per year in a specific area. Several different irrigation techniques are employed in avocado groves, including the sprinkler, basin, and furrow systems.

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[29]D. O. Rosedale and C. D. Gustafson, Orchard Operations for Citrus and Avocados in San Diego County (Sacramento: University of California Agricultural Extension Service, September, 1966), p. 2.

[30]D. I. Eidermiller, "Economic Geography of Avocado Growing in San Diego County," unpublished Master's Thesis (Berkeley: University of California, 1951), p. 93.

Sprinkler irrigation in California is preferred at the present time because it offers the advantages of convenience, uniform penetration, more positive water control, and better adaptability to groves with high water costs, steep terrain, and shallow soils.[31] The overhead spray is an example of a sprinkler technique which employs an apparatus elevated on tall risers so that the water is sprayed over the tree tops. This system was originally established in the lemon groves of Ventura and Santa Barbara Counties, and it is still used in several groves recently transformed to avocado acreage (Plate 5). Its high construction and maintenance cost, the need for copious quantities of water, the lack of mobility, and the system's ineffectiveness in strong winds have limited the number of new overhead installations, and many are being replaced.[32]

Two types of underhead sprinklers are more operationally efficient, flexible, and therefore, more preferred by grove owners. The underhead permanent apparatus, a system comprised of immobile plastic or metal tubing laid beneath the ground with an individual riser for every one or two trees, provides the convenience of limiting labor expenditure as well as operating time. The portable plastic

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[31]J. E. Pehrson and F. K. Aljibury, "Start Right With Avocado Orchard Sprinklers," California Avocado Society Yearbook (1965), p. 99.

[32]G. E. Goodall, "Planting Avocados," op. cit., p. 166.

Plate 5--An avocado grove located in the Carpinteria District of Santa Barbara County displays an overhead sprinkler system. The irrigation technique was retained when the grove was transformed from lemons to avocados (note the lemon tree with fruit in the left corner of the photograph).

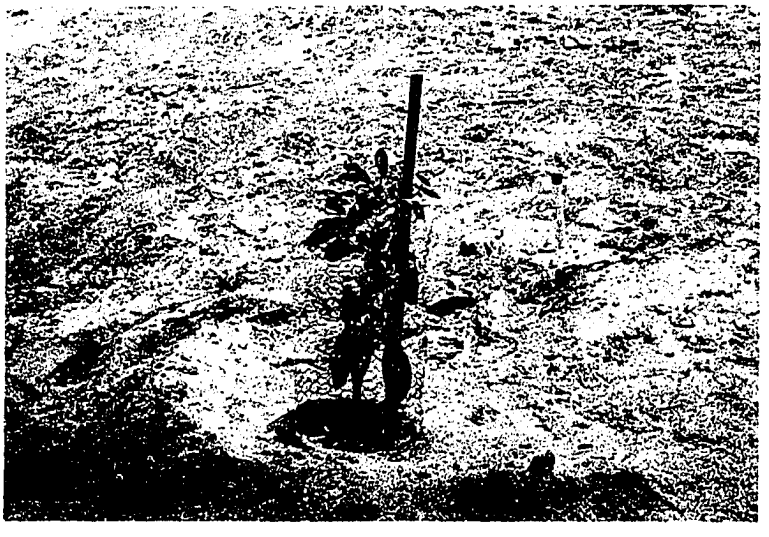

Plate 6--A young avocado tree located in the center of a recently constructed basin. A white spitter-type sprinkler head in the upper right side of the photograph supplies water to the tree. The chicken wire wrapped around the tree protects it from rodents.

hose system with sprinkler heads is a more flexible design. This technique, often called the "drag line system," involves moving the hose by hand between the rows, providing the advantage of placing the sprinklers in any desired position. Although the initial cost is lower, labor expenses are considerably greater. Thus, most growers, especially retired and part-time farmers, prefer the permanent system.[33]

Basin irrigation is utilized only during the new avocado planting stage. Each tree is placed in a small cone-shaped basin which is made by building the soil up around the drip line of the tree (Plate 6). Young trees, needing frequent irrigation due to their limited root system, are given water via permanently installed irrigation lines with spitter sprinkler heads in close proximity to the basin.[34] After the trees reach bearing age (4th year) the initial heads are replaced with a revolving sprinkler.

Finally, there is the furrow irrigation technique which works by gravity flow. This system, limited to relatively level topography, is employed on only a small percentage of the acreage devoted to avocados. Although generally regarded as an efficient and economical system,

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[33]C. D. Gustafson, Avocado Irrigation (San Diego: University of California Agricultural Extension Service, May, 1968), pp. 2-3.

[34]C. C. Delphey, Start Right With Young Avocados (Sacramento: University of California Agricultural Extension Service, September, 1964), p. 3.

furrow irrigation has the disadvantages of inadequate regulation of water dissemination, higher labor costs, and excessive evaporation loss. Most of the avocado establishments, still employing this irrigation system are large, relatively old ranches in which avocados have replaced citrus blocs.[35] In recent years the advent of the tensiometer has greatly assisted the application of water to the soil.

The relationship of a sandy loam soil with a high evaporation rate and a horizontal root structure, indicates that avocado plants must be watered frequently, at least every seven to 10 days. The method of determining the amount of soil water in the root area has been revolutionized by the use of the tensiometer. This instrument is a closed water-filled tube with a hollow ceramic tip. A pair of tensiometers is inserted into the soil, one at 12 inches, and the other at 24 inches where the soil dries out most rapidly at the drip line of the tree on its south side. The instrument designates the amount of soil suction which, in turn, indicates when the soil should be irrigated.[36]

Avocado rootstocks, like those of strawberries, are among the most sensitive to chloride salts in Southern California. The first irrigation in the spring should

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[35]Rosedale and Gustafson, op. cit., p. 2.

[36]Albert W. Marsh, Questions and Answers About Tensiometers (Riverside: University of California Agricultural Extension Service, July, 1967), pp. 1-17.

penetrate the soil depth (24 inches) at which injurious salts have accumulated over the preceding winter. The Colorado River, the primary source for most irrigation water in the Mid-Counties and San Diego County, contains over 100 parts per million of chloride.[37] Because the avocado tree is incapable of tolerating much more salt than is contained in the water, farm advisers recommend frequent light irrigations with a heavy application every five to eight weeks at the three-foot level.[38]

Much of the water for Southern California agriculture, as well as for industrial and domestic water supplies, is distributed by the Metropolitan Water District of Southern California (M.W.D.). The current water supply, received through the Los Angeles and Colorado River aqueducts, is enough to meet demands until the early 1970's. Fortunately, the State Water Project, bringing a supply from northern California, is expected to be in full operation by this time. The State Water Project, receiving most of its supply from the Feather River and Oroville Dam complex, will provide water to Southern California until 1990. At that time, the supply will have to be augmented by other means which may include dual-purpose nuclear desalination plants along the coast, northern California drainage basin

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[37]Lecture by C. D. Gustafson, farm adviser, at Fallbrook, California, June 6, 1968.

[38]Gordon Monfort, "Avocado Irrigation," Western Fruit Grower, 12 No. 2 (February, 1958), pp. C9-C10.

diversion projects, the reuse of waste water, and a general western states intraregional water plan.[39]

A change in water supply in the 1970's will have at least two effects on the avocado industry, one negative and another positive. In the first place, the cost of water will increase as a result of construction and long distance water conveyance. It is expected, however, that the chloride content of the water from the Feather River will be considerably less than that in the water now being utilized. Thus, when the northern water is finally mixed with Colorado River water at the local reservoirs, a general lowering of the salinity of the irrigation water can be expected.[40]

Harvesting and Processing

Although some harvesting does occur throughout the year, the period between December and October is the main season. The Fuerte variety, is picked between December and May, and the Hass variety is removed from the tree between May and September.[41]

By California state law the fruit can not be marketed if the oil content is below an 8 per cent average in a four-fruit sample lot, with a minimum floor of 7 per cent

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[39] Implementation of the California Water Plan, Bulletin No. 160-166 (Sacramento: State Department of Water Resources, March, 1966), pp. 20-21.

[40] Lecture by C. D. Gustafson, farm adviser, at Fallbrook, California, June 6, 1968.

[41] Rock and Platt, op. cit., pp. 14-15.

for an individual fruit. Most California varieties will shrivel up rather than soften once the fruit is removed from the tree if the oil content is much below this minimum percentage. Determination of the maturity of the fruit during the early harvest of a particular variety is not an easy task. The only positive way, is to have a few selective fruit tested in a laboratory, but there are several less effective ways of estimating maturity, such as through observation of the change of skin color, or the tint of the seed coat.[42]

The fruit continues to increase in oil percentage as the season progresses, but not all varieties mature at the same time. Perhaps the most favorable characteristic of the avocado, in contrast to other fruit crops, is that it does not ripen on the tree. The pericarp or edible portion is composed of parenchyma cells, which produce the oil, and a fibrous vascular system. Fruit growth is largely the result of the transportation of sugars and sugar derivatives from the large avocado leaves to the fruit where the sugar breaks down in a fatty oil.[43] Once the fruit is cut from the tree, the sugar supply terminates, and enzymes within the fruit

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[42] "Avocado Almanac," Citrus Leaves, A Handbook for California Fruit Growers (April, 1957), p. 16.

[43] C. A. Schroeder, "Growth and Development of the Avocado Fruit," California Avocado Society Yearbook (1958), pp. 114-118.

attack the cell walls causing a pericarp softening.[44] If the fruit was picked at a period when the oil content was low, the enzymes would not be plentiful enough to break down the cell walls adequately. A general deterioration would produce a shriveled fruit with a hard pericarp portion.[45] Avocado trees have the ability to retain their fruit for extended periods of time so that it can be picked selectively. This situation can result in favorable fruit distribution, providing the marketing procedure is administered properly.

Extreme care in picking, including the use of cotton gloves, must be practiced to prevent bruising the delicate skin of the avocado. Harvesting implements include two poles six feet and 12 feet long with a clipper blade and a canvas receptacle attached to the end; 10-foot and 25-foot wooden or aluminum ladders; 40-pound field boxes, hand clippers for arms-reach work; and a canvas picking bag which is carried by each person.[46]

The field boxes are kept in the shade as much as possible until the fruit can be moved to the packing plant. At the processing center, the avocados are brushed, sorted

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[44]E. Bogin and A. Wallace, "Avocado Fruit Ripening," California Agriculture (October, 1965), pp. 11-12.

[45]R. C. Bean, "Biochemical Reactions of the Avocado in Relation to Standards of Maturity," California Avocado Society Yearbook (1956), p. 450.

[46]David Freistadt, "Harvesting Avocados," California Avocado Society Yearbook (1958), pp. 39-40.

and weighed, all with careful handling. Finally, the fruit is placed in flats and lugs, containing 12 and 24 pounds of avocados respectively, pre-cooled to 42°F, and put in cold storage for a maximum of two to three weeks.[47]

Marketing, Transportation, and Distribution

Once the fruit has been harvested it must be marketed within 30 days. Approximately 60 per cent of the growers market their avocados through a cooperative agency, and nearly all the remaining fruit is handled through independent buyers.

The widely-used cooperatives are composed of growers and an elected board of directors. Operational fees for the purchase of buildings and equipment are obtained by keeping a percentage of the avocado sales.[48] On the other hand, the independent, or cash buyer, involves a private operation owned under a partnership or corporative structure. The cash buyer works on a profit motive basis, competes heavily with other handlers in terms of avocado sales from the orchard, assumes all fruit and marketing responsibilities once the grower sells the fruit, and usually operates on a

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[47]R. E. Puffer, Harvesting and Marketing Your Avocados (Sacramento: University of California Agricultural Extension Service, April, 1959), pp. 1-3.

[48]Ibid., p. 4.

low overhead basis.[49] In addition to the cash buyer's bargaining and sales capacities, it administers more than 60 per cent of the picking crews.

Both cooperatives and independent handlers process and distribute fruit. Since 1961, the California Avocado Advisory Board (C.A.A.B.), a state marketing order governed by growers and handlers, performs advertising, sales promotion, and marketing research for all California avocado producers. Calavo, the largest avocado cooperative agency, performs advertisement and promotional functions solely for its own products.

Once the fruit has been processed at the local packinghouse it is sold by private negotiation to brokers throughout the United States. The handler establishes an "asking price" which is adjusted daily and weekly depending upon supply and demand. After a period of bargaining, brokers purchase the fruit either f.o.b. packinghouse or as an order sale.[50]

Once purchased, the fruit is then moved from the packinghouse, which is located either at Santa Paula, La Habra, Fallbrook, or Escondido. Transportation services, in

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[49]Warren Henry, "The Role of the Independent Packer in the Avocado Industry," California Avocado Society Yearbook (1962), pp. 27-28.

[50]Stephen H. Sosnick, "Orderly Marketing for California Avocados," Hilgardia, 33 No. 14 (December, 1962), p. 708.

order of importance, include refrigerated truck, rail, ship, and airplane.

Nearly all avocado shipments west of the Mississippi River are transported by truck, a system which has advantages over rail service such as mixed commodity load, flexibility (associated with the carriers' ability to make intermittent unloading pauses in many cities along a single route), a lower volume requirement per carrier than the rail car, and prompt delivery. These advantages have resulted in the trucking of avocados as far east as Chicago.[51] It is significant to note that nearly all Florida avocados are shipped to eastern urban areas, including New York City, because the volume harvested at any one time in Dade County is not large enough to warrent bulk shipment in railroad cars equipped to handle 20,000 to 60,000 pound loads.

In the mid 1960's attention has focused on the "piggy back" or trailer-on-flat car railroad service. Special commodity freight rates have been established to provide an incentive to shippers of fruits and vegetables. The major reasons for utilization of this transportation system, even though it is about 10 per cent higher in cost than normal freight car service, is that the tariff is based

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[51] Telephone Communication with Robert Rock, Economist, California Agricultural Extension Service, Riverside, California, December 13, 1969.

on the vehicle, usually two trailers per flat car, rather than on weight.[52]

During specific times of the year when large quantities of fruits and vegetables can be transported from California at the same time, special transcontinental lading for full boxcar loads is arranged by the Santa Fe Railway Company. The route includes several communities in the South Coast Region and Imperial Valley-Coachella Valley of Southern California, southern Arizona, and involves shipments all the way to Chicago and New York. Avocados (during the months from February to August when production is highest), along with other perishable commodities, are transported in mixed carlot shipments under an incentive rate category. From region "Rate Basis 4" which includes California and parts of Arizona, the freight rates for a 40,000 pound carload are about 1.7 cents per pound to Denver and Oklahoma City and 2.07 cents per pound to Chicago, New York, and Atlanta.[53]

It is surmised that the rail tariff associated with the above destinations is not significant enough to threaten the future of the avocado industry in Southern California. The slight effect of transportation rates at the retail level is portrayed by the fact that the writer purchased two

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[52]Interview with Richard E. Warman, Chief Tariff Clerk, Santa Fe Railway Company, Oklahoma City, Oklahoma, December 13, 1969.

[53]Richard E. Warman, Personal Interview.

avocados of the same weight and variety, one from Oklahoma City and the other a week later in San Diego. The avocado in San Diego cost two cents more than the Oklahoma City purchase!

Once the fruit arrives at its destination it is moved by jobbers to wholesalers and retail stores. Calavo assists the sale and distribution of the fruit to the consumer by a nationwide marketing system composed of 26 offices strategically placed in major cities throughout the United States from Honolulu to Boston. Sales representatives in these cities obtain orders, and maintain contact with retail and wholesale buyers.[54]

From the loading docks at the packing plants, the fruit is shipped to all 50 states, Canada, and some overseas markets (Plate 13). Very little fruit is transported to West European markets via freighter or passenger liner because of fruit perishability and competition from the Republic of South Africa, Morocco, and Israel. In March, 1968, however the first shipment to the unexploited Japanese market was made on a new cargo vessel.[55]

Unfortunately, the distribution of avocados throughout the United States is not uniform. A 1963 California Avocado Marketing Survey of 463 retail stores in 16 major

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[54] Calavo Newsletter, June 23, 1967, p. 1.

[55] Calavo Newsletter, March 29, 1968, p. 1.

cities[56] provides some important insights into avocado distribution. Researchers conclude that the majority of the consumers are located in areas fairly close to points of production, i.e., in Southern California and Southern Florida. More consumer buying occurs in the western and southern states than in middle and northeastern states. In a recent conversation, Dr. Robert Rock estimated 1969 California avocado distribution outside the state at about 50 per cent of the total annual production.[57] Calavo's 1965 distribution figure of about 70 per cent outside California substantiates Rock's estimate since Calavo ships far more fruit outside California than any other handler.[58]

Table 3 indicates that only a few shippers provide service to eastern cities, but that no city had less than two shippers with sales outlets. The marketing researchers have also deduced that avocado sales occur mostly in large urban centers where the transportation network is well established. A high percentage of the food stores which sell California avocados are in Seattle, Denver, Chicago, New Orleans, San Antonio, and Dallas.[59]

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[56] Expanding the Market for California Avocados, Marketing Survey Report No. 19 (Sacramento: Department of Agriculture, Bureau of Marketing, February-March, 1963), pp. 2-4.

[57] Robert C. Rock, telephone interview.

[58] Calavo Newsletter, June 23, p. 2.

[59] Expanding the Market for California Avocados, op. cit., p. 4.

TABLE 3

A SAMPLING OF FOOD STORES HANDLING AVOCADOS AND THE NUMBER OF CALIFORNIA SHIPPERS

City	Number of Food Stores Handling Avocados			Number of Calif. Shippers[1]	Display Space in Square Feet[2]
	Florida Varieties	Calif. Varieties	None		
Seattle	0	28	4	7	5.9
Salt Lake City	0	18	1	3	6.4
Denver	0	28	0	5	3.2[3]
Kansas City	0	15	7	3	3.2
Minneapolis	0	15	4	2	2.6
Chicago	0	45	10	6	3.4
Dayton	4	10	3	3	2.0
Toledo	0	17	6	2	2.0
Cleveland	0	19	3	2	2.2
Boston	0	14	6	4	0.9
New York	10	32	27	4	1.3
Washington, D. C.	0	22	1	3	3.8
Atlanta	2	17	9	5	3.1
New Orleans	3	27	2	4	4.3
San Antonio	0	30	3	4	7.1
Dallas	0	26	5	3	5.4

[1]Only Shippers with brand names could be indicated.

[2]Average display space assigned to avocados in large stores.

[3]A low average due to one chain store with a very small store space.

Source: Expanding the Market for California Avocados, Marketing Survey Report No. 19. Sacremento: Department of Agriculture, Bureau of Marketing, 1963.

Further conclusions of the 1963 survey include: (1) most avocado consumers in the above cities are upper middle class urban residents; (2) most avocado consumers buy on impulse--therefore, the more attractive the display the greater the sale; (3) eastern consumers, although representing a small fraction of total consumer numbers, usually purchase more fruit per person; and (4) wholesalers and retailers generally feel that demand could be substantially increased by improving advertisement and promotional campaigns.[60]

In general, Southern California avocado authorities agree that consumer demand is more than enough to use up the United States annual avocado supply. A projected market-demand study conducted by the San Diego County Planning Agency indicated that consumer avocado demand by 1990 will be about 451,000,000 pounds per year. By that time, California production is not expected to exceed 296,000,000 pounds per year.[61] It appears that consumer demand in the future will be of minimal concern to the industry because California avocado acreage has nearly stabilized since the early 1960's.

Appendix I presents a summarization of avocado acreage, production, yields, and grower returns in California

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[60] Ibid., pp. 4-8.

[61] Agriculture, Regional General Plan, San Diego County 1990 (San Diego: County Planning Agency, 1966), p. 20.

from 1919 to 1968. Subsequent chapters deal with problems of location, development, and maturity, and with the shortcomings and future of the industry in the South Coast Region. Temporal changes will reflect the changing modes of production and the new distribution patterns.

CHAPTER III

HISTORICAL DEVELOPMENT OF THE AVOCADO INDUSTRY

The avocado had been known in the United States since the 18th century via importation from several Latin American countries. It was not introduced as a crop until 1833 when Henry Perrine, a nurseryman, planted a few Mexican seedlings south of Miami, Florida. The construction of a north-south railroad line in 1900 was the causal factor which helped develop large-scale south peninsula settlement in close proximity to Cuba, where the avocado was grown successfully.[1] The establishment of commercial avocado enterprises in southern Florida from Cuban seedings was fostered by the influence of nurserymen George B. Cellon and John B. Beach. Both experimented with avocado propagation, grafting, and budwood trials.[2] The knowledge gained from these early Florida studies helped to pave the way for the California

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[1]Wilson Popenoe, Manual of Tropical and Subtropical Fruits (New York: The Macmillan Co., 1927), p. 19.

[2]J. B. Beach, "The Avocado in Florida," California Avocado Association Report (1916), pp. 165-168.

industry which was just beginning to show healthy growth at the turn of the 20th century.

Introduction of the Avocado in California

The avocado, unlike many tropical and subtropical fruits, was not brought to present-day California by 18th century Franciscan missionaries.[3] The first record of the fruit in the state, according to the California State Agricultural Society, was the planting of several Nicaraguan seedlings in the San Gabriel Valley by Dr. Thomas J. White in 1856.[4] However, the California Avocado Society claims that the Dalton family planted the first avocados in 1858 in a community later to be called Azusa in the eastern Los Angeles Lowland.[5]

Before 1900, several individual South Coast plantings helped set the stage for orchard development. In 1871 Judge R. B. Ord of Santa Barbara planted three Mexican seedlings which, in turn, provided an incentive for others including J. C. Harvey and Francisco Franceschi to plant the exotic green fruit.[6] Juan Murrieta and Jacob Miller, among

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[3]Juan Murrieta, "Early Introduction of the Avocado into California," California Avocado Association Report (1918-1919), p. 84.

[4]Harry M. Butterfield, A History of Subtropical Fruits and Nuts in California (Berkeley: University of California, Division of Agriculture Science, 1963), p. 5.

[5]Walter R. Beck, "Report of the President," California Avocado Society Yearbook (1965), p. 12.

[6]Butterfield, op. cit., p. 6.

others, helped arouse interest in avocados in Los Angeles as the result of several importations from Mexico in the 1880's. Among the promising commercial varieties from these early plantings were the Royal, Walker, and Murrieta.[7] Further dissemination of commercial avocado plantings occurred in Escondido, by W. W. Prior (1892)[8] and C. P. Taft of Orange, California in 1899.[9]

In brief, the promising growth of initial plantings in the 19th century stimulated an expansion from a few back-yard trees to several larger experimental undertakings. There was a transformation from the early hobbyists and estate owners who planted avocados as a scientific curiosity, to more commercially-minded growers after the turn of the century.[10]

Nurserymen brought about the commercial avocado era in Southern California in the first decade of the 1900's.[11] F. O. Popenoe of the West India Gardens, a nursery in Altadena, realized the potential of the Florida industry and capitalized on the knowledge that had been learned there.

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[7]Knowles Ryerson, Avocado Culture in California (Sacramento, University of California, Agricultural Station Bulletin 365:1, 1923), p. 575.

[8]Claude B. Hutchison, California Agriculture (Berkeley: University of California Press, 1946), p. 215.

[9]Butterfield, op. cit., p. 6.

[10]Personal communication from Walter R. Beck, December 3, 1968.

[11]Hutchison, op. cit., p. 215.

After determining that Florida's West Indian varieties could not tolerate Southern California winter temperatures, he and several others explored the avocado districts of Mexico and Guatemala. One such explorer was Carl Schmidt, a 21 year old employee of the Altadena nursery, who brought 40 varieties back from Atlixco, Mexico. One of the varieties was budwood number 15, the only one of the lot to tolerate the 1913 freeze. It became known as Fuerte, Spanish for strong and hardy, and it remains the most important variety to the present day.[12] Several expeditions followed the F. O. Popenoe-Schmidt period, and many varieties of all three races were planted, but few of them were amenable to commercial cultivation. In 1913 F. O. Popenoe was employed by the Office of Foreign Plants of the United States Department of Agriculture to search for propitious foreign varieties to be grown in California and Florida.[13] By 1915, there were 85 known varieties. At this time the initiation of small groves with budded avocado trees, established for economic gain, brought the early exploratory and experimental period to a close.

Avocado prices in hotels and other limited markets in Los Angeles and San Diego at first ranged from

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[12]C. D. Gustafson, History of the Avocado (San Diego: California Agricultural Extension Service, November, 1967), p. 1.

[13]F. W. Popenoe, "Looking Back," California Avocado Association Yearbook (1936), p. 58.

$.60-$1.00 per fruit, a factor which led to rapid initial growth and a multitude of land promotion schemes.[14] Many of the early grove owners, most of whom were affluent landholders, realized the necessity for an avocado agency which could organize the growers and promote the fruit. As an example of the marketing dilemma, Mr. E. B. Rivers a produce dealer who had been importing avocados from Honolulu and Haiti for 15 years, stated in 1915 that the maximum market in Los Angeles was only three or four dozen fruit per year. Efforts toward improving the avocado situation resulted in the formation of the California Ahuacate Association (later changed to California Avocado Association) May 15, 1915 at the Alexandria Hotel in Los Angeles. The total membership of the organization, which later became known as the California Avocado Society, numbered only 74.[15]

The Birth of Calavo

Before 1920, avocado processing and marketing was handled at the grower level due to the limited number of participating owners. In fact, the entire South Coast contained only 100 avocado acres in 1915. With the increase in production, participants in the new industry realized the need to be formally organized. In 1923, the Association

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[14]Personal communication with Walter R. Beck, op. cit., p. 2.

[15]Jack Shepherd, "The Views of Janus," California Avocado Society Yearbook (1964), pp. 22-23.

sponsored an organization that would help establish markets and disseminate the fruit more effectively. The new marketing cooperative was known as the California Avocado Growers Exchange (later changed to Calavo Growers of California). George Hodgkin, a charter member of the Association, was designated as general manager.[16] Calavo was initiated as a non profit marketing agency which was to be owned and managed on a cooperative basis by its members.[17] By 1924, the organization marketed nearly 180,000 pounds of avocados, and the advertising program was underway.[18] Some of the problems that Calavo had to overcome included: (1) the 1913 Department of Agriculture report that the South Coast area was unsuited for the growth of avocados; (2) the promotion of a non-sweet, non-juicy fruit that was inedible at harvest; (3) an almost complete consumer and retailer ignorance.[19]

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[16]Jack Shepherd, "The Views of Venus," op. cit., p. 25.

[17]E. Humanson, "The History of Calavo, Subtropic Fruit Company," California Avocado Society Yearbook (1937), pp. 260-264.

[18]Jack Shepherd, "One Strong From Many Weak," California Avocado Society Yearbook (1962), p. 29.

[19]"End of An Era," California Citrograph, 54 No. 10 (August, 1969), p. 432.

Early Commercial Development in San Diego County (1915 to 1945)

San Diego, currently the major avocado county in California, has been characterized, more than any other county, by variety and acreage vicissitudes over the past 50 years. Although the commercial era began between 1915 and 1920, the first few years of the period were still predominately experimental in nature. Several Guatemalan and Mexican varieties were planted in an effort to determine their maximum and minimum environmental tolerances. A number of avocado districts developed out of the initial commercial areas. San Diego County's southern district was located in small communities adjacent to metropolitan San Diego (Chula Vista, Bonita, Lemon Grove, and Point Loma). Approximately 45 miles to the north, a second district began to take shape. The community of Vista dominated county acreage from the beginning, and lesser areas such as Encinitas, Carlsbad, and Fallbrook also began to form. Many of the early avocado groves were associated with larger citrus orchard plantings and were invariable small, usually 1 to 2 acres, with occasional orchards of 3 to 5 acres.[20] The avocado districts were supplied with irrigation water by recently completed dams on large ephemeral streams and by wells on alluvial lowlands and foothill aquifers. Many of

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[20] D. I. Eidemiller, op. cit., pp. 40-43.

the early groves failed to be productive due to a lack of experience in horticultural practices and techniques.[21]

It is doubtlessly true, however, that several orchards were highly productive for the period. The success led farmers to envision the expansion of avocado acreage on a much broader basis.[22] Land promoters and real estate agents, realizing the vast promotional potential of the avocado in the early 1920's portrayed the grove as a highly profitable enterprise.[23] Newspaper and magazine articles suggested many districts in San Diego County, especially Vista, as possible avocado Gardens of Eden. The end result was subdivision of chaparral topography on the periphery of the small, northern San Diego county communities into one and two acre plots. By the late 1920's, land values ranged from $400 to $1,200 per acre depending on water availability and site.[24] Unfortunately, many groves were indiscriminantly established on land unsuited for the growth of avocado trees. Little attention was given to the quality of the soil, especially subsurface drainage conditions, or location from a microclimatic viewpoint.[25] Many of the favorable sites were

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[21] Ibid., pp. 85-87.

[22] Ibid., p. 80.

[23] Walter W. Beck, personal communication.

[24] D. I. Eidemiller, op. cit., pp. 43-45.

[25] Handbook for Avocado Growers (Los Angeles: Calavo Growers of California, 1946), p. 100.

planted with the Fuerte which became the dominant variety in San Diego County. It seems a reasonable assumption that land promotion may not have been entirely detrimental to the industry in the long run, although several grove owners did sustain an economic loss. This speculation period succeeded in implanting the hithertofore almost unknown avocado in the minds of Southern California consumers. Moreover, it indirectly helped to determine the physical limits of the avocado at a relatively early period.

From 1921 to 1930, there was a shift in the avocado location from the original small-scale plantings around San Diego to the northern part of the county. Vista continued to dominate the acreage, but Oceanside, Rancho Santa Fe, Solana Beach, and Escondido joined Carlsbad, Encinitas, and Fallbrook. In the southern district, only the newly established La Mesa District experienced any growth during this period.[26]

By 1930, the focus of attention shifted to locations in which the physical amenities were in favor of profitable avocado growth.[27] Throughout the entire county the majority of the avocado groves were being established on hillside locations which afforded protection against winter lowland temperature inversions. Furthermore, sloping land offered no competition to other tree or field crops which were

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[26]D. I. Eidemiller, op. cit., p. 84.

[27]Ibid., p. 81.

usually grown on the lower slopes or flat lands where deep alluvial soils were available.

Land values increased sharply during the 1930's and 1940's in many sites adjacent to the avocado-growing communities. They were often in excess of $1,200 per acre due to increased assessed valuation of the land according to its urban resale value.[28] A high rate of new plantings was experienced throughout the region due to the quasi-avocado prosperity which developed during the years between 1930 and 1933. For example, San Diego County avocado acreage expanded from 3,585 acres to 8,392 acres during that period. The increase was most evident in the Escondido, Fallbrook, La Mesa, and El Cajon districts.[29]

With the onset of the depression, a general decline in the rate of new plantings occurred between 1933 and 1941 because of low fruit prices (Appendix I). By 1942, many avocado districts were beginning to be affected by the root rot fungus, Phytophora cinnamomi. In fact, 326 acres were removed in San Diego County alone during that year.[30] The problem became so acute by 1944 that the Avocado Society initiated a fund drive which acquired $6,000 in voluntary contributions for root rot research. The money was donated to the University of California at Riverside to help develop

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[28] Ibid., p. 84.

[29] Ibid., p. 46.

[30] Ibid., p. 47.

an intensive research project. This undertaking was the beginning of a long-term study in an effort to understand the causes of the fungus disease and to propagate a resistant root stock.[31] Nevertheless, avocado acreage continued to climb in the Mid-County area as well as in San Diego County.

Mid-County and North County Avocado Acreage Trends (1915-1945)

The Mid-County's initial thrust was a replica of San Diego County in terms of small initial plantings, the multitude of varieties, the speculation period, the rise in land values, and the rapidity of development due to the impetus of early commercial plantings. This early growth was facilitated by a relatively large local market in the Los Angeles Basin and the early development of the prolific Fuerte variety in the Yorba Linda community in Orange County.[32] Most Los Angeles grove establishment, after the promotion and speculation era of the 1920's, centered upon the area around Hollywood, the Whittier-Puente Hills District, and along the San Gabriel foothills from Pasadena, through Monrovia to Azusa.

Early avocado plantings in Orange County began as interplantings with citrus trees. However, most of the

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[31]Jack Shepherd, op. cit., pp. 26-27.

[32]Dwight Poole and Mildred Poole, "From Pigs to Riches," California Avocado Society Yearbook (1967), pp. 27-28.

avocado locations shifted to the rolling hills adjacent to the communities of La Habra, Fullerton, Yorba Linda, Orange and Tustin.[33]

The North Counties did not develop very rapidly despite early experimental plantings in Santa Barbara County. A small industry had developed by 1920 to the east and west of metropolitan Santa Barbara in the south coast area of that county. Unfortunately, lemon groves existed in the sites where avocados could thrive best, and the profits acquired from the citrus fruit precluded expansion beyond 400 acres until 1945.[34]

Similarly, Ventura County developed a small avocado crop as an alternate to lemons, mostly during the 1940's. This county was the first to establish an avocado school under the direction of farm advisers. The school helped convert many farmers from citrus to avocados, and acreage began to expand. By 1945, Ventura County, was only slightly behind its northwestern neighbor with 407 acres, but acreage was beginning to increase sharply especially in the Ventura-Fillmore area. An indication of expansion elsewhere in the county was a reflection of its future trend of becoming the

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[33]C. F. Kinman, Avocado Culture in California (Sacramento: United States Department of Horticultural Crops and Diseases, 1954), p. 1.

[34]R. C. Cole, et al., Soil Survey, Santa Barbara Area, California, Series 1944, No. 8 (Sacramento: United States Department of Agriculture, Soil Conservation Service, March, 1958), pp. 14-16.

most productive northern county,[35] yet it was still far behind the southern regions. For example by 1945, San Diego County comprised the majority of the acreage with 9,535, followed by Los Angeles with 3,456, and Orange County with 2,195 acres (Figure 4).[36]

General Economic Trends During the 1920-1945 Period

Avocado prices are, by and large, determined by supply and demand. The avocado industry over the years has undergone considerable annual price and grower return fluctuation. These annual changes are due to the tree's alternate bearing characteristic or untimely weather conditions which can give rise to either an exceptionally fine or a very poor crop year. Although there are yearly price changes, long term trends are quite discernible.

From the early 1920's until 1944 the general pattern of avocado prices per pound, was sporadically downward (Appendix I). At the same time, the total United States production increased from a few hundred tons in the early 1920's to an early high of 21,300 tons in 1943-1944.[37] It

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[35]Personal Interview with Calvin C. Delphey, former Ventura County Farm Advisor, July 16, 1968.

[36]R. C. Rock and R. G. Platt, Economic Aspects of Marketing California Avocados (Riverside: University of California, Agricultural Extension Service, May, 1968), p. 12.

[37]The avocado crop year begins October 1 and ends September 30.

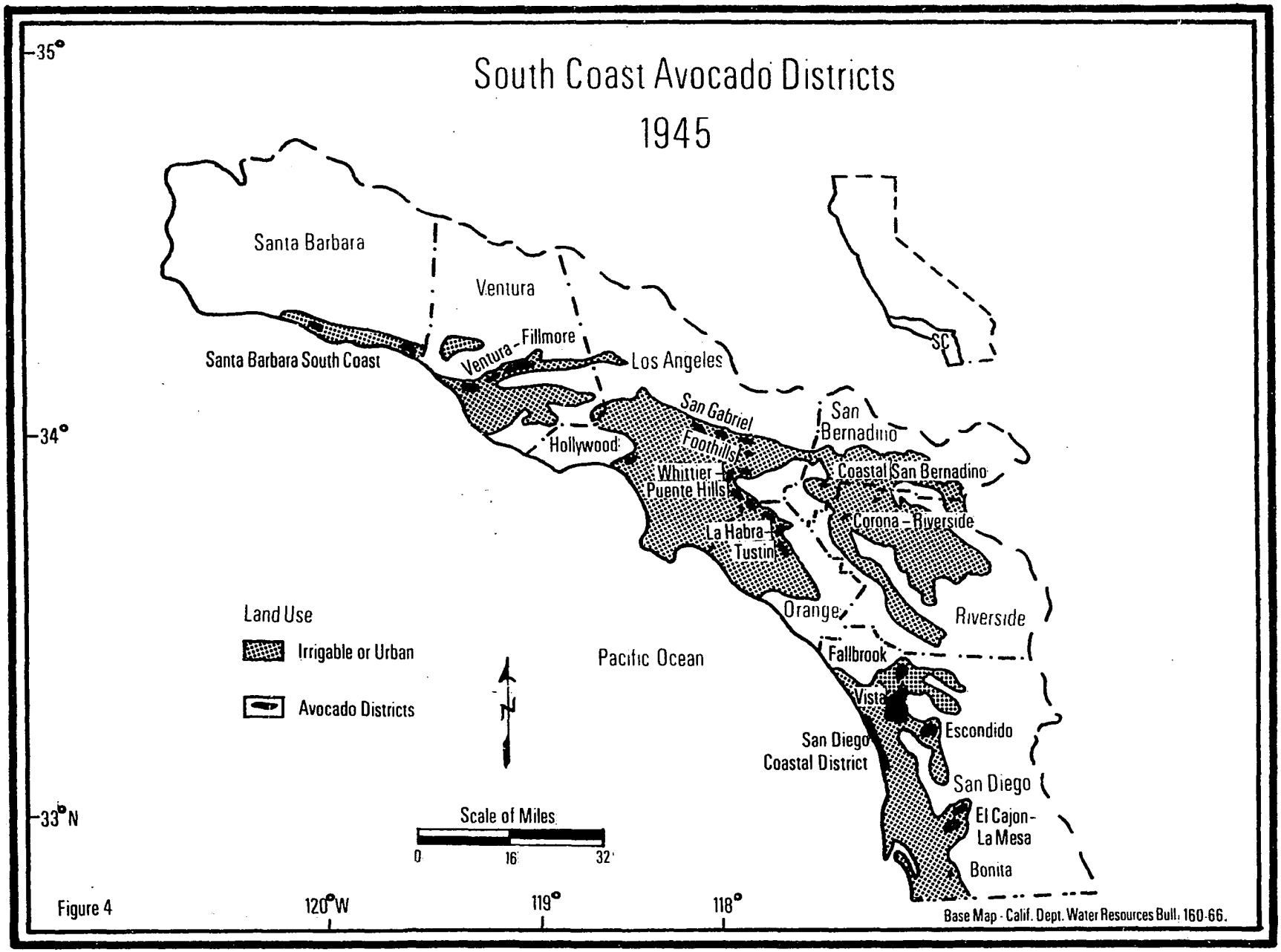
South Coast Avocado Districts
1945
35°
34°
33°N
120°W
119°
118°
Santa Barbara
Ventura
Santa Barbara South Coast
Ventura – Fillmore
Los Angeles
SC
San Gabriel Foothills
San Bernadino
Hollywood
Whittier – Puente Hills
Coastal San Bernadino
Corona – Riverside
La Habra – Tustin
Orange
Riverside
Fallbrook
Vista
Escondido
San Diego Coastal District
San Diego
El Cajon – La Mesa
Bonita
Pacific Ocean
Land Use
Irrigable or Urban
Avocado Districts
N
Scale of Miles
0
16
32
Base Map - Calif. Dept. Water Resources Bull. 160-66.

Figure 4

is significant to note that Cuban low duty importation exceeded the minor Florida production between 1924 and 1941, and California production did not exceed imports from Cuba until 1934.[38]

High prices were received for the fruit during the 1920's due to the small number of commercial plantings and sufficient demand in the local San Diego and Los Angeles markets. Lower fruit prices were prevalent throughout most of the 1930's due to increased production and the economic depression which reduced consumer purchasing power. Avocado prices began to rise again during World War II. The crop year 1942-1943 was the first year in the industry's history in which gross returns exceeded $3,000,000.[39] During the 1944-1945 crop year, the price per pound of fruit increased to 26.1 cents, a mark which had not been surpassed since 1929-1930.

Economic conditions during the war brought stability and relative prosperity to the avocado industry. The avocado was approved for wartime production because of the low labor requirements and its relative high nutritive food value, especially in vitamins, proteins, minerals, and fatty

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[38]Frank Gilkerson, "Avocado Marketing Methods: The Commercial Association," California Avocado Society Yearbook (1962), p. 33.

[39]W. Sullivan, Avocado Situation in California, 1947 (Sacramento: California Agricultural Experimental Station, Circular 372, 1947), p. 14.

oils.[40] In brief, avocado prices increased sharply at the retail level, and consumer interest reached a new high due to the wartime economy.

The Modern Commercial Era, 1945 to the Present

After the war, the economic trend provided by a favorable wartime economy continued with an expansion in the state avocado acreage to over 16,000 acres in 1946. This growth persisted until a peak was reached in 1959.[41] The general upward trend in the late 1940's and 1950's was the result of a combination of several variables which shall be enumerated subsequently.

By the early 1950's many middle class Southern Californians had accumulated enough wealth to escape from their urban environment, and an important trend was developing. Colorado River water was made available for irrigation purposes following the completion of the aqueduct system in 1941 to Los Angeles County, and in 1947 to San Diego.[42] In the years thereafter, increased volumns of water were transported to the Metropolitan Water District of Southern California as agricultural, domestic, and industrial demands

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[40] B. O. Bergh, and R. H. Whitsell, "A History of the California Avocado Industry," California Citrograph, 54, No. 7 (May, 1969), p. 319.

[41] Rock and Platt, op. cit., p. 13.

[42] Coastal Los Angeles County Land and Water Use Survey, 1960 (Sacramento: State Department of Water Resources, March, 1964), p. 16.

grow larger.[43] Between 1950 and 1954, nonbearing acreage, which is an indication of new plantings, averaged about 8,500 acres per year, largely due to increased availability of water, land, and capital. The early 1950's represented the most prodigious planting period in the history of the industry. Moreover, the demand for additional trees fostered a growth in avocado nurseries as well as most other facets of the industry.[44]

Avocado Acreage Shifts in the Mid and North Counties

Individual county acreage, however, fluctuated more dramatically than total acreage during the modern era. For example, while San Diego County showed a general upward trend through 1959, Los Angeles had already reached its acreage peak in 1945 and was declining. Orange County increased over 900 acres from 1945 to 1958, and Riverside and San Bernadino counties increased a total of 557 acres.[45] The lack of large-scale growth in the Mid-Counties, and a specific decline in the Los Angeles Lowland exemplified a shift in acreage and dominance.

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[43] Water and San Diego County Growth (San Diego: Western Management Consultants, 1966), pp. 45-46.

[44] Oliver Atkins, "Present and Future Outlook of the Avocado Nurserymen in California," California Avocado Society Yearbook (1968), p. 59.

[45] Rock and Platt, California Avocados, op. cit., p. 13.

By the 1960's the combination of increasing taxes, water cost, and land values in Los Angeles County had discouraged new plantings and serious grove clearing for urban development occurred generally throughout the Mid-Counties. It progressed to the point where farm advisers, realizing the futility of the problem, no longer considered the area to be of commercial value.[46] Because of a population spillover from the Los Angeles metropolitan area, Orange County experienced a similar trend, but commercial groves on two large corporation holdings in the Irvine-El Toro District helped prevent an almost complete transformation of avocado groves to a noncommercial status. The most significant rise in acreage occurred in the North Counties.

Both Santa Barbara and Ventura exceeded the 1,000 acre mark in 1950, but the acreage in Ventura County had stabilized somewhat after 1959, whereas Santa Barbara continued to gain slightly.[47] The Santa Barbara District consolidated in the 1950's in an area from Goleta in the west to Carpinteria on the east. Ventura County's groves have centered in recent years on the Ventura-Santa Paula District in the north and the Camarillo Heights-Somis-Moorpark District to the south of the Santa Clara River Valley (Appendix II). In brief, the most significant trend in the

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[46]Communication with Arthur Van Dam, Los Angeles County Farm Advisor, July 2, 1968.

[47]Rock and Platt, op. cit., p. 13.

modern era, other than the continued dominance of San Diego County, has been the substitution of secondary economic dominance from the Mid-Counties to the North Counties.

San Diego County Acreage Increases

In the late 1940's, the foothill zone in the northern portion of San Diego County continued to dominate all other counties with approximately two-thirds of the acreage. Vista contained the majority of acreage with nearly 3,500 acres, but the Escondido District was asserting some dominance of its own with 1,400 acres. Much of Vista's avocado area, located on its eastern foothill periphery, was planted on poorly drained soils. As a result, many groves succumbed in the late 1950's and early 1960's due to the combination of a perched water table and the presence of root rot fungus.[48] Since the mid 1960's, Escondido has been undergoing a similar trend, but the situation is magnified by increasing land values as well. Like most of the larger districts in the county, Escondido's orchards are characteristically located on the upper hillsides slopes, whereas citrus and row crops occupy the lower slopes and bottom lands.

The Fallbrook District, including San Luis Rey Heights, was nearly completely transformed from an olive and field crop area to an important avocado center shortly after

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[48] D. I. Eidemiller, op. cit., pp. 47-50.

the end of World War II. The change from dry cropping occurred when irrigation water was made available from the Colorado River. Prior to this time, avocado acreage was somewhat limited due to poor water quality in the local aquifers.[49] There were three outstanding reasons for the rapid growth in Fallbrook: (1) the local dissected hillsides near an established service center offered a prime location for avocados once irrigation water was available; (2) the small amount of citrus acreage did not act as a significant competitor as it did in some other areas; and (3) the rural landscape presented an enticing environment for Los Angeles Lowland residents in search of less expensive land. As a result, Fallbrook expanded from an estimated 900 acres in 1950 to a point where it had surpassed all others in Southern California by the end of the decade.

Another northern San Diego County avocado zone of particular note is the Pala-Pauma District which began to develop about 1950 when only 30 acres were bearing fruit.[50] In the past fifteen years the district east of Fallbrook from Rainbow through Pala-Pauma valleys and Valley Center has become the fastest growing avocado area in the South Coast. Much of the orchard growth here can be attributed to an outward migration from the central Fallbrook District,

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[49]Personal interview with Walter R. Beck, Avocado Industry Leader and San Luis Rey Heights grove owner, June 14, 1968.

[50]D. I. Eidemiller, op. cit., p. 52.

toward the east and a continued interest in land speculation and rural living by Los Angeles Basin residents.

Unlike the northern interior foothill avocado districts of San Diego County, the orchards along the coastal margin have been experiencing a serious acreage reduction. The littoral between Oceanside on the north and Solano Beach at the southern extremity has been declining for the following reasons, i.e.: land speculators refuse to provide the proper care needed to retain the groves on a commercial status; housing construction has grown at the avocado orchard's expense; the loamy sand soils of the marine terraces are not conducive to favorable tree growth; and none of the major coastal varieties such as Hass, Fuerte, Itzamnia, Anaheim, Nabal, and Dickinson have been very productive along the coal littoral. By the mid 1960's, this district was no longer significant commercially, although some fruit is marketed each year from groves in the Encinitas-Leucadia Hills area.[51]

Lakeside and El Cajon, near the city of San Diego, have also failed to increase their avocado acreage since 1945. Even the La Mesa District, which was largely confined to the eastern and western slopes of Mount Helix, has declined. After World War II, Eidemiller[52] estimated that the

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[51] Personal interview with Everett Johnson, Vista Independent Buyer, August 25, 1968.

[52] D. I. Eidemiller, op. cit., p. 45.

La Mesa District had 480 acres, but the development of urban lots with expensive homes on the scenic hillsides of Mount Helix reduced the avocado acreage in the 1960's until hardly a complete grove remained intact.[53] Appendix II displays the avocado plantings in Southern California as they appear in 1969.

In addition to a considerable shift of avocado districts in Southern California, the modern era has been characterized by a reduction in the number of commercial varieties prevalent in the industry. In the mid-1950's, the California Avocado Society Variety Committee initiated an intensive drive to remove varieties which were unproductive as well as undesirable in taste, appearance and handling. For example, the Taft, a major variety in the first two decades of the industry, had a severe alternate bearing habit and came into initial production very slowly. Another early variety, the Lyon, produced so profusely that the tree was stunted and would often die under the bearing strain. The Nabal was known by many growers as the best tasting fruit, but it was generally a poor producer.[54]

After a massive two-year grafting (topworking) program, more than 50,000 trees were topworked to more propitious varieties. The multitude of older varieties were

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[53]David Freistadt, personal interview.

[54]B. O. Bergh, "Breeding Avocados at C.R.C." California Avocado Society Yearbook (1961), pp. 67-74.

replaced by Hass, Fuerte, Bacon, and Zutano, but the Fuerte which does not produce well in the North and Mid-Counties was grafted to Hass.[55] The trend toward Hass has also been evident in San Diego County mainly because it yields more fruit per tree.

Marketing Crisis and Reorganization of the 1960's

In the mid 1950's, and especially in 1959, the industry had been beset by three years of heavy production and associated low prices. Many growers became disenchanted with Calavo, which at that time had been marketing between 60 and 85 per cent of California's avocados.[56] Some felt that Calavo, the only handler to perform a large-scale advertising program, had failed to develop the eastern market. Thus, fruit distribution was limited during heavy crop years by a static buyer demand which resulted in a pronounced fruit price drop. The consequence was an exodus from the cooperative agency to a multitude of independent handler organizations which were initiated and continued to grow at Calavo's expense.[57] The low mean gross return per acre from 1957 to 1960 of $158.00 discouraged the introduction of new

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[55]James A. Beutel, "50,000 Avocados Trees Top-worked," California Avocado Society Yearbook (1957), pp. 43-45.

[56]Frank Gilkerson, op. cit., 33.

[57]David Freistadt, personal interview.

plantings. Moreover, several small nurseries became overstocked with young trees and were forced into bankruptcy.[58]

In 1959, several Fallbrook grove owners met to discuss the possibility of developing an industry-wide avocado advertisement and promotional campaign. It was obvious to them that the industry needed an agency which could draw wide grower and handler support. As a result, a voluntary agency called the California Avocado Development Organization, was established primarily as a marketing and promotion organization. However, in July, 1959, it did not receive approval by the handlers.[59] A short time later the Avocado Promotion Committee of the Avocado Society conceived of a compulsory plan for the collection of promotional funds under a state marketing program. After considerable delay, the California Avocado Marketing Order was finally implemented in 1961.[60] The development organization, which also became active in 1961, was revised to deal with problems of a general nature within the industry, especially at the handler's level. On several occasions, the Marketing Order and the Avocado Development Organization have coordinated

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[58]Oliver Atkins, op. cit., 59.

[59]B. O. Bergh and R. H. Whitsell, op. cit., p. 39.

[60]Walter R. Beck, "California Avocado Marketing Order," California Avocado Society Yearbook (1962), pp. 17-18.

closely on matters of importance to the entire industry.[61] Thus, the era of the 1960's was characterized by the initiation of the two new associations which provided more unity and organization, and helped to integrate and amalgamate a highly agglomerated industry.

After a detailed portrayal of the avocado industry's man-land relationships through time, it is important to examine the factors which have placed physical restrictions on the location and profitable development of the crop. These physical limitations exhibit many aspects of geographic possibilism.

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[61] T. E. Lynn, Preston, "C.A.D.O.--The Avocado Handlers Association," California Avocado Society Yearbook (1962), pp. 23-25.

CHAPTER IV

PHYSICAL DETERMINANTS IN AVOCADO LOCATION

From the first appearance of the avocado in California, there has been great concern over the commercial feasibility of avocado production in the United States, and rightly so, because the plant had never been grown at a latitude beyond 32°N. The question that played constantly on the minds of early horticulturists was the physical limitations that might restrict the effective planting range of the commercial varieties. This concern is not without justification even in the modern period, for the avocado, according to Hodgson, is considered to be unquestionably the most sensitive and demanding subtropical fruit grown commercially in the United States.[1]

The perception of three physical variables influences avocado grove location: physiography, climatology, and pedology. The physiographic factor plays a significant role in restricting northern and eastern expansion, and, at the same time, affords protection to the South Coast from

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[1]Robert W. Hodgson, "The Avocado--A Gift From the Middle Americas," Economic Botany 4 No. 3 (1950), p. 265.

extensive cold air mass intrusion. Climatological controls help to limit the milieu within which avocado trees can survive in California, but it is the micro-climatic factors, including maximum and minimum temperatures, which play the most important roles. Soil characteristics essential to avocado cultivation are complex, but significant soil factors are related to subsurface drainage, and only in a limited degree to distribution.

Correlation of Physiography and Avocado Cluster Location

The commercial avocado industry is almost entirely confined to a narrow belt of land southwest of the Transverse and Peninsular ranges. The northern boundary is clearly defined by the west-east trending Transverse Range which includes the major individual systems of the Santa Ynez, Santa Monica, San Gabriel, and San Bernadino mountains (Figure 5). These mountains consist of folded sedimentary and igneous rock, underlain by a massive batholithic intrusion, with faults along the periphery.[2]

The Peninsular Range is a northwest to southeast oriented system which nearly abuts the Transverse Range on the north at the San Gorgonio Pass. Located approximately 55 miles from the Pacific Ocean, this elongated complex is comprised of several individual mountains separated by fault

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[2]William D. Thornbury, Regional Geomorphology of the United States (New York: John Wiley and Sons, Inc., 1965), pp. 545-546.

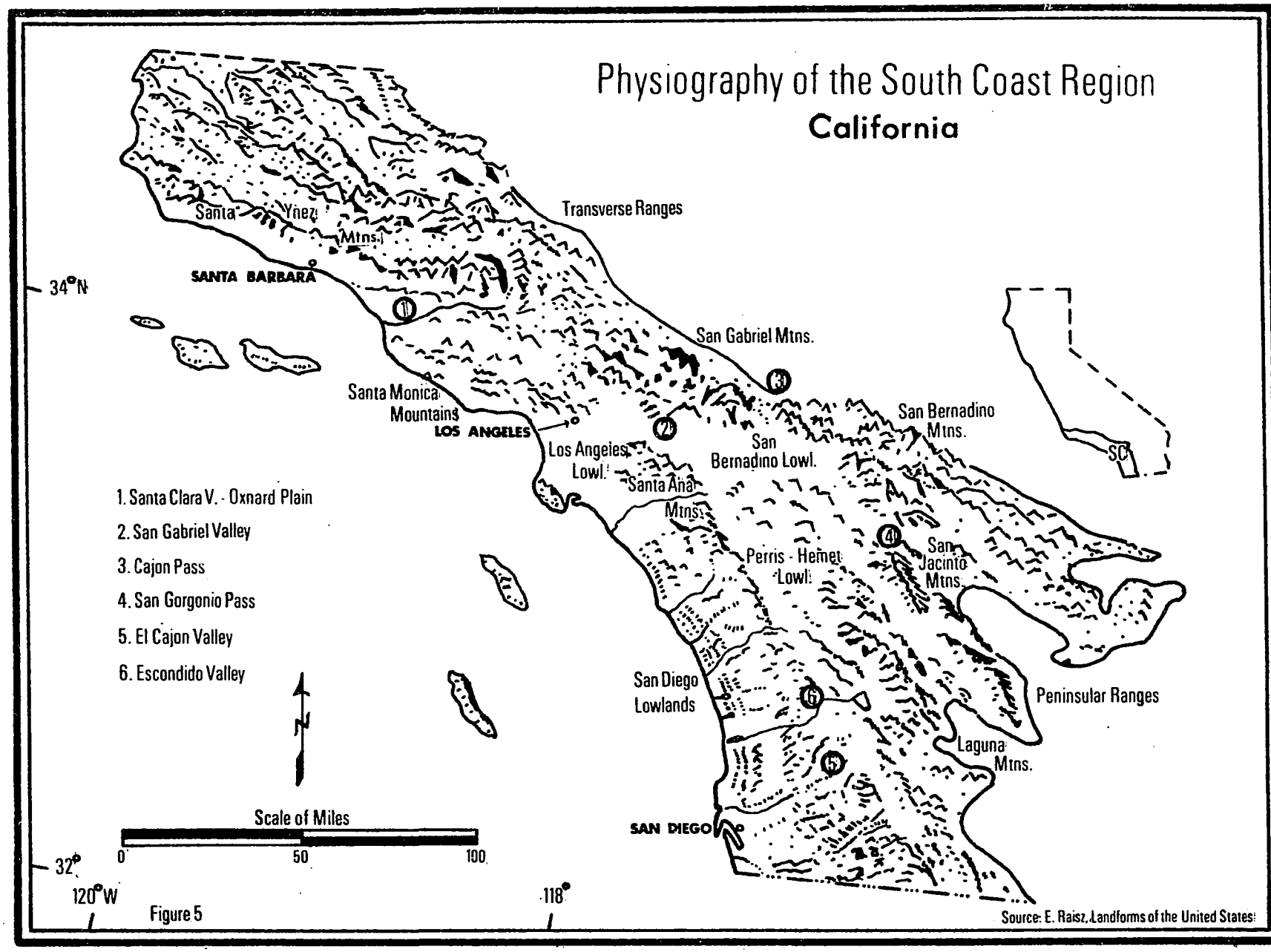
Physiography of the South Coast Region
California
Transverse Ranges
Santa Ynez Mtns.
SANTA BARBARA
34°N
San Gabriel Mtns.
Santa Monica Mountains
LOS ANGELES
Los Angeles Lowl.
San Bernadino Lowl.
San Bernadino Mtns.
Santa Ana Mtns.
Perris - Hemet Lowl.
San Jacinto Mtns.
SC
1. Santa Clara V. - Oxnard Plain
2. San Gabriel Valley
3. Cajon Pass
4. San Gorgonio Pass
5. El Cajon Valley
6. Escondido Valley
San Diego Lowlands
Peninsular Ranges
Laguna Mtns.
SAN DIEGO
N
Scale of Miles
0
50
100
32°
120°W
118°
Source: E. Raisz, Landforms of the United States

Figure 5

systems. The most outstanding physical masses include the San Jacinto, Santa Ana, Agua Tibia, Palomar, Hot Springs, Volcan, Cuyamaca, and Laguna Mountains.[3] It was mid-Pleistocene diastrophism that gave rise to this regionally asymmetrical uplifted fault block of the Southern California batholith. The plutonic Peninsular Range, which extends southward into Baja California, is composed of highly metamorphosed gabbro, tonalite, and granodiorite rocks.[4] Both mountain ranges contain a series of dissected foothills within which a significant proportion of the avocado orchards are located.

To the south and west of the Transverse-Peninsular ranges is an array of marine terraces, structural basins, alluvial valleys, and uplifted hills which makes up the complexity of the South Coast topography. Beneath the precipitous Santa Ynez Mountains which act as the northern margin in Santa Barbara County, there is a narrow irregular coastal plain usually less than five miles wide composed of several recently developed marine and alluvial terraces. In addition, there are many deep valleys eroded at right angles to the west-east trends which occasionally broaden out as deltas at the coastline. Many of the interfluves have

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[3] Geology of Southern California, Bulletin 170 Vol. 1 (San Francisco: State Department of Natural Resources, 1954), pp. 2-6.

[4] Ground Water Occurence and Quality: San Diego Region, Bulletin 106-2 (Sacramento: State Department of Water Resources, 1967), pp. 13-16.

developed into relatively low smooth foothills with rounded ridges well suited to avocado cultivation.[5] Further complexity is expressed in the immediate vicinity of the city of Santa Barbara where a lowland graben is between the marine wave cut terraces and the residual foothills. Avocado groves in Santa Barbara County are along this diverse four-mile wide stretch between Goleta in the west and Carpinteria on the east where water, soils, and microclimate permit favorable avocado growth.[6]

To the east and south of the Santa Barbara Avocado District is the Santa Clara-Oxnard Plain of Ventura County which is drained by the Santa Clara and Ventura rivers as well as Calleguas Creek. The avocado districts are either in the foothills juxtaposed on these drainage systems or directly on the structural, alluvium-filled Santa Clara Valley which ranges from 1.0 to 18.0 miles wide.[7]

The Santa Monica Mountains south of the Oxnard delta-plain continue eastward from the edge of the Pacific Ocean to the northern edge of the Los Angeles Lowland. They

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[5]San Luis Obispo and Santa Barbara Counties, Land and Water Use Survey, Bulletin 103, 1959 (Sacramento: State Department of Water Resources, 1964), p. 7.

[6]R. C. Cole, et al., Soil Survey, Santa Barbara Area California, Series 1944 No. 8 (Sacramento: United States Department of Agriculture, University of California Agricultural Experimental Station, 1958), pp. 7-8.

[7]Lantis, Steiner, and Karinen, California: Land of Contrasts (Belmont, California: Wadsworth Publishing Company, Inc., 1963), p. 247.

partially enclose the structural San Fernando Valley on the south side, whereas the San Gabriel Mountains enclose the northern end. Just a few miles to the east, the San Gabriel fault block precipitously overlooks the Los Angeles Lowland and the San Gabriel Valley. Its foothills still retain a large share of the remaining avocado groves in Los Angeles County. East of the Cajon Pass, the San Bernadino Mountains continue eastward reaching a maximum elevation of 11,485 feet at San Gorgonio Peak. To the south, the Peninsular System continues to isolate the South Coast Region of Southern California.[8]

Fenneman's "Lowland of Southern California,"[9] is an area between the Santa Monica, San Gabriel, and San Bernadino mountains and the Peninsular Range. The area is largely composed of a series of coastal terraces, valleys, and basins separated by several small uplifted or erosional hills. Most of the basins are relatively level due to alluvial fill from several ephemeral streams (the Los Angeles, Rio Hondo, San Gabriel, and Santa Ana Rivers) or aggradation of regolith from the surrounding hills within the Beverly-Newport Uplift. Some of the more conspicuous land forms

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[8]Nevin M. Fenneman, Physiography of the Western United States (New York: McGraw-Hill Book Company, Inc., 1931), pp. 497-498.

[9]Ibid., p. 500.

within the group are the Palos Verdes, Signal, Baldwin, and Dominguez Hills.[10]

A series of dissected marine terraces with broad relatively flat interfluves uplifted during the Pleistocene epoch lie to the west of the Beverly-Newport Uplift. East of the uplift there is the 15 mile-wide Los Angeles coastal plain, an almost undissected structural basin, filled with recent alluvium, which extends into Orange County. The San Gabriel Valley, separated from the Los Angeles Lowland by the Puente, San Jose, and Chino Hills complex,[11] continues to possess many avocado groves. Unfortunately, horticultural degradation is prevalent throughout the area due to an expanding population perimeter.

The San Bernadino Lowland is located east of the Santa Ana Mountains in coastal San Bernadino and Riverside counties. This lowland is a piedmont alluvial plain occupying the major part of the Upper Santa Ana River Drainage Basin. The narrow Perris-Hemet Lowland extends 40 or more miles to the southeast of the San Bernadino Lowland between the Santa Ana and San Jacinto Mountains.[12] The foothills on the western end and the undulating hills in the

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[10] Geology of Southern California, op. cit., p. 205.

[11] Coastal Los Angeles County Land and Water Use Survey, 1960, Bulletin 24-60 (Sacramento: State Department of Water Resources, 1964), p. 3.

[12] Upper Santa Ana River Drainage Area Land and Water Use Survey, 1964, Bulletin 71-64 (Sacramento: State Department of Water Resources, 1966), pp. 9-10.

southeast of these two juxtaposed lowlands represent the extreme eastern perimeter of avocado culture in Southern California. The San Diego Lowland section directly to the south is the only remaining area where avocados are grown.

The San Diego Lowland, comprised of coastal terraces on the western margin, merges on the east almost imperceptibly into the foothills of the Peninsular Range. In the extreme northwest of San Diego County, the Santa Ana Mountains and associated foothills extend to the littoral where there is a series of narrow step-like terraces formed by wave erosion and deposition. The marine terrace zone widens from one mile in the northwest to 14 miles in the south near San Diego. These terraces become broad flat-topped interfluves or "mesas" which rise from 300 to 1,200 feet above sea level. Several broad flat-bottomed channels cut by intermittent streams traverse the mesas.[13] The major alluvium-filled valleys within coastal San Diego County, which played an early role in local avocado irrigation, include the Santa Margarita, San Luis Rey, San Dieguito, and San Diego rivers.[14]

On the eastern margin of the coastal plain, the relatively unconsolidated marine sediments contact inner-coalescing alluvial fans, structural foothills with a

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[13]Geology of Southern California, op. cit., p. 206.

[14]Ground Water Occurrence and Quality: San Diego Region, op. cit., p. 18.

residual cover, and alluvium-filled intermontane basins. This foothill region is sufficiently hilly to provide a suitable location for avocado growing. Fallbrook and Escondido, just a few air miles from Palomar Mountain in The Peninsular Range, are in this foothill belt.[15]

The importance of land forms to avocado location is expressed in topographic limitations associated with elevation, configuration, and lack of regolith. Further avocado restrictions can be observed more overtly in climatic complexities often related to the surrounding mountain barriers.

Climate, A Determinant in Avocado Location

Limitations of the Physical Location Analysis

It might appear more important, academically, to examine and determine the maximum and minimum temperature tolerances of the avocado, as well as any other pertinent climatic variables. From these factors, specific avocado varieties could be associated with particular climate-variety zones. On the contrary, the nonindigenous avocado plant and the California milieu do not contain factors which can be logically approached from this viewpoint. In fact, the avocado in time and spatial arrangement, has been superimposed upon the landscape in a manner similar to many other

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[15] Ibid., pp. 16-21.

crops in which data on the physical environment was meager during the early planting period.

Historically, avocado varieties were planted with little forethought or previous experience on which to rely. Oftentimes, the nature of the plantings was quite haphazard, with little or no concern for pedologic or climatological limitations. Eventually, a system of trial and error[16] provided answers to some of the environmental queries, and it was learned that the tender avocado tree had to be confined to certain microclimatic sites, especially in the interior coastal realm. However, few data were accumulated or analyzed, and the dissemination of favorable agricultural methods and techniques took place via experienced growers and some farm advisers. Unlike citrus trees, its sensitivity often precluded extensive plantings. The result was a few clustered groves located where winter frosts were at a minimum.

The small size of the avocado industry and limited financial backing prevents the acquisition of microclimatic information necessary to determine the exact limits of the avocado. Such a study would require several hundred microclimatic stations located at various hillside elevations in order to discover the precise intensity and duration of valley temperature inversions and related minimum

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[16]Erich W. Zimmermann, Introduction to World Resources, H. L. Hunker, ed. (New York: Harper and Row Publishers, 1964), pp. 57-58.

temperatures. Only three or four stations have been established in the entire avocado region. In addition, the short operating time of the observations (one to four years) does not lend itself to a highly valid research study. The accumulated data have not been thoroughly examined or made available to non-University of California scientists. The preliminary results of these tests have served as little more than a guide to South Coast grove owners.

Any climatic study of the avocado belt would necessitate the acquisition of data from the exact locations of the groves. Unfortunately, almost all first, second, and third order weather stations are near major communities or in low lying sites where avocados are not grown. Thus, the climatic information available at existing weather stations vitiates any attempt to accurately conceive variety-climate regions.

Therefore, the decision to establish an avocado grove, in addition to the climate factor, has been based to a significant degree on the experiences of others, grove owner attitudes, and preference for a particular variety. Because of these conditions it seems best to examine the climate within the avocado domain and to determine the manner in which the avocado has been superimposed on it. Although it is unreasonable to study variety regions, it is quite possible to determine approximate northern and eastern boundaries of the commercial Persea americana in Southern

California. Thus, an examination of the general climatic controls in the South Coast region will be undertaken in an effort to provide a technical background for the particular environment in which the Mexican and Guatemalan avocado races have prospered.

Climate Controls

The South Coast area of Southern California is dominated by a maritime influence which provides a temperate, low rainfall climate with above average sunshine. Climatologists refer to the South Coast as an area with summer-dry subtropical (Mediterranean) climate with a small zone of semiarid climate.[17]

Rainfall in the coastal and foothill avocado districts rarely exceeds 17 inches per year. The positioning of the mid latitude wave cyclones and the limited orographic lifting of the onshore winds results in winter rainfall. Precipitation in San Diego, Orange, and Los Angeles counties can be attributed to the minor orographic lifting on the lowlands by occasional moisture-laden southwest air masses. Greater precipitation is experienced in the interior where the air masses are forced over foothills and mountains.[18]

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[17]John James, "A Modified Koeppen Classification of California's Climate According to Recent Data," California Geographer (1966), p. 11.

[18]D. I. Eidemiller and W. Finch, Field Trip Guide San Diego County (San Diego: San Diego State College, Department of Geography, 1966), pp. 4-5.

From a climatic-year viewpoint, however, the annual rainfall is extremely variable with dry years ranging from 4.0 inches to wet years with as much as 25 inches at Lindbergh Field, San Diego.[19] What are the climatic controls that give rise to the precipitation and temperature characteristic of Southern California.

A great deal of the summer dry period in Southern California is related to atmospheric pressure, winds, ocean currents, and mountain barriers. During the summer when the sun's rays begin to contact lower latitudes the North Pacific subtropical high pressure system intensifies. It migrates northward displacing the winter cyclonic activity and the juxtaposed jet stream aloft. The summer dominant high pressure system centered at about 40°N gives rise to several controls: a subsiding air mass on the eastern end of the subtropic high pressure system; divergent northwest winds paralleling the coastline; cool California current and coastal divergence away from the littoral; and upwelling of colder water from greater depths along the coastal margin to replace the diverging surface current.[20]

The single most important control preventing summer rainfall is related to a combination of the above controls

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[19]D. I. Eidemiller, "Economic Geography of Avocado Growing in San Diego County," op. cit., p. 63.

[20]Glenn T. Trewartha, The Earth's Problem Climates (Madison: University of Wisconsin Press, 1966), pp. 271-272.

which results in the development of a temperature inversion aloft. The slowly descending air in the upper surfaces (above 1,500 to 2,000 feet) of the oceanic subtropical anticyclone warms by compression. The air in the lower level of the high pressure system contacts heavier air beneath which has been cooled by an ocean current and upwelling. The surface air remains cooler due to a constant turbulence or upward and downward air movement.[21] In the end analysis, the temperature decreases at a normal lapse rate from sea level to about 1,500 feet until it contacts the warmer air aloft. At this point the temperature increases rapidly, and there is a marked decrease in relative humidity. Temperatures continue to rise within the inversion layer until a normal lapse rate is resumed above the subsidence aloft. The air becomes extremely stable because the temperature inversion prevents vertical movement of air above the 2,000 foot level (Figure 6).[22] These controls provide the reasons for the lack of summer rainfall and point out why avocado grove irrigation is practiced between the months of March and October.

The angle at which the sun's rays hit the earth's surface during the winter results in cooler temperatures. The controls which give rise to a cool littoral are further

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[21]Glenn T. Trewartha, An Introduction to Climate, 4th edition (New York: McGraw-Hill Book Co., 1968), p. 50.

[22]Harry P. Bailey, The Climate of Southern California (Los Angeles: University of California Press, 1966) p. 62.

Summer Inversion Layer Aloft Over Southern California

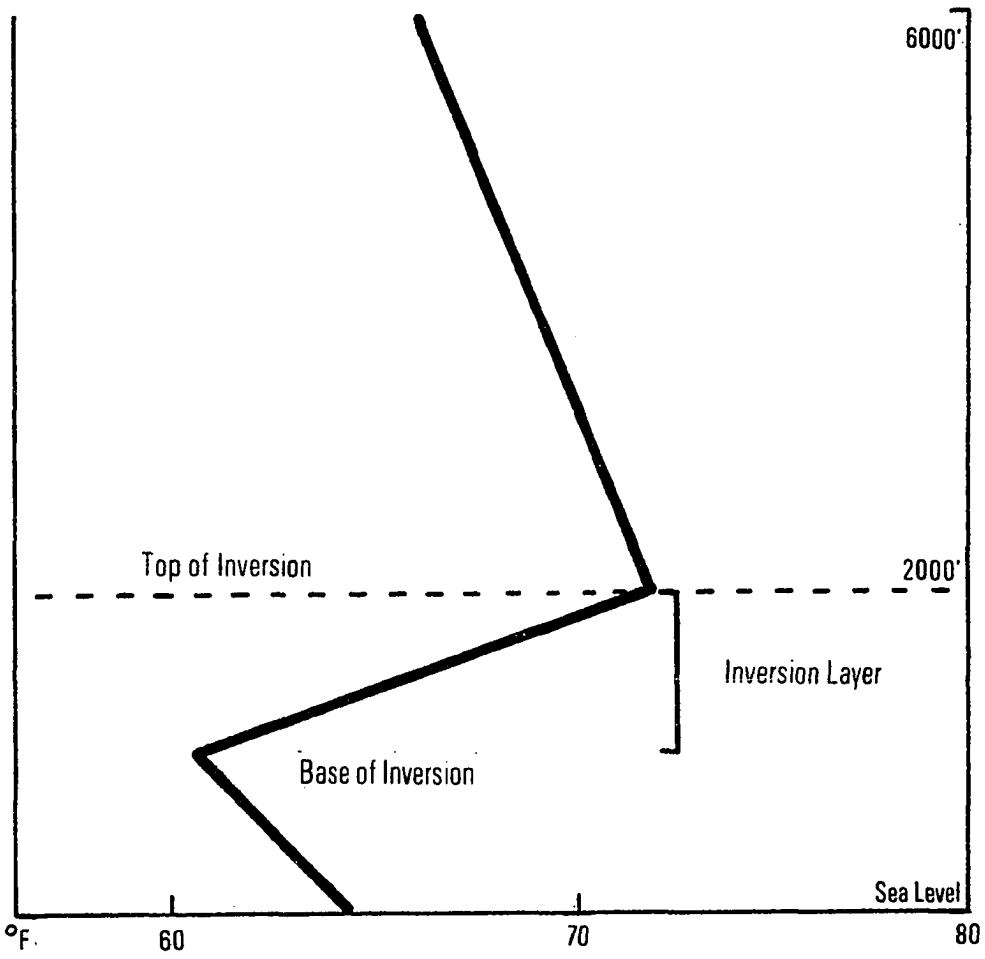

Figure 6

Source. H.P. Bailey, The Climate of Southern California.

complicated by the Catalina eddy phenomenon during the spring months. At this time, the air crosses the Catalina Embayment off the Southern California coast and swirls in a counter clockwise direction resulting in the deepening of the marine air due to turbulence. This process gives rise to a cloud cover development as the warm air is condensed over the cooler water surface.[23] The cloud condition or advection fog moves shoreward blanketing the entire coastline. As a result, the intake of insolation is reduced due to the overcast skies, and the coastal temperatures remain cool for several days at a time during the period from April through June.

Development of Microclimate Zones

Grove owners have suspected for many years that there are at least two climatic zones within the South Coast area which are related to the development of the current avocado agglomerations. They have correctly hypothesized that the marine climate of Southern California is influential in providing an equable location for fruit growth. Bailey,[24] a climatologist from the University of California at Riverside, carried the idea a step further by dividing the general semiarid and Mediterranean (summer-dry subtropical) climate into two somewhat northwest to southeast trending zones.

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[23] Ibid., pp. 23-25.

[24] Ibid., p. 62.

His division was based on the temperature contrast between the immediate coast and a narrow belt of land just a few miles inland. Neither region has an annual precipitation greater than 21 inches or a mean annual temperature range of more than 30 degrees.

The average annual precipitation on the coastal zone ranges from 10.42 inches at San Diego to 17.63[25] inches at Santa Barbara, and from 14.63 inches at El Capitan Dam inland from San Diego to 20.2 inches at Ojai in the northern interior. Moreover, both climatic zones are characterized by a minimum mean monthly temperature of 50°F during the coldest month. This figure correlates closely with the 56°F minimum pollination temperature necessary for the winter-flowering Fuerte variety. It is assumed that on the average there is a six degree discrepancy between lowland weather stations and the foothill avocado sites during the winter months. Lack of information makes further relationships between the minimum temperature for pollination and the mean monthly temperature in January impossible.

Because of the modified environment which has been created by irrigating avocado trees, it seems logical to disregard precipitation as a valid criteria with which to designate the distinction between the two climate zones. The 72°F isotherm provides an adequate boundary between the

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[25] California Weekly Weather and Crop Bulletin, for the Week Ending September 7, 1969 (Sacramento: California Crop and Livestock Reporting Service, 1969), 1-2.

two zones into which early and modern growers have planted and established avocado groves. Therefore, the climatic belt, i.e. area with a mean monthly temperature below 72°F and a mean January temperature of ≧ 50°F will be known as the Coastal Margin. The area with a mean monthly temperature greater than 72°F and a mean January temperature of ≧ 50°F shall be called the Interior Foothill and Valley Zone (Figure 7).

Coastal Margin (0-1,200± feet)

The coastal fringe represents the area most affected by maritime influences. It is a narrow belt of coastline including the San Diego County coastal terraces, the Los Angeles Lowland west of the downtown Civic Center, the Oxnard-lower Santa Clara River Valley, and the southern and western margin of Santa Barbara County.

Average temperature maxima seldom exceed 95°F nor descend below 40°F due to the daily influx of moist maritime air and greater cloud cover.[26] During the low sun period, the marine influence tends to prevent below freezing temperatures. Few climatic stations south of Santa Barbara County ever experience temperatures below 32°F (Table 4). The moist air which often condenses to form a low coastal stratus cloud deck or heavy fog, decreases from Santa

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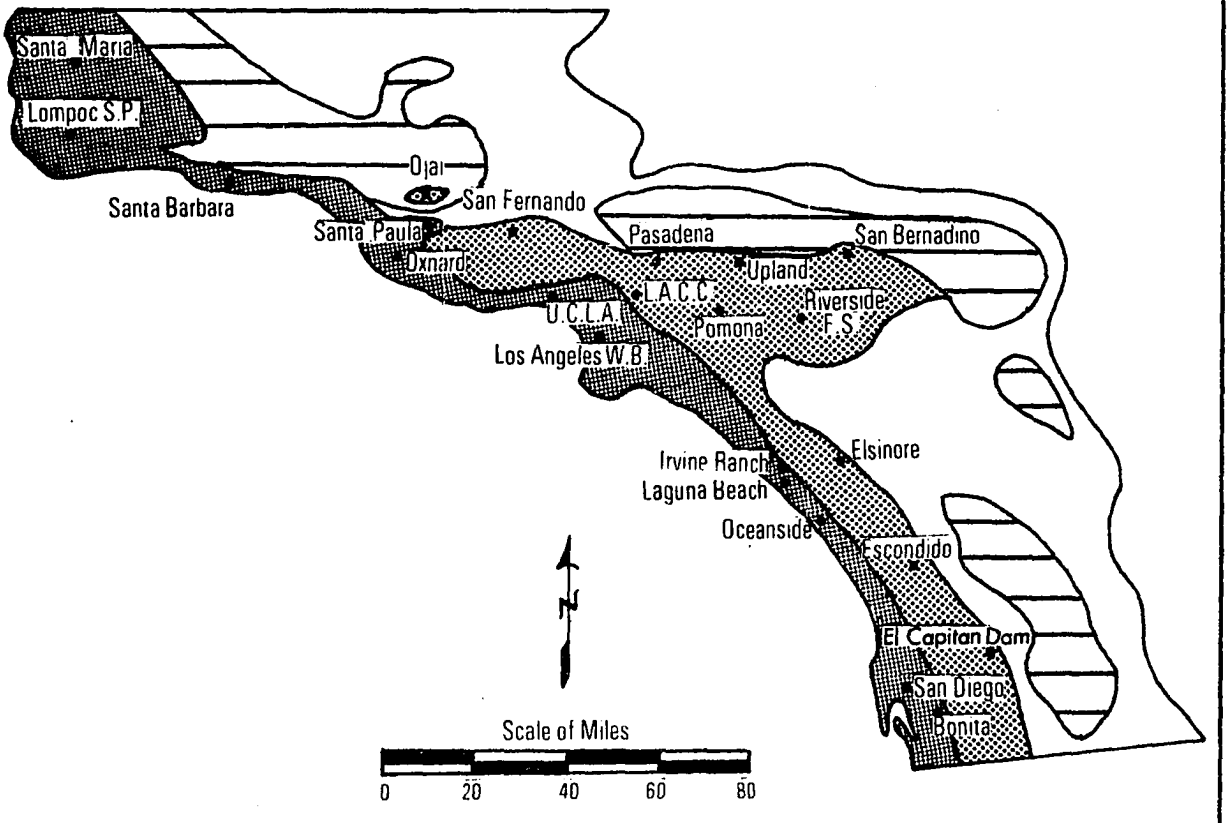
[26]D. I. Eidemiller, op. cit., p. 56.

South Coast Micro - Climate Zones



Climate Zones	Mean Daily Temperature of Coldest Month	Mean Daily Temperature of Warmest Month
Coastal Margin	> 50	< 72
		Avocado Belt
Interior Foothill and Valley	> 50	> 72
Transition	< 50	> 72
Mountain	< 50	Depends on Altitude

Figure 7

Source: H.P. Bailey, The Climate of Southern California.

TABLE 4

CLIMATIC DATA FOR SELECTED SOUTH COAST STATIONS
IN THE COASTAL AND INTERIOR FOOTHILL ZONES

Station	Climate Zone	Elevation	Mean Annual Prec.	Mean Daily Max. Temp. of Hottest Month	Mean Daily Min. Temp. of Coldest Month	Mean Temp. in July (Ju) or Aug. (A)	Mean Temp. in Jan.
		Feet	Inches				
Bonita	Coastal Margin	105	11.12	80.6	39.9	70.3 A	53.2
San Diego		19	10.42	77.1	46.6	71.8 A	55.0
Oceanside		60	8.17	73.0	44.5	68.1 A	53.3
Laguna Beach	Mean Jan.	35	12.47	77.4	44.0	68.6 A	53.6
Irvine Ranch	Temp.	118	13.16	84.8	39.5	71.5 A	52.6
Los Angeles W. B.	Greater	99	10.40	75.7	44.0	69.1 A	54.4
U.C.L.A.	Than 50° F	440	16.57	78.8	47.4	69.2 A	55.8
Oxnard		45	14.75	74.2	41.9	65.2 A	53.3
Santa Paula	Mean high	265	16.00	83.4	40.7	68.9 Ju	54.3
Santa Barbara	Sun Temp.	118	17.63	76.7	41.6	67.4 A	52.6
Lompoc S. P.	Less Than	100	13.30	70.6	39.3	62.0 A	51.0
Santa Maria	72° F	238	13.37	71.6	38.2	62.4 A	50.2
El Capitan Dam	Interior Foothill and Valley	600	14.63	93.4	40.9	76.0 Ju	54.2
Escondido		660	16.22	87.8	36.6	73.4 A	51.0
Elsinore		1,285	11.58	98.2	35.3	78.5 Ju	50.0
Riverside F. S.		820	11.04	94.1	37.8	75.8 Ju	51.9
San Bernadino	Mean Jan.	1,125	17.71	96.6	37.0	76.6 Ju	51.4
Upland	Temp.	1,840	19.51	89.8	39.9	73.4 Ju	50.8
Pomona	Greater	855	17.78	91.7	35.2	75.0 Ju	50.8
Pasadena	Than 50° F	864	19.17	88.3	40.4	73.7 A	53.2
Los Angeles, C.C.		312	14.68	82.3	46.3	73.1 A	55.8
San Fernando	Mean high	965	16.87	92.5	42.3	74.3 Ju	53.3
Ojai	Sun temp. Greater Than 72° F	750	20.20	92.1	36.5	73.2 Ju	50.2

TEMPERATURE IN DEGREES FAHRENHEIT

Source: Climatography of the United States, No. 86-4, Decennial Census of U. S. Climate, Climatic Summary of the U. S. - Supplement for 1951 through 1960, California, 1964; and H. P. Bailey, The Climate of Southern California, 1966, pp 83-87.

Maria's 88 day frequency to 53 days in San Diego.[27] The influence of the cool marine air and cloud cover extends only a few miles inland in Santa Barbara County but as much as 10 miles in the other lowlying areas. Although the littoral is somewhat overcast, it should be pointed out that approximately 65 per cent of the yearly daylight hours lack significant cloud cover.[28]

In conjunction with the maritime influence, relative humidities in both San Diego and Los Angeles range from 61 per cent in January to 74 per cent in July, and Santa Maria's concomitant range is 73 and 78 per cent. In all cases, the lowest relative humidity will be recorded during the maximum afternoon heat.[29]

Summer temperatures remain below those experienced in the interior zone because of late spring and early summer cloud cover which reflects and diffuses insolation. Furthermore, the increased intensity of the onshore breezes, due to high pressure over the water surface and low pressure over the land, complement temperature conditions fostered by overcast skies.

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[27]F. R. Byers, "Summer Sea Fogs of the Central California Coast," University of California Publication No. 9, 33 No. 5 (1930), p. 319.

[28]H. P. Bailey, op. cit., pp. 25-28.

[29]D. I. Eidemiller, "Economic Geography of Avocado Growing in San Diego County," op. cit., p. 70; H. P. Bailey, op. cit., p. 87.

Interior Foothill and Valley Zone (1,200-2,000± Feet)

The Interior Foothill and Valley zone is a fragmented region lying between the maritime fringe and the Mountain and Valley zone.[30] It extends from El Cajon in the south, through the Perris-Hemet and San Bernadino lowlands to the San Gabriel, San Fernando, and Ojai valleys in the northwest. Unlike its counterpart to the west, it is characterized by longer periods of sunlight during both the summer and winter seasons. This zone acquires more insolation during the daylight hours and undergoes extensive cooling at night, thereby producing greater daily and annual temperature ranges. As might be surmised, relative humidity is slightly lower than on the littoral, but the humidity ratio is high enough to indicate the presence of a maritime influence. For example, Riverside's January relative humidity is 57 per cent, and that of July is 50 per cent.[31] In general, relative humidity decreases 30 per cent from the coastal to inland stations.[32] However, the temperature factor is the most important physical characteristic in terms of boundary location.

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[30]The mountain and valley zone is outside the purview of this study due to cooler temperatures associated with greater elevation and interior location.

[31]H. P. Bailey, op. cit., p. 87.

[32]Eidemiller, "Economic Geography of Avocado Growing in San Diego County," op. cit., pp. 71-72.

The inner boundary of the Foothill and Valley microclimate which is associated with the 50°F January isotherm coincides with the interior margin of avocado plantings established by trial and error. Furthermore, the 50°F isotherm delineation is on hillsides between 1,500 and 2,500 feet in elevation, but it is not found much above 1,000 feet on level topography where a valley inversion phenomenon prevails. The rolling dissected landscape has become the leading avocado zone in Southern California as a result of its microclimatic characteristics.

A microclimatic phenomenon of particular significance is the valley or surface inversion. During calm clear winter nights the hillsides radiate considerable long wave energy to the atmosphere. The air drains from the hilltops downslope into the bottomlands after it has become colder and heavier. Eventually, a temperature inversion occurs when cold air accumulates in the narrow valleys and becomes colder than the air above it (Figure 8).[33] Because freezing conditions are frequent in the lowlands where cold stagnant air prevails, the tender avocado trees are almost invariably planted on hillside locations 50 to 100 feet above the valley bottom on slopes where air movement is favorable. The most propitious location is precisely in an inversion layer, a

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[33]Trewartha, 4th ed., op. cit., pp. 48-49.

Southern California Valley Inversion

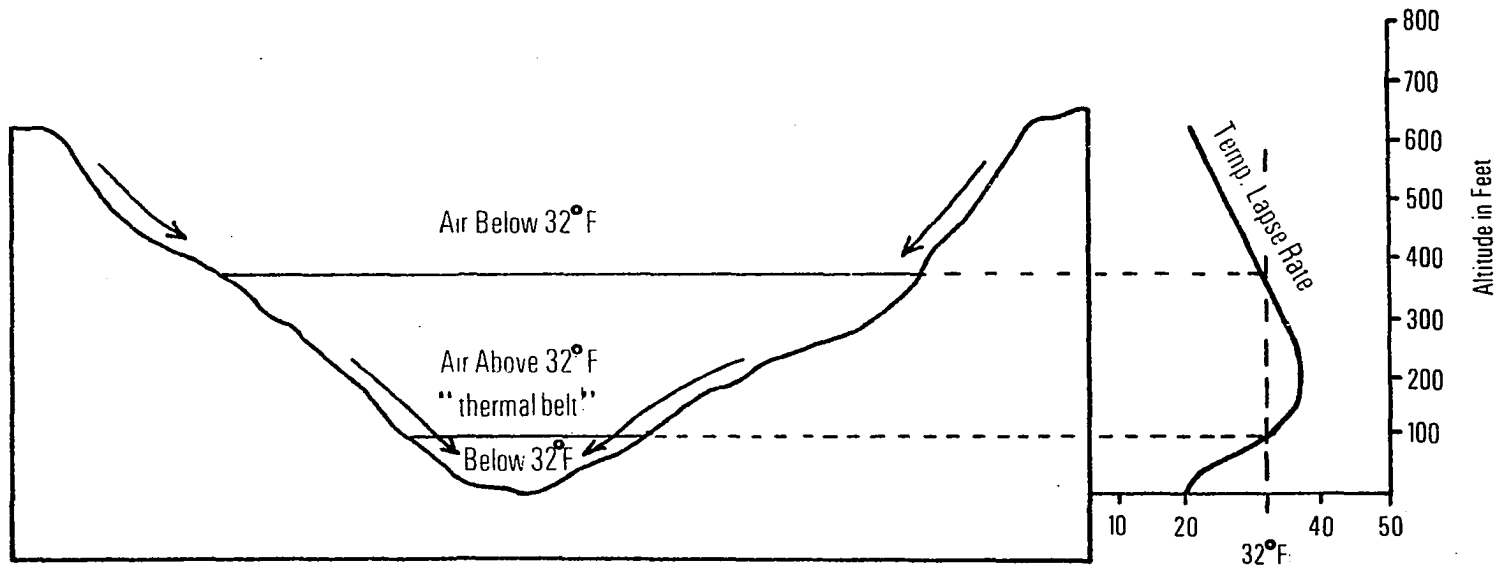

Figure 8

Source: G.T. Trewartha, An Introduction to Climate, 4th Ed.

zone known as the "thermal belt."[34] This surface inversion condition takes place only in the Foothill and Valley climate zone.

The clear skies of the interior also allow much warmer daytime temperatures than the littoral. The mean temperature ranges are rather mild, as exemplified by stations at Riverside with 75.8° in July and 51.9° in January. But extreme temperatures above 100°F, such as the daily maximas of ±110°F at Riverside, ±105°F at Burbank, and ±102°F at Escondido,[35] can cause fruit damage if they are sustained for more than 30 minutes. However, research on the maximum temperature tolerance is so meager that climatologists do not know exactly how long a particular variety will tolerate temperatures above 100°F without some damage.

It should be made clear that locating avocados on rolling hillsides does not entirely eliminate either the winter freeze or summer heat hazard, particularly in the more interior areas where little maritime influence is felt. The Perris-Hemet Lowland is blocked from direct ocean breezes by the Santa Ana Mountains, whereas the San Fernando Valley receives moisture-laden air only through the Glendale Narrows. Furthermore, much of the San Bernadino Lowland is too far from direct marine influence. It is concluded that temperatures along the inner margin of the interior zone may

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[34] H. P. Bailey, op. cit., pp. 99.

[35] Ibid., p. 87.

be either too hot or too cold to cultivate avocados on an economic basis. This hypothesis is formulated largely because neither growers of San Bernadino nor Riverside counties have planted avocados in these marginal areas with any degree of success. Pollination and fruit setting are intimately related to microclimatic conditions.

Pollination and Fruit Setting Phenomena

Avocado pollination requires a combination of time and weather factors. The flower of the avocado has a dual-opening cycle occurring within 24 hours. A female or receptive stage is followed by a male or pollen shedding stage, each of which lasts about six hours. Weather conditions at the time of flowering and fruit set can retard or accelerate these cycles to the point at which some self-pollinating varieties will fertilize individual flowers on the same tree. It has been learned, however, that honeybee pollination is essential to the development of a commercially productive grove. A bee pollination problem may develop on the littoral or interior areas during the winter and early spring, when daily temperatures below 50°F are common. Bees tend to be sluggish or inactive if the temperature does not exceed 50°F between 11:00 A.M. and 2:30 P.M. when the male-female interflower periods are most likely to overlap.[36]

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[36]B. O. Bergh, "Reasons for Low Yields of Avocados," California Avocado Society Yearbook (1967), pp. 166-167.

In addition to the effect on bee pollination, cool temperatures during the flowering period severely influence tree productivity. If the temperatures fall below the critical day or night-time level of 56°F, the Fuerte variety will not flower or set properly. It appears that if the weather is too cool the flower may not open in the female stage precluding the onset of fertilization.[37]

Fruit set can be delayed for a considerable period of time by extensive cloudiness and associated cool temperatures (below 56°F). However, fruit set can still be quite favorable even after a long delay if the temperatures eventually exceed the minimum temperature tolerance of the avocado tree.[38] A further complication in weather conditions, such as an alternation of cool and warm periods, can produce an avocado fruit called a "cuke." In this situation, fertility occurs, but the prolonged temperatures below 56°F cause an embryo abortion, and the fruit continued growing as a small elongated seedless, yet tasty specimen[39]

Maximum and minimum temperatures influence the location of particular avocado races. After many unsuccessful plantings, growers concluded that the Fuerte variety will not set fruit properly along the immediate coast due to cool

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[37]B. O. Bergh, "Reasons for Low Yields of Avocados," op. cit., p. 161.

[38]Ibid., p. 162.

[39]Personal interview and field trip with Bertrand Lee, Ventura County Farm Adviser, June 3, 1969.

onshore winter breezes and extensive cloud cover. On the other hand, the Hass, MacArthur, and Nabal are cultivated along most coastal lowlands because they flower during the warmer late spring period when temperatures are above 56°F. Nevertheless, even Guatemalan avocado plantings under the direct influence of the cool onshore breezes in the North Counties will not produce enough fruit to be economically feasible. For example, the Hass variety has been planted for 20 years or more on the Oxnard Plain, yet its failure to be productive has resulted in general grower discouragement and removal of trees.[40]

Minimum and Maximum Temperature Tolerances

In addition to the relationship between pollination and cool temperatures, the establishment of particular races depends upon avocado gene construction and its derived tolerance to absolute daily minimum temperatures. In general, Mexican and Guatemalan races can not tolerate temperatures much below 32°F. for more than a few hours. Even though certain West Indian and West Indian-Guatemalan hybrids can grow in Southern California, few, if any, will bear fruit. The degree of tree and fruit injury is directly related to microclimate. The avocado injury depends on the intensity and duration of the local cold air mass.

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[40]Personal interview with Paul J. Leavens, Saticoy, Ventura County, Avocado Grower, July 10, 1968.

The sensitive nature of the avocado plant causes nearly all varieties to be grown in the irregular topography of the avocado "thermal belt." Guatemalan varieties are the most sensitive commercial types currently being grown (minimum tolerance of 32°F). As a result of this physical restriction, the Guatemalan race is confined almost entirely to the coastal margin. However, the prolific Hass variety is being planted on much of the available acreage in the entire South Coast area, including favorable thermal belt topography of the Interior zone. It should be made clear, however, that the Hass experiences its best growth in secluded coastal areas out of the influence of strong cool onshore breezes during the low sun period. The Fuerte is located almost entirely in the Interior Foothill zone where temperatures seldom fall below 27°F. Furthermore, Mexican varieties, such as Bacon, Zutano, and Duke seedlings (a preferred rootstock) will tolerate temperatures between 24°F and 22°F for a limited period of time. Unfortunately, these varieties are plagued with low productivity and poor fruit quality which discourage widespread planting activities in either climatic zone.[41] As a final point of contrast, the Mexican Race compares in tolerance limits with the Washington Navel orange Citrus sinensis, whereas the Guatemalan

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[41] D. H. Close, C. D. Gustafson, and R. G. Platt, Avocado Care in the Home Orchard (Sacramento: University of California Agricultural Extension Service, 1967), pp. 1-2.

Race and the Fuerte hybrid are similar to the Eureka lemon Citrus limon.[42]

To some extent, one can observe a regional variety distribution, however the exceptions are so numerous as to make the validity of expounding along this particular line questionable. For example, although the Fuerte is characteristically located in interior San Diego County, it can be found in coastal Orange and Los Angeles County. Furthermore, the Hass variety, which is well distributed in the North Counties, is rapidly becoming the dominant variety in San Diego County.

Maximum temperatures, however, can in some ways be just as detrimental to avocado production as minimum temperatures. Excessive heat for prolonged periods of time, especially sudden hot spells during the blossoming period, can damage newly fertilized fruit. Prolonged heat above 95°F can cause weakening and drying of the young fruit recently set, and maximas of 105°F to 115°F cause leaf fall and excessive fruit drop due to sun scalding.[43]

Summary of the Physical Location Variables

It is possible to enumerate several factors which play a significant role in locating the avocado in Southern

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[42] D. I. Eidemiller, "Economic Geography of Avocado Growing," op. cit., p. 61.

[43] J. W. Bequette and J. Van Dam, Why Avocados Fail to Produce Fruit (Los Angeles: University of California Agricultural Extension Service, 1967), p. 2.

California. They include the physical variables of topography, climate, and soils, in addition to the process of human selection.

The efforts of scientists and the trial and error method of grove owners, have resulted in the conclusion that only two races of the sensitive Persea americana can be commercially productive in Southern California. Furthermore, the genetic limitations of the Mexican and Guatemalan races restrict planting sites to particular areas where physical landscape and micro-climate are favorable.

Topographically, the precipitous mountains of the Transverse and Peninsular ranges preclude planting because of the vertical zonation of climates, steep slopes which limit accessibility, and lack of soil. However, the high mountains prevent most cold air mass intrusions from the northeast. Climate further restricts avocado planting because of the minimum and maximum temperature tolerances during the low sun period as well as during the flowering period.

The complexity of avocado location in the South Coast is further complicated by the fact that the establishment of many avocado groves was largely determined by man's decision to experiment or speculate with several untested varieties. When it was discovered that one or two varieties were well suited to certain micro-environments over a long period of time, they then became the dominant varieties of

the region. Oftentimes, the initial varieties were selected on the basis of personal appeal for certain tree and fruit characteristics, or purely on the chance factor that a particular graft might produce a desirable product. The result of this complexity is the establishment of 34 square miles of foothill and coastal terrace groves scattered throughout a northwest to southeast distance of more than 200 miles. The physical variables are further complicated by environmental hazards such as the Santa Ana wind, wild fire, flooding, frost damage, and smog. These latter factors are the topics of Chapter V.

CHAPTER V

ENVIRONMENTAL HAZARDS AND GROWER PERCEPTION

Although an analysis of physical factors such as landforms and climate provides some insights into the spatial distribution of the avocado industry, not all factors of location fall under the physical penumbra. Several additional environmental variables, including natural and man-induced hazards play a significant role. For example, the Santa Ana wind phenomenon in just a few days is capable of severely reducing yearly avocado production. A single continental Arctic air mass invasion can reduce production to zero for one to three years. Phytophora cinnamomi is so detrimental to the avocado root system that grove sites are limited to well drained soils where roots are properly aerated, and the downward percolation of water is facilitated. It would seem that avocado hazards directly or indirectly affect the location and the development of the grove by virtue of their negative impact.

Short Term Environmental Hazards

Santa Ana Wind Condition

The Santa Ana katabatic wind is a short-term weather factor which threatens avocado production several times each year. A description of the synoptic weather pattern which gives rise to this phenomenon in the South Coast area follows.

The synoptic condition conducive to the development of the Santa Ana begins with the passage of a maritime polar (mP) air mass over the Pacific Mountain System, usually during the low sun period. The relatively dry air mass stagnates between the Rockies and the Sierra-Cascade mountain ranges, where it develops into a cool dry high pressure system. Extensive night-time cooling due to clear skies results in lower temperatures and an intensified high pressure cell which can no longer be retained in its intermontane position.[1] Thus, the air mass begins to spill over the Transverse and Peninsular ranges as well as through Soledad-Weldon Canyons, Cajon Pass, and San Gorgonio Pass into the South Coast as a katabatic wind. The movement of the air toward the coast is facilitated by a decrease in atmosphere pressure from the Great Basin area to the Southern California coast. In fact, there must be a 3 millibar decrease in pressure from Tonapah, Nevada, to Los Angeles in order for the

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[1]Bruce M. Aiken, "Devil Winds," The Flight Service Journal (July-August, 1965), pp. 12-13.

condition to be officially forecast as a Santa Ana. Once the air mass becomes constricted in avenues of least resistance (canyons), the flow accelerates sharply from 10 to 60 m.p.h. with gusts to 90 m.p.h.[2]

As the air mass traverses the mountains and through the canyons, eventually reaching sea level, the air is compressed and warmed at the rate of 5.5° per 1,000 feet. The result is a net temperature increase from the desert to the South Coast lowland of 10°F to 40°F. Moreover, the air becomes extremely dry with the relative humidity usually below 30 per cent, and on rare occasions as low as 1 per cent.[3]

A frequency study of the Santa Ana Wind phenomenon at the Los Angeles International Airport in 1961 revealed that 149 Santa Ana conditions occurred during a 54 year period. It is deduced that the Santa Ana will take place on an average of 2.7 times per year. However, it should be made clear that, although there may be a similar frequency throughout the entire South Coast area, its severity varies considerably from one location to another. Moreover, 87 per cent of the winds noted in the study occurred between October and February, 8 per cent from April to May, 5 per cent in the August to September period, and none between

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[2]J. Edinger, R. Helvey, and D. Baumhefner, Surface Wind Patterns in the Los Angeles Basin During "Santa Ana" Conditions (Los Angeles: University of California, Department of Meteorology, June, 1964), p. 4.

[3]Herbert Riehl, Introduction to the Atmosphere (New York: McGraw-Hill Book Company, 1966), pp. 254-255.

June and August.[4] The number of Santa Anas is not the critical factor. It is the great intensity of the wind and heat which affects avocado production most seriously. The combination of high wind velocity, low relative humidity, and temperatures in excess of 100°F can produce extremely hazardous conditions in avocado districts. In the fall, after temperatures have become cooler, a sudden Santa Ana Wind can cause excessive evapotranspiration. Therefore, it is necessary to establish an accurate forecasting service for this phenomenon. If not, the farmer may irrigate the soil improperly and fruit drop, leaf burn, or the development of small-sized fruit could occur.[5] Farm advisers must constantly remind farmers at local meetings and through brochures of the critical September to October irrigation procedures.

The occurrence of Santa Anas in mid-winter during the Fuerte flowering period can result in widespread destruction to the flower and the newly set fruit because of excessive heat.[6] Many growers claim that a "heat wave" of three to four days with temperatures in excess of 95°F will produce

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[4]Leo A. Sergius, "A Progress Report of Studies for Improving Santa Ana Wind Forecasts" (Weather Bureau Airport Station, Los Angeles International Airport, March, 1961), p. 5 (Mimeographed).

[5]R. W. Hodgson, op. cit., p. 283.

[6]D. I. Eidemiller, "Economic Geography of Avocado Growing in San Diego County," op. cit., p. 74.

considerable fruit scorching and heat kill to young trees.[7] It is suggested, however, that this situation would tend to occur most frequently in coastal areas where the trees have not become adapted to such heat. There is little protection against excessive temperatures, but it is possible to protect avocados against high wind velocities to a certain degree.

In general, avocado trees contain soft brittle wood which makes them particularly subject to high velocity wind injury. The wind speeds become so great in the Orange County Coastal Plain and the lower Santa Clara-Oxnard Plain that many orchard owners have planted windbreaks. These shelter belts, originally planted to protect citrus groves, are largely bluegum eucalyptus, Eucalyptus globulus, and some recent plantings of the tall Bacon avocado variety (Plate 7).

Pauma Valley in San Diego County, is particularly susceptible to wind damage due to its location at the base of Palomar Mountain. During the years 1966 and 1967 well over 1,000,000 pounds of fruit were blown from the trees. In 1966 alone, the Pauma-Rincon, Santa Paula-Fillmore-Moorpark, and the Irvine-Orange districts experienced about 1.75 million pounds of fruit drop due to Santa Ana conditions.[8]

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[7]F. O. Popenoe, "Symposium in Heat Injury," California Avocado Association Report (1917), pp. 94-95.

[8]Calavo Newsletters, February 8, 1966 and January 10, 1967.

Plate 7--A shelter belt area in the lower Santa Clara River Valley showing both blue gum eucalyptus and Bacon wind breaks. The Santa Ana wind arrives annually from the distant left at about 8 o'clock (east). Note the predominance of citrus on the valley floor.

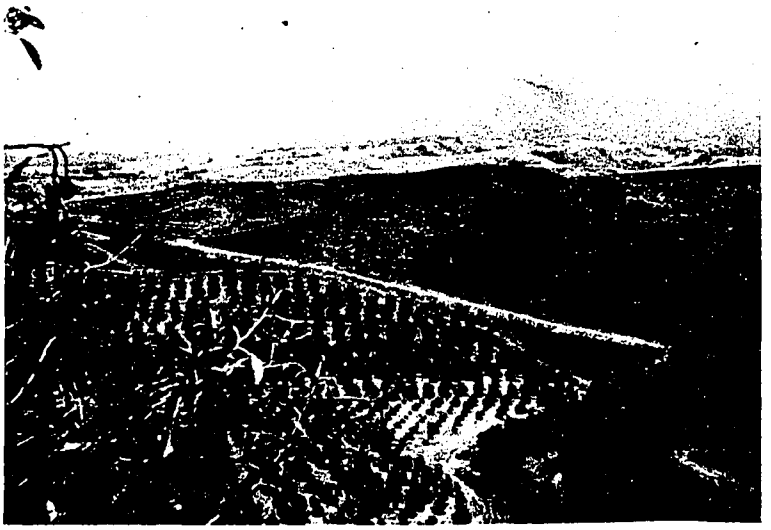

Plate 8--A grove and chapparal area near Goleta in Santa Barbara County which was affected by wildfire. The broken line in the center indicates the burned area (the view looks southwest).

The Wildfire Hazard

The wildfire phenomenon is another avocado weather hazard that is directly related to the Santa Ana wind. A long period of low winter precipitation, followed by a Santa Ana wind with very low relative humidity, high wind velocity, and excessive temperatures is a situation conducive to a fire-weather condition. If, under these circumstances, combustion is attained by lightning or human error, little can be done to prevent a widespread chaparral fire. When this occurs, in close proximity to inhabited areas, property damage, including damage to avocado groves, is a near certainty.[9]

In September, 1964, less than 10 years after a major wildfire involving some avocado acreage (Refugio Fire, 1955) the Coyote Fire burned 20 avocado orchards including 10,000 trees. Estimated fruit loss was about $140,000 with additional tree damage of $100,000 (Plate 8). Similar fires have occurred throughout the South Coast area affecting avocado property.[10]

As a result of wildfire damage to property and life in the 1950's and the 1960's, California Agricultural Extension Service employees have been educating grove and home

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[9]Joe J. Callahan, et al., The Wildfire Treat (Santa Barbara: Palmer-Larson Communications, March, 1967), pp. 1-5.

[10]G. E. Goodall, "Avocados and the Coyote Fire," California Avocado Society Yearbook (1965), p. 81.

owners on the seriousness of the problem. One method has been to publish information pamphlets on sprinklers, water supplies, and wildfire protection.

Flood Devastation in Avocado Districts

Unlike wildfires and Santa Ana wind phenomena, flooding is not considered to be a serious problem to avocado grove owners because it has occurred only six times during the 20th century. The paucity and variability of South Coast precipitation is exemplified by the record at Perris, California (the Perris-Hemet Lowland) which received 19.7 inches of rainfall in 1952 and only 3.52 inches the following year.[11] The niggardly rainfall gives rise to ephemeral streams throughout Southern California which empty upon the coastal lowlands in poorly defined alluvial fans. This situation is conducive to inundation and silting.

Since man has begun to inhabit upland locations, fires, vegetative clearing, and modified chaparral growth have transformed the topographic drainage and erosional patterns. Much of the existing vegetation, lacking a well established root system, is easily eroded by winter downpours. Many areas have become extremely susceptible to denudation when heavy precipitation follows an earlier rainfall which has saturated the soil. The second rainfall must

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[11] Climatological Data, California Annual Summary, 1963, Vol. 64-70 No. 13 (Washington D.C.: United States Department of Agriculture, 1963).

run off and streams quickly overflow, eroding the uplands and silting the valleys and basins below.

During the winter of 1968-1969, the rainfall amounts in January and February were greater than had ever been experienced in the recorded history of the two northern counties. C. J. Barrett, Ventura County Agricultural Commissioner, stated that it was the most precipitation that he could recall in 62 years.[12] Precipitation percentages based on norms, ranged from slightly above average at San Diego to 200 per cent of the expected seasonal amount in the San Gabriel Valley.[13] Santa Barbara reported over 22 inches of rainfall between January and April. It was inevitable that flooding and silting should occur.

The disaster occurred in February, after considerable precipitation the previous month had saturated the soil. Extensive degradation occurred along the sides of the canyons, and the debris was deposited on hundreds of citrus and avocado orchards. Santa Barbara and Ventura Counties received the most damage. Forty-four inches of rainfall fell in the Santa Ynez Mountains overlooking the Santa Barbara lowlands in a 10 day period. Flooding caused $5,000,000

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[12]"A Winter That Would Not End," California Citrograph 54 No. 5 (March, 1969), p. 170.

[13]"California Percent of Normal Precipitation, July, 1968 to June, 1969," California Weekly Weather and Crop Bulletin (Sacramento: California Crop and Livestock Reporting Service, 1969).

damage to Carpinteria agriculture which included greenhouse flower establishments, lemon orchards, and avocado groves (Plate 9).[14]

A similar disaster befell Ventura County, especially in the lower Santa Clara Valley. General silting on the Oxnard Plain, destruction of irrigation wells, removal of road sections, destroyed sprinkler irrigation systems, equipment losses, and damaged buildings exemplified the devastation of flooding.[15] It is estimated that $200,000 damage was done to avocados, oranges, and ornamentals in nurseries alone and that the cost of removing silt from orchards amounted to $700 per acre.[16] A great deal of rehabilitation, including soil refill and grove reconstruction, was performed by the Army Corp of Engineers, and by June, 1969, major repairs had been accomplished.

Frost Damage

In addition to flooding, the winter period of 1968-1969 was a disaster to avocado growers in terms of damaging freeze conditions. That winter and the one of 1936-1937, are estimated to have been the most destructive winters in the 20th century. Lack of precise weather data for many of

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[14]Personal interview and field trip with George Goodall, Santa Barbara County Farm Adviser, June 2, 1969.

[15]Personal interview and field trip with B. W. Lee, Ventura County Farm Adviser, June 3, 1969.

[16]"A Winter That Would Not End," op. cit., pp. 170-171.

Plate 9--Excessive rainfall during the winter months of 1969 on the slopes of the Santa Ynez Mountains resulted in severe flooding. The ephemeral stream overflowed its channel and caused excessive damage to the Carpintera avocado grove which once occupied the center of the photograph.

Plate 10--A view of several trees in a large grove located in the Corona Area of Riverside County which were completely defoliated by temperatures in the low 20's. The oil heater in the lower right was incapable of protecting the avocado trees from the continental arctic air mass intrusion.

the agricultural districts precludes a highly accurate conclusion. If the Southern California coastal fringe is known as having one of the most temperate climates in the United States, then the question arises: what are the annual and short-term weather controls which give rise to freeze damage?

Temperatures below 32°F are seldom experienced along the immediate littoral, but the foothill and valley region characteristically experiences a valley inversion or radiational freeze phenomenon each winter. Excessive night-time cooling can produce a local cold air mass which is deep enough to affect avocado groves in the "thermal belt." Wind machines, although not often used in small avocado acreages, can prevent freezing by forced mixing of the warm and cool air for a period of two to four hours. In some cases, orchard heaters are used in the low lying areas, but usually this procedure is too costly for most groves.[17] The radiational freeze condition is not particularly important because avocado trees are normally grown in selective locations where the cool temperatures damage little more than an occasional limb, fruit, or foliage. On the other hand, the influx of cold air masses from the northeast warrants considerable attention. For example, significant winter freeze

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[17]Interview with Dr. Turrell, Frost Protection Specialist, University of California, Riverside, August 26, 1968.

conditions occurred in 1916-1917, 1921-1922, 1932-1933, 1936-1937, and 1947-1948.[18]

Advection freezing, involving the migration of frigid continental Arctic (cA) air of Canadian origin, causes widespread crop damage in the South Coast on an average of 1 year in 10.[19] The influx of a cA air mass occurs only when a well developed high pressure system several thousand feet thick passes over the Southern California mountain systems enveloping the entire area. Under the influence of this short-term phenomenon, avocado damage is imminent, especially if the soil in the groves is quite dry. Both wind machines and oil heaters must be employed, but success is usually minimal. Heaters are seldom used in foothill belts because their effectiveness is limited on sloping land.

In general, frost protection costs, labor needs, grove size, and limited effectiveness of equipment in the inversion layer have prevented extensive use of frost protection measures. A few large grove owners utilize orchard heaters and wind machines on the coastal lowlands of Orange, Ventura, and Santa Barbara counties. Oftentimes the devices are simply a relic from the days when the groves were transformed from citrus to avocados. Furthermore, these tools are not very effective on young plantings. In the case of

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[18]R. W. Hodgson, op. cit., p. 266.

[19]Bailey, op. cit., p. 52.

young trees, the plants are protected by a burlap or paper wrap.

The destructive force of an extremely cold advection air mass intrusion is illustrated by the December 20 through 22, 1968 freeze (Plate 10). Soil moisture prior to the freeze was 50 per cent below normal. By the morning of the 20th of December, temperatures had dropped to the low 20's and even to 18°F at some stations. Grove owners had given up trying to prevent damage by the use of orchard heaters or wind machines.[20]

Freeze damage to the harder hit groves of Fallbrook-Pauma Valley of San Diego County and Riverside County in general, was 50 to 90 per cent of the total crop. Light to moderate damage was experienced throughout the remainder of the avocado districts.[21] Considerable damage in San Diego County resulted in a poor Fuerte fruit set for the following year. Moreover, a significant percentage of the mature fall and winter fruit had to be marketed rapidly due to frozen stems and fruit drop. Severe damage to nursery stock in the Fallbrook District gave rise to a reduction in non-bearing

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[20]Interview and field trip with Paul Hanson, Calavo Field Representative, June 1, 1969.

[21]California Weekly Weather and Crop Bulletin (Sacramento: California Crop and Livestock Reporting Service, January 6, 1969.

acreage, due to a shortage of young trees for planting in the middle and south counties.[22]

Frost warnings to Southern California farmers are broadcast each night via local radio stations from November 15 through February 15 by the United States Weather Bureau Fruit Frost Service. The service is initiated in November, largely because it is the period prior to development of winter tree tolerance. Under such conditions even a moderate freeze can result in widespread damage to the tree.

Smog, An Environmental Avocado Hazard

Smog is an environmental hazard to avocados, although it is extremely difficult to measure the effect on the fruit at the present time. It is suspected that the unusual skin character of many fruit in the Mid-Counties is the result of air-pollutants.[23] Southern California smog is derived from transportation, industrial, and refuse burning sources. Most of the smog is produced by photochemical action on hydrocarbons from automobile exhaust effluents. The products are retained near the surface due to an inversion layer aloft in the Los Angeles-San Bernadino

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[22]Paul Hanson, personal interview.

[23]Personal interview and field trip with Gary Suthers former Orange County Farm Adviser, July 2, 1968.

Lowland, especially within a radius of 20 miles from the city of Los Angeles.[24]

In spite of the fact that agricultural experts in Southern California hypothesize that smog may damage the avocado skin, it has never been conclusively proven. However, blatant evidence such as end spotting and a corky appearance, which are genetic malfunctions of the exocarp, are associated with heavily polluted areas. It is suggested that automobile exhaust, which is the dominant contributor to pollution in Southern California, is affecting the avocado.[25] At the moment, only the Mid-County avocado acreage is noticeably affected. However, all avocado areas contain some pollutants even in northern San Diego and southern Riverside where the photochemicals go unnoticed by the majority of the local residents. The importance of this factor to the welfare of South Coast fruit and vegetable crops has encouraged increased research at the University of California at Riverside. Unfortunately, little avocado smog research has been specifically performed in recent years. Avocado hazards do not terminate with Santa Ana winds, wildfire, continental air mass intrusion, and smog. Perhaps the most serious dilemma yet to be overcome is a

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[24]Bailey, op. cit., pp. 75-78.

[25]W. B. Storey and B. O. Bergh, "End Spotting and Corking of Avocado Fruits," California Avocado Society Yearbook (1968), pp. 97-101.

fungus which affects the root system under certain soil conditions.

Soils and Avocado Location as a Prelude to Root Rot Hazard

The Mediterranean climatic regime of the South Coast is characterized by a predominance of winter precipitation when biological-chemical soil activities are minimized. The limited amount of humus produced in the evergreen chaparral and oak-parkland environment is not readily removed from the soil by chemical means or leaching rains. The combination of climate and chemical-biological soil-producing factors has given rise to calcic and noncalcic brown soils which predominate in California's avocado producing areas.[26]

The avocado tree is grown on a wide variety of soils within the isolated foothill locations dictated by microclimate.[27] Unlike many crops, an understanding of soil profiles is not nearly as important in terms of avocado location as subsoil drainage characteristics which prevent the development of the root rot fungus.

A major physical hazard to the avocado industry is the Phytophora fungus which produces root rot under conditions of excessive soil moisture. Root rot conditions may

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[26]R. E. Storie and F. Harradine, "Soils of California," Soil Science, 85, No. 4 (April, 1958), p. 207.

[27]Hodgson, op. cit., p. 7.

be caused by overirrigation, breaks in water line systems, or excessive rainfall even on well drained soils. However, it most commonly occurs when the internal soil drainage is restricted.[28] Internal drainage impairment is often caused by the presence of tight clay layers (clay loam), in the "B" horizon, or a dense rock stratum within one to three feet of the surface. Under this circumstance a perched water table develops, and internal drainage is impaired. The saturated condition of the soil profile provides an environment favorable to the liberation of spores followed by the germination and the infection of the root system.[29] The soil organisms appear to be active during the warmer months of the year when the soil temperature is between 77°F and 87°F. Under favorable moisture and temperature conditions the mobile spores are attracted to the avocado tree by a chemical which is given off by the roots. Fortunately, when the moisture level of a sandy loam soil is reduced to 3 per cent for two weeks the spores will die.[30]

An examination of the soils is essential to an understanding of the avocado root rot hazard. The fungus

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[28]G. A. Zentmyer, A. O. Paulus, and R. M. Burns, Avocado Root Rot, Circular 511 Revised (Riverside: University of California Experimental Station, 1967), p. 3.

[29]J. J. Commy and C. D. Gustafson, How to Select Your Orchard (Sacramento: University of California Agricultural Extension Service, 1966), p. 1.

[30]Zentmyer, Paulus, and Burns, op. cit., p. 9.

apparently has an effect on avocado trees in almost every soil series within which the plants can be grown.

Soil series can be categorized according to their internal drainage. Drainage, or lack of it, corresponds closely to susceptibility to root rot fungus. Although the Phytophora cinnamomi has affected every avocado district, it has not been disseminated through space or time at the same rate, largely because of the diversity of soils and drainage patterns. The soils in which avocados are grown have been grouped together in accordance with their root rot hazard potential: (1) severe hazard soils are characterized by slow subsoil permeability and a shallow profile of less than 36 inches; (2) moderate hazard soils are somewhat poorly drained and have a depth range between 36 to 60 inches; (3) slight hazard soils have relatively rapid subsoil permeability and a soil profile in excess of 60 inches (Table 5).[31] Utilizing this classification as a point of departure, the general characteristics of the South Coast soils in the avocado clusters will be discussed in greater detail.

Generalized Soil Geography of the Avocado Belt and the Root Rot Hazard

Within the calcic-noncalcic brown soils group, located where annual precipitation ranges between 10 to 20 inches, there are four soils associated with avocado

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[31] Ibid., p. 11.

TABLE 5

ROOT ROT HAZARD RELATED TO SOIL SERIES

Severe Hazard		
Aliso	Huerhuero	Rocklin
Altamont	Madera	San Joaquin
Bensall	Merriam	Santa Lucia
Cibo	Milpitas	Sespe
Clear Lake	Montezuma	Sweeney
Cometa	Olivenhair	Tierra
Diablo	Placente	Twin Oaks
Dublin	Porterville	Watsonville
Escondido	Rincon	Zaca
Moderate Hazard		
Ballard	Los Pasos	San Andreas - Tierra
Botella	Naciamento	San Benito
Carpenteria	Ojai	Sobrante
Chino	Pleasanton	Soper
Conejo	Ramona	Zamora
Fallbrook	Salinas	
Slight Hazard		
Baywood	Marina	Vina
Elder	Metz	Visalia
Greenfield	Mocho	Vista
Hanford	Sorento	Yolo
Honcut	Tujungo	

Source: G. A. Zentmyer, A. O. Paulus, R. M. Burns, Avocado Root Rot, Circular 511 Revised, California Agriculture Extension Service, November 8, 1967.

location, i.e. Valley land soils, Terrace Land soils, Ill-Drained Lowland soils, and Upland soils (Figure 9). The Valley Land soils are found on alluvial flood plains such as the Santa Clara River Valley or other lowlands of Southern California. They are derived from sedimentary and granitic rock alluvium and are loam to sandy loam. The calcic brown alluvium includes the Hanford, Sorrento, and Visalia series, whereas the Carpinteria, Yolo, and Zamora are categorized as noncalcic brown.[32]

These deep alluviums are well drained and are generally classified as soils least susceptible to root rot.[33] For example, the Tujunga series is a highly permeable noncalcic brown type with a stony or gravelly sand texture located on gently sloping deep alluvial fans. It is not susceptible to serious root rot development due to a good permeability throughout the soil profile. These recently deposited fan soils are often found in scattered Los Angeles, Riverside, and San Bernadino county locations, especially in the foothills of the San Gabriel Mountains.[34] Fortunately, rockiness is not extremely detrimental to site

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[32]R. Storie and W. Weir, Generalized Soil Map of California, Manual 6 (Berkeley: California Agricultural Experiment Station Extension Service, 1963), pp. 2-10.

[33]Robert M. Burns, Soils and Avocado Root Rot Damages (Riverside: University of California Agricultural Extension Service, February, 1962), p. 1.

[34]Storie and Weir, op. cit., pp. 8-9.

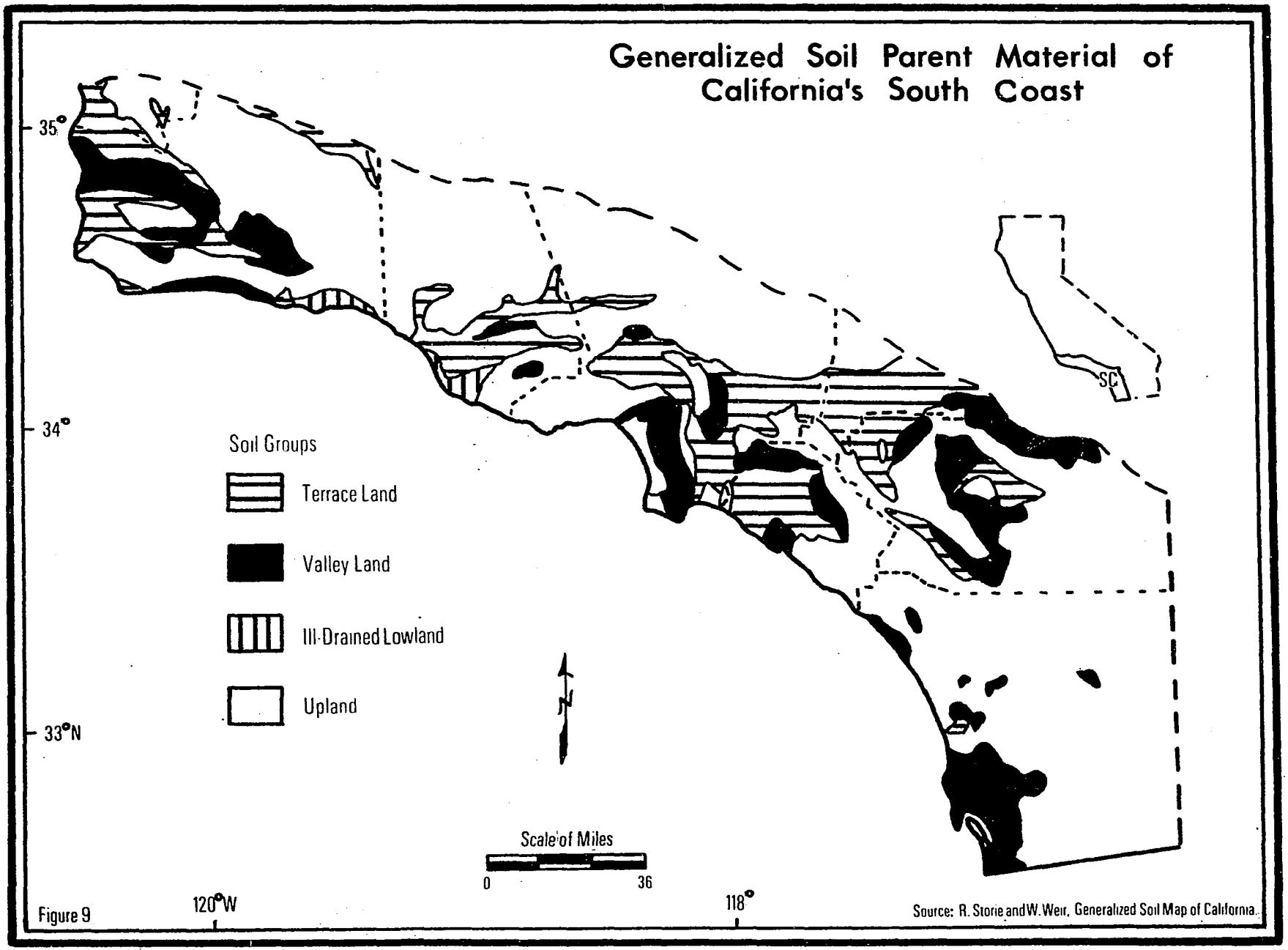
Generalized Soil Parent Material of California's South Coast
35°
34°
33°N
120°W
118°
SC
Soil Groups
Terrace Land
Valley Land
Ill-Drained Lowland
Upland
N
Scale of Miles
0
36
Source: R. Storie and W. Weir, Generalized Soil Map of California

Figure 9

location because foothill growers follow nontillage practices.

The Ill-Drained Lowland group or Wiesenboden soil type is of considerable concern to avocado growers. This soil group, with respect to avocado plantings, is almost exclusively in the Carpinteria Lowland. The Clear Lake soil series, which exemplifies this group, is a transported alluvium derived from a shale bedrock. It is very susceptible to root rot fungus due to poor drainage.[35]

The Terrace Land soils are on gently sloping to rolling topography along the flanks of valleys up to 100 feet above the bottomland on coastal marine and interior fluvial terraces. The interior soils are older consolidated valleyfill exemplified by the Ramona sandy loam of San Diego County and the Ojai loam of Ventura County. Both soils have a moderate root rot hazard. Few of the terrace soils have had large avocado plantings on them due to the precarious nature of the microclimate. On the other hand, two other soils contain a clayey subsoil which is susceptible to root rot development. These soils, primarily found in San Diego County, include the Merriam loam and the Bonsall sandy loams. Both are derived from granitic rock alluvium and contain a dense clay "B" horizon which results in slow

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[35]Ibid., pp. 18-20.

[36]Burns, op. cit., p. 1.

subsoil permeability.[37] The Elkhorn loamy sand, a marine sediment derivative, has been of particular significance to the coastal section of San Diego County in the past few years. It is on relatively smooth topography and contains a friable "A" horizon, but the compact clayey "B" horizon gives rise to a root rot problem.[38] Over the past 15 years in San Diego County, extensive fungus infestation and lack of personal care have resulted in general deterioration of plantings in the coastal margin to the east and west of Interstate Highway 5 (Plate 11).

The Upland type, a residual soil located on the foothills of the Transverse and Peninsular ranges is by far the most extensive soil type. Not all upland soils are favorable for avocado cultivation. For example, the Diablo and the Zaca soil series on hilly to steeply sloping land in Santa Barbara County, have a clayey profile due to the shale bedrock parent material.[39] Both soils are susceptible to a severe root rot hazard.[40] The soils comprising the largest avocado acreage in California are the residual soils of tonalite or granodiorite, primarily in the Fallbrook District. The Vista sandy loam, the most wide spread soil in

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[37]Storie and Weir, op. cit., pp. 21-31.

[38]D. I. Eidemiller, p. 83.

[39]Soil Survey, Santa Barbara Area California, op. cit., pp. 23, 27.

[40]Zentmyer, Paulus, and Burns, op. cit., p. 10.

Plate 11--A coastal terrace scene displaying a defoliated grove on the left and the remnant of a larger avocado orchard on the right. This San Diego County scene west of Interstate Highway 5 has declined due to root rot, lack of care, and urbanization.

Plate 12--A Fuerte grove in Fallbrook, California, which shows an advanced stage of root rot infection. This defoliated grove will probably be replaced with single unit dwellings in the near future.

avocado acreage, has a moderately deep and porous profile rated as a slight hazard. The Fallbrook sandy loam, a shallow soil with a somewhat dense subsoil, is rated as moderately susceptible to root rot development (Plate 12).[41] In addition the Sespe series, a North County upland soil derived from a sedimentary parent material, has a severe root rot hazard due to a dense rock substrata.[42] In the final analysis, the most logical procedure in the establishment of avocado groves is to determine subsurface drainage prior to planting and irrigation.[43] Unfortunately, this procedure was not practiced during the initial stages of commercial avocado grove development in California. Even today soil scientists are not certain how much soil area is conducive to avocado growing. Much of the attitude toward environmental hazards is related to grower perception.

Perception of Environmental Hazards in the Avocado Industry

Effective management of the avocado industry depends on how well the growers perceive environmental hazards which could affect annual productivity. After both natural and man-induced hazards have been explained, it is necessary

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[41] Burns, op. cit., p. 1.

[42] Storie and Weir, op. cit., p. 46.

[43] Personal interview with Ralph Bishop, San Diego County Work Unit Conservationist, Escondido Branch, June 26, 1968.

to understand how growers perceive them and what decisions are made as a result of the hazard's threat.

According to Burton and Kates, there are two ways to approach hazards, i.e. prevention or control.[44] Prevention of climatic hazards implies changing the nature of the weather, and success in this area has been very limited. Control measures suggest that man and his products must be modified, but changing the conservative grove owner is not practical. Unlike removing man from potential areas of inundation along flood plains or coastal margins, the grower is unable to transfer the avocado to a more favorable location. In the first instance, most growers have invested so much in their land that it is more logical to "weather" the hazard. Further, the sensitive avocado varieties are so restricted in location that there is little land in which another grove of 20 to 100 acres could be established.

Like many locations which are susceptible to several hazards, human responses to the uncertainty of the phenomena may include any of the following: (1) deny its existence, as illustrated in the attitude, "it can't happen to me"; (2) transfer the uncertainty to a higher being, as in the fatalistic conception that the occurrence is in the hands of God; (3) deny that the hazard will occur again, with the confidence that: "Lightning never strikes twice in the same

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[44]Ian Burton and Robert Kates, "Perception of Natural Hazards in Resource Management," Natural Resources Journal, 3 No. 3 (January, 1964), p. 443.

place"; (4) perceive the potential hazards objectively. With this last choice the hazard becomes a calculated probability such as "the freeze usually hits once every 10 years, so I can count on a good harvest for at least nine years." The fact that the large majority of the growers are not commercial farmers in the real connotation of agricultural activities, leads to the conclusion that few are overly concerned about hazards. In most instances, it is suspected that their awareness of the potential destruction from environmental hazards is rather nebulous. The mere fact that a grower experiences some economic loss due to such phenomena does not necessarily mean that he will become more cognizant of the existence of hazards and repercussions. This is especially true after time has erased some of the memory of the disaster.

It is hypothesized that the majority of the growers with small acreage find solace in choices 1, 2, and 3 mentioned above. On the other hand, the large grove owners, whose thoughts are directly more to the crops as a full time occupation, perceive hazards differently. Avocados are viewed as carrying certain production risks. Most expect a small crop loss from freezing, flooding, and Santa Ana conditions one year in ten and a severe loss, similar to the 1968-1969 period once every 50 years. These commercial growers, committed to a long-term investment, adequately finance their property to carry the operation through a

year or even a series of years of adverse conditions.[45] If a grove is damaged to the point that considerable financial loss is incurred, some owners will sell a portion of property in an effort to regain their monetary composure. In some instances, more tolerant Bacon and Zutano varieties are planted in the coldest locations.[46] Commercial avocado grove owners take great pride in their livilihood, and nearly all of them will undergo considerable financial sacrifice to reestablish the orchard.[47]

Few grove owners have lived in an avocado district a sufficient length of time to understand the long-term average threat of natural climatic hazards. For example, it has been previously pointed out that intensive cold air mass intrusions have occurred on an average of 1 year in 10, but the actual occurrence is too irregular to determine a pattern. No matter what the hazard, most growers retain their agricultural function; they accept the short-term weather risks, rather than abandon their way of living for an uncertain livelihood elsewhere.

In contrast to climatic hazards, grower awareness of root rot hazard is an example of the farm adviser's

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[45]Personal letter from B. W. Lee, Ventura County Farm Adviser, September 29, 1969.

[46]Personal letter from Theodore Todd, Owner, Todd Ranch Company, September 29, 1969.

[47]Personal letter from George E. Goodall, Santa Barbara County Farm Adviser, September 30, 1969.

ability to provide technical advice which has resulted in hazard control measures. The Southern California avocado grove owners have been so severely affected by the fungus that they are receptive to the technical advice provided by agricultural authorities. It is suspected that future selection of avocado acreage will largely be based on the knowledge of the area's susceptibility to root rot development. The general attitude toward root rot correlates with other perception studies. Most major changes in public policy are made shortly after severe natural disaster has forced a more cognitive perception of the environment. For example, many farmers in San Diego County are not satisfied with a suboptimal solution to Phytophora root rot. This attitude is the main reason for establishment of the Root Rot Committee.

In conclusion, it can be stated that the perception of avocado hazards is based to a significant degree on one's past and present experiences, personal values, and individual attitudes. It is out of this perception of the environment that decision-making takes place as to the location and permanency of the grove. Chapter VI will progress beyond cultural causation associated with the physical environment to the complex human judgments which have organized and integrated the industry.

CHAPTER VI

INTEGRATING ELEMENTS IN THE AVOCADO INDUSTRY, THEIR INFLUENCE AND FUNCTIONS

One of the prominent characteristics of the avocado industry is its noncontiguous nature. This chapter is concerned with discovering the factors which have acted as links between the avocado regions and helped to unify the industry into its current complex whole. Some of the most important entities associated with the industry's unity are Calavo, the California Avocado Advisory Board, the California Avocado Development Organization, and the California Agricultural Extension Service. The functions of each of these groups will be examined with the hope that among others, agricultural leaders of developing nations who aspire to establish an avocado industry will understand the complexity of the task.

To a certain degree, the avocado regions, since their initiations have been bound together by the uniqueness of the fruit and the special characteristics of grove owners. Further solidification was acquired by the combined work of the California Avocado Association and Calavo before the

crop had become a major commercial operation. For a period of nearly three decades Calavo, with between 80 and 90 per cent of the growers as members and a small group of intelligent and aggressive leaders, integrated the scattered industry. However, the marketing crisis of 1959 initiated an era of uncertainty. The influx of several new independent handlers challenged Calavo's dominance, especially in northern San Diego County. These handlers added to industry instability by excessive fruit price competition among themselves. It seemed for a time that the marketing fragmentation and lowering prices, associated with a record crop production in 1958-1959, might result in the disintegration of the avocado industry. It was at this point that several organizations produced an avocado spatial interaction between the various districts and improved an extremely precarious situation.

The development of modern marketing practices and the close relationship between marketing agencies and growers have resulted in industry-wide coordination during the 1960's. Early growers realized that processing, advertising, promotion, and vigorous marketing, with research, were necessary tools to produce a sustained profit-making avocado industry. The initial marketing organization, Calavo, became one of the most important systems within the avocado industry.

Calavo Growers of California

Calavo, a non-profit cooperative marketing association, is one of the primary reasons for California avocado integration. It functions as the most significant organization in harvesting, processing, and nationwide fruit distribution. It is without doubt the most diverse avocado organization in the United States.

The Calavo field representatives, located in seven field offices throughout the South Coast Region, are the coordinators between cultivation and marketing. It is the representative's responsibility to work as a team with the grower-member in terms of giving advice on fruit maturity and harvesting the crop. Moreover, he is responsible for housing and organizing picking teams as well as recruiting new members. One of his major acts is to see that the mature fruit within the district are moved to the packing plant as advised by the selective picking methods of the field manager. In several districts, Calavo employs the use of field offices, vehicle radio transmitters, and vehicles with trailers which provide more rapid movement of the harvested fruit to the processing plant.[1]

Calavo, although not the initiator of the concept of grove care and management, developed their own service in

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[1] "Scouts Pack A Lot Of Avocados," International Trail, 36 No. 5 (1966), pp. 16-17.

1965[2] to meet the needs of older members and absentee owners who are not able physically to manage the groves. At the present time the grove care program is administered from its Fallbrook and Escondido service centers.

Once the fruit is picked, it is quickly transported to one of five Southern California packing plants. The Escondido and Santa Paula plants, in addition to having the largest avocado packing facilities in the world, have extensive mechanized equipment, oil maturity test laboratories, and cooling facilities. These modern plants provide rapid and efficient dusting, sorting, and packing operations. Some of the modern equipment includes a patented box inverter, an automatic sizing conveyor cup, an electric counting device, and dylite-polystyrene plastic trays formed to hold the 13 different sizes.[3] Greater external processing efficiency has been accomplished by the recent merger of Calavo with three packing plants in Orange, Ventura, and Santa Barbara.[4]

The realization that without publicity avocados would have little distribution outside the large Los Angeles market prompted Calavo to establish advertisement and

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[2]Calavo Newsletter, February 8, 1966, pp. 1-2.

[3]Personal interview and tour with Jerry Jackson, Manager of Calavo Packing Plant in Santa Paula, California, July 10, 1968.

[4]Calavo Annual Report 1967 (Los Angeles: Calavo Growers of California, 1968), p. 13.

promotional campaigns. Currently, the cooperative is engaged in store displays, year-round advertisement with comparison lines in retail stores and trade publications. The "Calavo" trademark, which applies to the top fruit grade, has been observed by consumers in store demonstrations and display kits across the country. In fact, many consumers refer to the fruit as a "Calavo." In recent years, a home economist has been employed to develop and promote avocado recipes. Furthermore, publications, newspaper advertisements, news releases, and participation in such community activities as the National Avocado Festival in Fallbrook[5] are all ways in which Calavo communicates with growers and consumers.

Expenses incurred as the result of costly equipment and an elaborate operation, with many administrators, have forced Calavo to diversify production. In an effort to defray the cost of producing high quality output, it has developed frozen avocado products via the process of cryogenic freezing and it is now distributing companion line fruit products. Frigid Foods Incorporated in Escondido, California, is a subsidiary company purchased in 1962 with the purpose of providing ready-to-eat fruit to large institutional consumers (restaurants, airlines, and hotels), and frozen guacamole for the general market. During high

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[5]Fortieth Annual Report, 1963 (Los Angeles: Calavo Growers of California, 1964), pp. 13-14.

production years and periods of severe weather the cryogenic freezing process can provide a market for low grade fruit (discolored, scarred, wind burned, smog damaged). This mature fruit can be readily converted to frozen guacamole. Moreover, mature halves, slices, and chunks can be frozen and shipped to the institutional consumer without the heavy seed. Defrosting and salad preparation can be accomplished in a one to four hour period once the fruit has been received from the wholesaler.[6] The cryogenic freezing process has the disadvantage of being an expensive operation, but this is compensated somewhat by the consistent production of a high quality commodity. It is especially advantageous in heavy crop years when the surplus fruit can be frozen and distributed to large volume users every month of the year. The frozen avocado is particularly appealing to restaurants and housewives who do not have the time or patience to wait for several days while the fruit ripens. The concept of world-wide distribution of guacamole has been employed in trial shipments to Japan, Germany, England, and France.[7]

In addition to products associated with cryogenic freezing, Calavo has developed companion-line sales as another aspect of "total marketing." Some of these products include avocados from Florida, limes, coconuts, dates,

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[6]The San Diego Union, April 3, 1968, pp. 11, 14.

[7]"Cold Magic," Cornerstone, 1968 (Sacramento: The Jostal Company, 1968), pp. 40-43.

mangos, raisins, and pineapples. It is the cooperative's belief that a 12-month advertising and promotion campaign for all these commodities, under the name Calavo, will make them better known to the consumer. It should also have the effect of selling more avocados, the primary product.[8]

Thus, Calavo, through grove care, harvesting, processing, distribution, companion lines, and a nation-wide marketing system (Plate 13), retains an important position within the avocado industry as an integrating force. This force manifests itself in that approximately 2,800 of the 5,300 growers are members of the cooperative.[9] It is this strength which has helped Calavo to provide funds for research, marketing, and distribution programs closely aligned with independent handlers and the California Avocado Advisory Board.

Independent Handlers

In looking over the recent history of the rise of cash buyers, one might wonder if the independents did more to fragment the industry than to integrate it. Whether this is true or not remains for future analysis, but it is certain that the cash buyers, plus one small cooperative organization, market as much as 40 per cent of the avocados in California annually (Plate 14). Although there are 68

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[8]Calavo's Fortieth Annual Report, 1963, op. cit., p. 14.

[9]Personal interview with Jack Shepherd, Calavo Public Relations Officer, July 14, 1968.

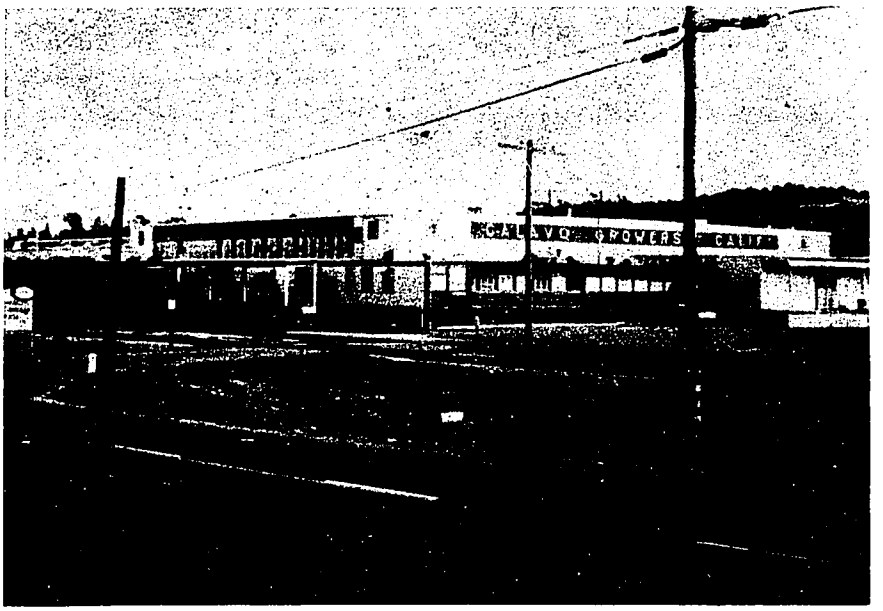

Plate 13--The Calavo Packing Plant, located near Escondido, California, is the largest avocado processing facility in the world. Although railroad boxcars are still utilized, trucking is the dominant mode of transportation.

Plate 14--The Cal-Brook Avocado Company is one of three packing facilities located in northern San Diego County which is owned by a single group. Cal-Brook, ranked among the top ten avocado packing houses, ships fruit throughout the United States. (Photograph courtesy of Dr. Robert Rock.)

handlers registered with the State Bureau of Marketing, only 10 of them, including Calavo, market in excess of 90 per cent of the crop.[10]

Independent handlers differ from Calavo in that most of them are small in size with limited operating expenses and few highly paid administrators. The operation is managed on a profit motive basis, and little promotion or advertisement except the use of trade names is employed.

Although most individual cash buyers are too small or recent in terms of development to perform a large-scale avocado regional integrating function like Calavo, there have been many achievements. Several of the larger cash buyers contract with one or more national chain stores, such as Market Basket or Mayfair. This arrangement provides the independents with continual nationwide avocado exposure.[11] Such contact is important to the industry because many middle class consumers, who characteristically buy their products in the large chain stores, purchase several fruit per year, thereby perpetuating avocado sales interest. Most of the eight largest cash buyers distribute fruit nationally,

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[10] Letter from Ralph M. Pinkerton, Manager, California Avocado Advisory Board, December 5, 1968.

[11] Personal interview with Donald Munro, Manager, Calbrook Avocado Company, Fallbrook, California, June 12, 1968.

and a few even transport avocados to a limited number of West European cities.[12]

Pacificado Incorporated, a packing plant established in Fallbrook in the autumn of 1968, represents one of the most progressive of the independents. However, in the process of acquiring a modern facility it is suspected that operating costs have increased significantly. Its contribution to the industry appears to be a dynamic approach which reflects a confidence in the future of the avocado industry in northern San Diego County. Pacificado's idea is centered around elaborate equipment utilized in harvesting, processing, and marketing, as exemplified by the following: all-metal field bins; a tractor-trailer combination for hauling bins to the packing plant; new refrigeration design in the plant; an up-to-date concept in grader-size design; and an entire automatic fruit conveyance system from weighing through packing.[13]

In conclusion, it would seem that the most significant factor which developed out of the 1957 to 1960 cash-buyer era was the establishment of an air of competition. Prior to that period, Calavo monopolized marketing. The rise of independents not only provided new avenues of processing and marketing, but it forced Calavo to evaluate itself and

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[12]Personal interview with William McDaniel, Owner, McDaniel Packing Plant, Fallbrook, California, June 5, 1968.

[13]The Packer, October 12, 1968, pp. 1, 5.

its procedures. Each of the handlers helps to coordinate and integrate the industry through his contact with the grower. Although there is a trend toward consolidation of packing plants, the fact that there are still many handlers in this small industry leaves considerable room for further integration. In the end, both cooperatives and independent handlers perform one very important task for the grower; they convert the fruit to a monetary return.

California Avocado Advisory Board

In the 1958 to 1959 crop year fruit price per pound decreased to $.05 at the packinghouse, and the avocado market seemed near collapse. It was the establishment of the California Avocado Advisory Board, referred to as CAAB, which helped to retain a fragment of hope for the future of the industry. CAAB is a state marketing order whose purposes are to improve return per acre and to build avocado consumer awareness via promotion, advertisement, and research. The Board helps to develop a more propitious climate for marketing the crop while refraining from selling, controlling fruit movement, or influencing avocado prices at the buyer level.[14]

The organization is composed of 14 elected board members, 10 growers, two cooperative representatives, and two independent handlers, all of whom are appointed by the

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[14]Walter R. Beck, "California Avocado Marketing Order," California Avocado Society Yearbook (1962), pp. 17-20.

California Director of Agriculture. The Board's task is to operate, direct the program, and authorize the expenditures. CAAB is financed by a 5 per cent levy on each gross dollar paid to growers for their fruit, and a salaried manager and staff carry out the programs as set forth by the board.

The Advisory Board has several committees which are responsible for various programs such as advertising, research, marketing, and public relations. The board employs professional agencies for research and counseling services. Its research programs, usually performed in conjunction with a professional research agency, are concerned with the improvement, advancement, and promotion of the California avocado.

Studies have identified the ramifications of consumer use, and the findings have helped direct avocado advertising toward the consumer.[15] One study has determined patterns of national avocado consumption. For example, only 10 per cent of the population in the United States eat any avocados on a yearly basis. The greatest consumption is in California, particularly Los Angeles. Therefore, the promotion of retail sales has been directed toward large cities in the east where consumer purchases are lowest in the nation. Much current advertisement and promotional emphasis has been directed to the commercial buyer. In recent years

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[15]Ralph M. Pinkerton, "California Avocado Advisory Board," California Avocado Society Yearbook (1962), pp. 15-16.

large corporations have developed or merged to the point that the number of small wholesale buyers has declined. It has become necessary to concentrate the promotional energies on large grocery concerns such as Safeway and Kroger.[16]

On the whole, CAAB has concentrated on the multiple unit[17] female household buyer. Fruit prices cannot be substantially lowered to meet the pocketbooks of the less economically endowed individual. Moreover, the Advisory Board has focused on both the light user (a person who consumes one unit per year) and the heavier users because these people are all familiar with the fruit. It follows that advertising design has been directed toward increased consumer interest through the following media: women's magazines; radio; newspapers; national television; and a new 48-page avocado recipe book.[18]

Recent studies indicating how avocados are being displayed in stores have resulted in large-scale promotional campaigns to increase the attractiveness of the retail display. One advertising approach has been the production of a 20 minute color training film to educate the retail produce manager on proper storage, handling, and display methods.

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[16]Ralph M. Pinkerton, "Research Directed Advertising For California Avocados," California Avocado Society Yearbook (1967), pp. 29, 30, 33.

[17]One unit equals an 8 ounce fruit.

[18]Ralph M. Pinkerton, "Avocado Advertising As a Profitable Investment," California Avocado Society Yearbook (1963), pp. 26-27.

Another promotional scheme has been a tie-in program with other major food companies such as Kraft, Morton Salt, Rath Meat, and Spice Island. Furthermore, a new avocado merchandiser display rack has been developed in which unripe and ripe fruit are placed in separate sections. Finally, the Advisory Board has instituted a nutritional research committee. Its main function is to dispel the assumption espoused by many dietitians and physicians that the avocado is detrimental to the health of cardiac patients whose diets require a low cholesterol content.[19]

The Advisory Board's efforts over the years from 1961 to 1968 have had several results. In the past seven seasons the annual value of production rose from $10.7 million to $17.2 million for a total increase of about $6.5 million. In contrast, there was only a $2.3 million increase between 1950 and 1961.[20] The writer suggests that the effectiveness of advertising and promotion campaigns during the 1960's is a major reason for changes in consumer preference and taste, improved market performance, and favorable variations in patterns of shipment and distribution. Although CAAB has been a major contributor to the promotion of avocados, it would be remiss not to mention the impact of

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[19]Ralph M. Pinkerton, California Avocado Advisory Board, Annual Report, 1966-1967 (Newport Beach, California: California Avocado Advisory Board, 1968), p. 7.

[20]R. C. Rock and R. G. Platt, Economic Aspects of Marketing California Avocados (Riverside: University of California Agricultural Extension Service, May, 1968), p. 13.

the designation and utilization of the color "avocado green" on consumer awareness. The wide use of this "new" color in conjunction with automobile, household furniture, and appliance advertising remains a mystery. Certainly the avocado itself has also helped to develop and retain consumer interest by the obvious fact that it is an interesting and an unusual fruit.

The success of the California Avocado Advisory Board since it began functioning in 1961 is largely due to the skillful decision-making performed by its board of directors. These individuals represent some of the most intelligent and aggressive leaders in the industry. As a result, they command a good deal of respect from growers and handlers alike. Thus, the California Avocado Development Organization and CAAB have become the most important integrating factors in the 1960's because they have provided a common ground where groups from all factions of the industry may discuss and solve marketing problems.

California Avocado Development Organization

Shortly after the newly formed California Avocado Development Organization, popularly called CADO, failed to acquire approval by the avocado handlers to engage in advertising and promotion, there was some question as to its function. However, many of the packers realized the need for industry integration, and the development organization did represent both cooperative and independent handlers for

the first time. It seemed logical to make an attempt to develop the organization around the concept of shipper co-operation. It was in this manner that the California Avocado Development Organization became a forum where all avocado handlers could assemble and discuss common problems.

In 1961, following the formal establishment of the organization, it began to make an effort to deal generally with the avocado industry's problems. CADO's main goal was simply to help the industry become more stable, efficient, and economically profitable for all the industry's members.[21] Several important programs have developed as a result of its work. In coordination with the Federal-State Market News Service and Dr. Robert Rock, a California Agricultural Extension Service economist, CADO developed a crop estimating system which makes information available to grower and handlers. It also facilitates advertising and promotional work carried on by CAAB. The establishment of accurate crop estimation has helped to provide a more consistent movement of fruit to the market. It was through the efforts of CADO that the standard fruit container was established by every packer, thereby eliminating the use of confusing odd-sized containers. CADO was instrumental in establishing a state law for determining the minimum number of avocados (five from a sample picking lot) which must be

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[21]Frank Gilkerson, "Avocado Marketing Methods: The Commercial Association," California Avocado Society Yearbook (1962), pp. 35-37.

examined to establish oil content and fruit maturity. It was one of the first agencies to coordinate medical research concerning the effects that avocados have on weight, nutrition, and cholesterol content in the human circulatory system. Recent studies have been concerned with more efficient ways of determining the maturity of the fruit. In addition to internal activities, research coordination has taken place between the California Avocado Society and the California Avocado Development Organization to understand retailer and consumer preference for specific avocado varieties.[22]

It would appear that general handler consolidation and the establishment of CAAB and CADO have resulted in horizontal marketing integration and the most satisfactory internal cooperation that the industry has witnessed to date. There is every indication that until the 1960's the industry was undergoing a horticultural change, but this trend has recently given way to the dynamic forces of marketing. However, some evidence of personal conflicts, jealousies, and general distrust between the cooperatives and the independent packers still remains. In conclusion, there is a trend toward amalgamation of the once severely divergent marketing philosophies and a mellowing of harsh personality

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[22]T. E. Lynn Preston, "C.A.D.O.--The Avocado Handlers Association," California Avocado Society Yearbook (1962), pp. 23-25.

conflicts. The long term influence of the Avocado Society has also played a role in this movement.

The California Avocado Society

In 1915 when the Avocado Association was first conceived, its initial purpose was to amalgamate the small unorganized industry into a strong marketing agency. Currently the association, now renamed a "Society," under the leadership of an elected board of directors, is involved in a multitude of programs. It provides research funds and acts as a collecting point and clearing house for avocado information. The California Avocado Society Yearbook is an annual publication of more than 200 pages containing papers by qualified agricultural specialists from every segment of the avocado industry. Moreover, the Society coordinates an annual meeting for members and guests with the purpose of improving communication. The conference involves lectures by agricultural scientists, marketing specialists, and outstanding growers in addition to providing exhibits and equipment displays.[23]

Since its inception, the Society has recognized 50 men for outstanding meritorious service.[24] These individuals have served as Society officers and on many committees which

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[23]Wells N. Miller, "The California Avocado Society," California Avocado Society Yearbook (1960), pp. 11-12.

[24]"Awards of Honor," California Avocado Society Yearbook (1968), p. 7.

represent the functional element of the organization. There are five major groups within the Avocado Society including research, foreign exploration, varieties, and avocado quality control committees, as well as a nurserymen's section. The Society's contributions to the industry are intricately interwoven within these committees.

One of the most important committees of the Avocado Society is the Research Committee. The research undertakings, mostly concerned with acute grower problems, are handled through the facilities of the University of California at Los Angeles and Riverside. The committee representatives visit the university's research centers periodically. Research projects are in the following areas: pests and plant diseases, variety selection, macro-soil and micro-soil nutrient studies, irrigation and salinity investigation, and grower education concerning the research findings.[25]

The Foreign Exploration Committee conducts trips to other countries in an effort to find superior varieties. Seed collections have been obtained from Argentina, Colombia, Hawaii, Puerto Rico, Mexico, to name a few. Committee members or delegates on the long trips acquire seeds mainly in

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[25]George B. Bowker, "Report of Avocado Research Committee," California Avocado Society Yearbook (1968), pp. 21-23.

an attempt to find a rootstock which is resistant to root rot.[26]

Another active Avocado Society subdivision is the Variety Committee, which studies and suggests potentially commercial South Coast avocado varieties. A record is kept of all named varieties which have been examined by the committee. This committee, in conjunction with Calavo and the University of California, has conducted a campaign to limit the number of commercial varieties. The urgency was vividly portrayed in 1960 when there were 200 commercial varieties with only 12 being recommended. After intensive study of fruit qualities the four current varieties discussed in Chapter II were finally recommended.[27]

The most recent committee, known as the Avocado Quality Control Program Committee, was established in 1967. This group, which appears to have the most comprehensive program within the Avocado Society, is concerned with the overall quality of every aspect of the industry. Included within its interests are cultural practices, physical environmental influences (climate, soils), factors associated with micro and macro-nutrients, irrigation, pest and disease, processing activities, transportation, fruit distribution,

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[26]Wells M. Miller, "The Avocado Society," California Avocado Society Yearbook (1960), pp. 11-12.

[27]Personal letters from James L. Todd, Secretary-Treasurer, California Avocado Society, October 27, 1969.

and retail handling practices.[28] In addition, the program stimulates interaction between CADO, CAAB, and the Avocado Society. It is hoped that the coordination of these three main organizations will improve every facet of the avocado industry.

Although not a committee, the Nurserymen's Section within the California Avocado Society has become an integral part of the organization. The nurserymen's section, under the direction of Oliver Atkins, became attached to the Society in 1968. Its primary purpose is to more effectively develop the avocado nursery trees in Southern California. Just as important, it gives widely scattered nurserymen the opportunity to discuss common problems and exchange new techniques.[29]

Nurseries are an integral part of the industry because the economic feasibility of a grove depends on the production of high quality young trees from good seeds and budwoods which must be consistently available to the grower. In recent years particular emphasis has been placed on preventing the spread of sun blotch virus and root rot fungus.

The California Avocado Society, although influential, is not without problems. In recent years the Society has

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[28]William F. Catlin, "Report of the Fruit Quality Improvement Committee," California Avocado Society Yearbook (1967), p. 17.

[29]O. Atkins, E. W. Frey, and W. H. Brokaw, "California Avocado Nurserymen's Group Becomes a Reality," California Avocado Society Yearbook (1968), pp. 25-26.

suffered a net loss of approximately 20 members per year. Many of the smaller grove owners find very little utility in membership, whereas older grove owners fail to renew membership when their groves are sold. Younger growers often are more interested in the avocado as a business venture or for land speculation purposes than as a crop. The general trend has been a decline in Southern California growers membership, whereas foreign enrollment has increased.[30] Jack Shepherd, Acting President at the Annual Society meeting on October 7, 1967, stated: "I give warning that the life of the California Avocado Society would not be much longer unless the members of it would individually undertake an active interest and leadership role."[31] Even though the loss of membership, and associated financial research assistance has declined, it is suggested that the trend is commensurate with an increase in the size of acreage per owner. Thus, it is quite possible that fewer owner-members represent more total acreage. Just as in past years, a minority of the Society members carry the burden of the majority. It is probable that the reason the Society attracts only 1 grower in 10 is the attitude of the retired urban businessman who has turned to rural avocado grove

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[30]Personal interview with G. L. Baldwin Manager of the San Joaquin Fruit and Investment Company, Irvine, California, July 18, 1968.

[31]"Report of the Annual Avocado Society Meeting," October 7, 1967," California Avocado Society Yearbook (1967), p. 11.

ownership only as a relaxed way of life in the twilight of his years.

Whatever the reason for membership decline, the California Avocado Society remains one of the most important influences and integrators. This appears true by virtue of its bringing growers, handlers, and university officials together through conferences and publication. Moreover, it plays an influential role by assisting newly developing foreign avocado plantings. One of the reasons why the University of California Agricultural Extension Service research has been so extensive in such a small industry is the aggressiveness and financial backing of the Avocado Society.

Influence of the California Agricultural Extension Service

The Agricultural Extension Service (A.E.S.) an arm of the University of California Division of Agricultural Sciences, is the research backbone of the avocado industry. Without such assistance it is doubtful that the industry could be as well developed today. Nearly all current research on the avocado occurs at the University of California at Riverside and its South Coast Field Station. The diversity of research is exemplified by the following list of subjects, i.e. biochemistry and maturation, market quality of mature avocado fruits, biological control of insects and

other avocado pests, plant breeding, diseases, soil and plant nutrition, and irrigation techniques.[32]

University field investigations are being carried on at the South Coast Field Station located near the El Toro Marine Corp Air Base in Orange County. This agricultural experiment station was established in 1956 as a result of the strong support given by the California Avocado Society and several other influential organizations. Two hundred acres have been set aside primarily to test subtropical crops on a long-term basis under physical conditions generally similar to the South Coast Agricultural Region.[33] Over 30 acres are devoted to avocado research, including the resistant root-stock investigations carried on by Dr. G. A. Zentmyer.[34] In addition to helping support the field station, many grove owners have provided time, energy, and land in cooperation with the Agricultural Extension Service to perform valuable research directly on their properties. For example, A. Von Norman in Fallbrook, has performed variety studies, while S. Shepard in Carpinteria has researched root rot problems and new varieties for several years.

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[32] Annual Report 1966-1967 South Coast Field Station (Riverside: University of California, 1967), pp. R34, R35, R41, R42, R44, R45, R54, R60.

[33] Gary L. Suthers, "South Coast Field Stations An Important Avocado Research Facility," California Avocado Society Yearbook (1967), pp. 21-24.

[34] Personal interview with D. F. Miller, Administrator, South Coast Field Station Administrator, El Toro, California, July 10, 1968.

Without a doubt, the county farm adviser is one of the most outstanding integrators. The farm adviser is an academic staff member of the University of California Agricultural Extension Service. As a member of the county staff, he is kept informed of all research findings accumulated at Riverside and elsewhere, and it is his responsibility to dispense this information to the growers. Avocado information is provided by the farm adviser via personal visits to farms and homes in addition to conferences, telephone communications, newsletters, and other publications. In addition, he develops intensive training sessions and field tours.[35] More than any other human aspect of the industry, the four or five avocado farm advisers in Southern California are exceedingly valuable to the welfare of the industry because they understand growing practices and grower psychology better than any other group of people. It is through the influence of these able farm advisers that a great deal of grower decision-making occurs.

In summary, the avocado grower, over the years, has realized that in order to provide a high quality commodity to the consumer he must strive to improve every aspect of the avocado industry. Such improvement includes planting in favorable physical environments, efficient methods of cultivation, using quality rootstocks and rationalizing the

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[35] R. G. Platt, "A Day With A Farm Advisor," California Avocado Society Yearbook (1961), p. 23.

complex marketing system. The agglomerated industry, which must give attention to all of these factors, reacts as a unit due to the coordinating forces of the Avocado Society, the California Avocado Advisory Board, the California Avocado Development Organization, and the Agricultural Extension Service. In the end analysis, it is group initiative which has provided the necessary impetus to thrust the avocado industry on its dynamic path. The discussion in the previous paragraphs has dealt with activities and attitudes within the industry. To continue, Chapter VII is concerned with the "personality" of the industry as expressed through the concepts of regional difference and environmental perception.

CHAPTER VII

REGIONAL ATTITUDES AND TERRITORIAL OCCUPANCY, A PERCEPTUAL STUDY OF THE THREE AVOCADO REGIONS

To be cognizant of the regional character within the avocado industry, it is necessary to become aware of grower purposes, past and present experiences, values, preferences, and attitudes.[1] These factors give rise to the growers' decisions and way of life and provide a deeper understanding of the clustered agricultural pattern. The interaction of man in groups, land, and mind through time-produces distinctive regional "personalities" such as the Mid-Counties, San Diego County, and the North Counties. Essentially, the emphasis, is placed on the idea of a cultural region based on man's concept of the landscape. This perception of the environment is in contrast to the usual agricultural regions as defined by physical criteria.

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[1]Jan O. M. Broek and John W. Webb, A Geography of Mankind (New York: McGraw-Hill Book Company, 1968), pp. 30-31.

Mid-County Regional Character

The regional personality of the Mid-Counties is largely the result of the forces associated with urbanization. From a 1968-1969 sampling survey[2] it was learned that only 57 of 336 commercial avocado grove owners in the Mid-Counties are full time farmers (Table 6). It is hypothesized that the majority of these full time farmers are in Riverside County and southern Orange County, where commercial agricultural enterprises have not been influenced by the urbanization trend. In addition, there are 244 growers, representing 72 per cent of the total who are part time farmers. These growers utilize the crop to augment their primary occupation income. The part time owner category is indicative of the land-use situation in the southern Santa Monica, the western San Gabriel, and the northwestern Santa Ana foothills where only the remnants of a once-thriving industry persist.

Assuming that the urban resale value of avocado acreage far exceeds its yearly return, possible reasons for much of the retention of avocados in the Mid-Counties may be human preferences and attitudes. Many groves have been retained or recently acquired by businessmen, because they offer a parcel of personal pseudo-rural space in an otherwise urban environment. It is possible that entrepreneurs

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[2]Information concerning Mid-County avocado acreage was obtained from Paul Hansen, Mid-County Calavo Field Representative.

TABLE 6

A SAMPLING OF AVOCADO GROVE OWNERSHIP IN THE MIDCOUNTIES SAN DIEGO AND VENTURA COUNTIES

Counties	Ownership				
	Fulltime	Part Time-Supplimental Income	Retired	Absentee	Corporation
Midcounties	57	244	24	2	9
South (San Diego)	5	345	90	93	2
Ventura	255*	90	12	6	25
Ownership Totals	317	679	126	101	36

*Nearly all growers either augment their income with investment or utilize the avocado return to supplement a primary occupation.

Source: Calavo Field Representatives and Personal Interviews, 1968-1969.

greatly value the appearance of a green hillside of avocados (or some other crop) after a considerable period of time spent in late afternoon rush-hour automobile traffic (Plate 15). The avocado grove offers a quiet, esthetic green area which the part time grower can manage successfully on weekends, with some profit. In addition, the grove may simply provide a place of solace with a measure of isolation from work and neighbors. In essence, it offers an escape from urban living, which is preferred to the chaparral vegetation found in hillsides near urban foothill dwellings.

For years, the La Habra Heights Improvement Association in Los Angeles County has preserved avocado acreage by enforcing strict regulation which limits property sales to a minimum of one acre. Bradbury Estates, located in the foothills of the San Gabriel Valley, epitomizes man's desire for rural living. These expensive estates are 10 acre plots mostly owned by affluent physicians, dentists, and business executives. Most of the avocado acreage, like many other foothill plantings, are old groves which function only to provide beauty to the environment. Thus, grove care services are maintained to ensure this end. Unfortunately, the 10 acre restriction terminates in 1970, and the prospect of subdivision becomes more acute. However, the presence of several owners with wealth, influence, and a rural attitude should prevent immediate large-scale property resale.

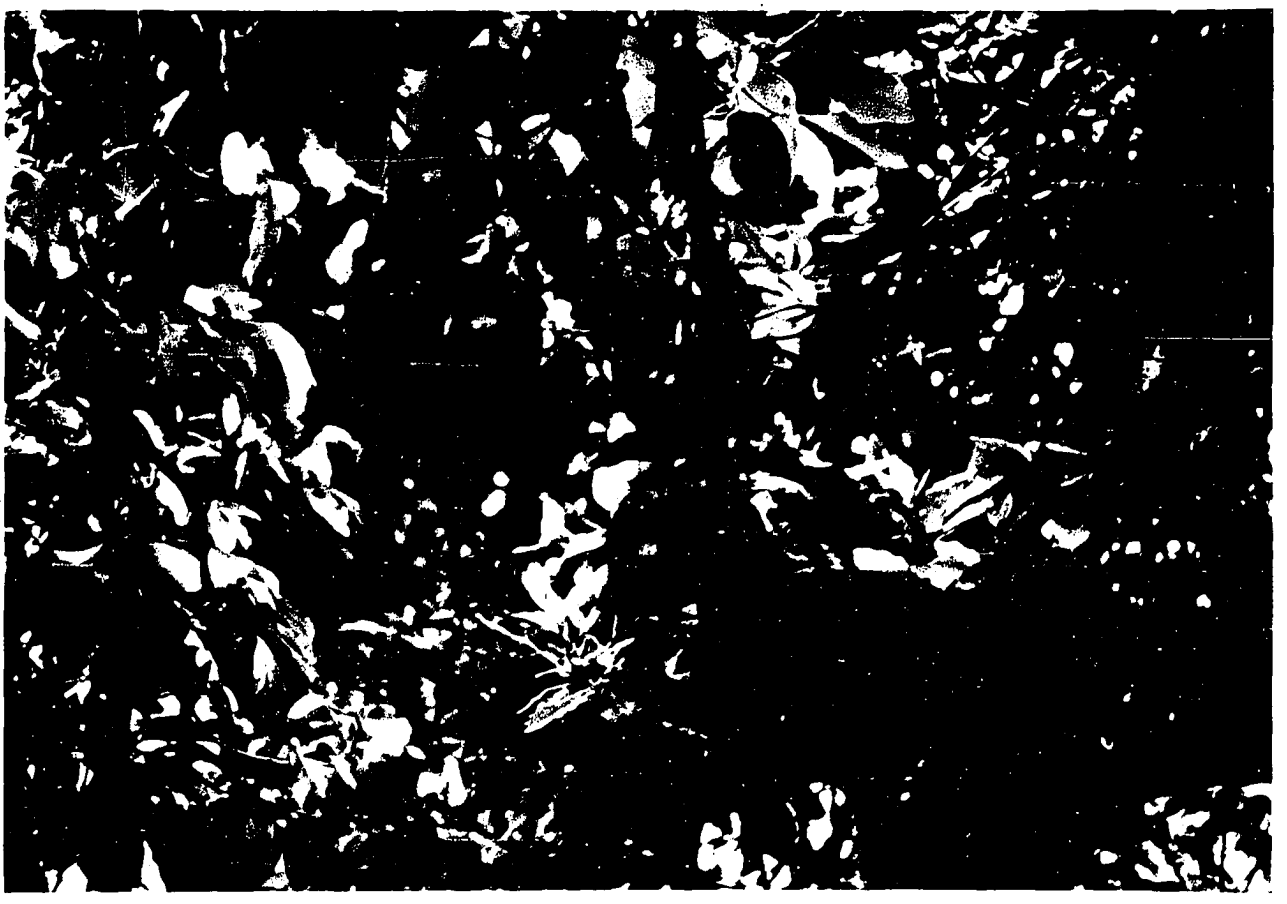

Plate 15--Many orchardists prefer to live and grow avocados as a way of life in addition to the motive of economic gain. It is hypothesized that the perception of the color avocado green may entice many urban or rural dwellers, who are unaccustomed to green vegetation, to live in this attractive setting.

Many grove owners throughout the Mid-Counties are not wealthy enough to utilize grove care services, and most young executives and professionals possess far too little leisure time to maintain the orchards personally. Hence, there are a considerable number of foothill groves which lack proper care. This situation, plus a rapid spread of root rot fungus, has left many ranches and upper-middle class estates with a leafless grove. (Plate 16). Thus, the property becomes less attractive, and the owner awaits a favorable offer for the acreage.

Land speculation is another factor which is characteristic of urbanizing areas. Many orchards along Foothill Boulevard in the San Gabriel Valley, in the Corona-Riverside area, and in the orchards between the La Habra-Tustin area of Orange County are being replaced by housing subdivisions. Most of the current avocado grove owners in these areas are simply waiting for the opportunity to acquire a sizable profit from the land.

The southern portion of Riverside County and Orange County south of Tustin represents the last remaining commercial avocado producing areas. Orange County's urban-agricultural boundary is a sharp line beginning with the 88,000 acre Irvine Ranch. This departmentalized corporation and the juxtaposed San Joaquin Fruit and Investment Company tract contain nearly 200 acres of avocados. In Riverside County commercial acreage is exemplified by the Todd Ranch

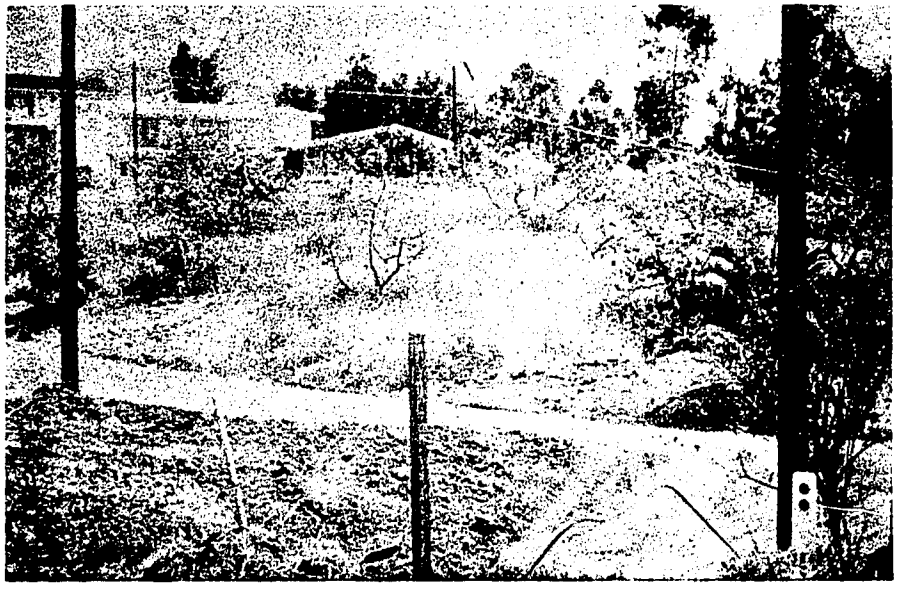

Plate 16--An urban hillside grove in the Santa Ana Canyon area of Orange County which is undergoing defoliation and decline. It is suspected that neglect rather than root rot is the main cause for this degradation of the landscape.

Plate 17--A well developed commercial Bacon avocado orchard in Orange County which displays the characteristics of a former citrus planting such as tilling, furrow irrigation, and a blue gum eucalyptus wind break.

Company in the Temescal Canyon area where the major avocado groves are found.

In contrast to the small part-time farmer groves, the southern sector of the Mid-Counties, with its highly efficient commercial operations, represents a different regional design. The professional growers of these large ranches are interested in the welfare of the industry, because their avocado acreages provides significant returns in proportion to the size of the plots.

Avocados were introduced into the former citrus acreage as a means of crop diversification. The general avocado landscape reflects the attitudes and decisions of the growers and/or agricultural managers. Most avocados were originally interplanted between citrus which was later removed as the avocado trees became productive. Furrow irrigation, with its characteristic irrigation standpots, was often retained. Lack of a cover crop and tillage between rows are still characteristic on the flatlands. Giant blue gum eucalyptus trees, planted many years ago, are retained as windbreaks. Most commercial groves have planted the more locally productive Hass, Bacon, and Zutano varieties, whereas the Fuerte variety is still grown in the urban areas (Plate 17). Imminent urbanization of many of these profitable Mid-County groves will undoubtedly cause an orchard acreage decline, as it has in the noncommercial groves just to the north.

Several of the remaining grove owners have made the decision to retain their property at least temporarily because of the color of the grove and exterior space perception. Much of the avocado landscape in San Diego County is related to the attitudes and desires of former Los Angeles and Orange County residents who have migrated to avocado districts in the northwestern section of the county.

San Diego County, God's Little One To Four Acres

Many farmers in the United States pursue an agricultural occupation because it provides them with a profitable livelihood. Contrary to this situation, most avocado grove owners in San Diego County do not fit the mold. For example, it is estimated that less than one per cent can be labeled as full time farmers. A recent sampling (Table 6) has shown that only five of 345 owners make their entire living from the sale of avocados. A large majority of the orchard owners are retired, absentee, or part time farmers, who depend upon another occupation for primary support.

Observation has revealed a rather unusual group of avocado grove owners in the Fallbrook District. In a single morning, the writer encountered several properties and/or owners which epitomize the avocado ownership in the northwestern area of San Diego County, i.e. a millionaire business executive who owns a small jet airplane; a large incorporated grove owned by several well known movie stars;

a grove manager who takes care of several hundred acres of absentee-owned groves; a grove owned by an absentee veterinarian whose property is managed by his son; a retired grove owner whose fortune was acquired in a Colorado mine venture; and a former Oklahoman with a modest affluency obtained in petroleum dealings.[3] In general, ownership in northern San Diego County is characterized by middle to upper class inhabitants whose annual incomes range from $8,000 to $100,000 or more. Why is such an affluent group of individuals from diverse occupations engaged in growing avocados? The answer appears to be associated with man's environmental preferences and the expense of establishing and producing avocados.

Avocados are not considered a highly profitable crop in spite of the fact that the gross return per unit area surpasses that for all other tree crops. For example, the cost of acquiring potential avocado acreage in northern San Diego, is $3,000 per acre, but most property with an established orchard sells for as much as $7,000 to $10,000 per acre. The cost of establishing a grove (Table 7), including land, trees, equipment, buildings, materials, overhead, and interest exceeds $5,000 per acre in the first year. By the end of the fifth year, when the grove reaches commercially productive levels, the cost increases to $6,636

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[3]Personal interview and tour with Mr. Leslie Oertle, Fallbrook, Independent Milk Distribution, June 21, 1968.

TABLE 7

1968 COSTS TO ESTABLISH A 10-ACRE FUERTE ORCHARD IN SAN DIEGO COUNTY

Cost Factors	Years				
	1	2	3	4	5
Labor and Field Power	367	98	95	102	107
Materials	373	79	77	114	152
Cash Overhead	194	138	137	147	171
Depreciation	136	136	136	136	136
Less Fruit Credit	-	-	-	50	100
Accumulated Total Cost	1,070	1,521	1,966	2,515	3,181
Land @ $3,000 per Acre	3,000	3,000	3,000	3,000	3,000
Irrig. Sys. and Equipment	999	863	727	591	455
Total Accumulated Investment Value at End of Year*	5,069	5,384	5,693	6,106	6,636

*Interest on investment not included.

Source: California Avocado Society Yearbook, 1968, p. 89.

TABLE 8

1968 COSTS TO PRODUCE A 10-ACRE FUERTE AVOCADO CROP IN SAN DIEGO COUNTY

Labor	156
Material, Equipment and Cost Per Acre	236
Overhead Costs	209
Depreciation	371
Total Pre-Harvest Cost	972*

*Interest on Investment ($355.00) not included.

Source: California Avocado Society Yearbook, 1968, p. 91.

per acre.[4] Moreover, the annual cost (1968) to produce the fruit, based on a 10 to 15 year old 10 acre Fuerte orchard, was approximately $972 (Table 8).[5]

An examination of the limited net profit obtainable on a one to four acre plot can be realized by a study of yields per acre, harvest costs, and average returns on avocado fruit per pound. The average annual production of a mature (10 acre) commercial Fuerte orchard is about 8,000 pounds. Picking costs at $.015 to $.03 per pound and a 5 per cent assessment for CAAB are deducted from a mean gross return per acre. Based on an arbitrary fruit price at the packinghouse of 15¢ per pound, it is calculated that the gross return per year would be about $1,200 per acre. Subtracting this total from a preharvest cost of $972, the net return would be $228 per acre per year. Furthermore, an average Fuerte grove does not yield fruit at a profitable level until about the fifth year after planting, although some production may occur earlier. Several highly efficient groves will produce as much as 15,000 to 18,000 pounds per acre annually, whereas others may harvest a crop below the mean for several years. In any case, these examples suffice to point out that small four acre plots are not economically feasible. It can be concluded that few avocado grove owners

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[4] C. D. Gustafson and R. C. Rock, "Cost to Develop an Avocado Orchard in San Diego County," California Avocado Society Yearbook (1968), pp. 87-90.

[5] Ibid., pp. 91-93.

are engaged in its culture primarily for significant profit. Why, then, do Southern Californians become growers, and what is the environmental expression of their activities and decisions?

Most grove owners in northern San Diego County migrated from coastal Los Angeles and Orange County. These former businessmen, bankers, insurance brokers, military officers, advertising executives, along with an occasional orange grove owner, have resided for a large portion of their lives in an urban environment.

Between the period 1961 to 1965 over 5,000 acres had been sold in northern San Diego County, largely in four acre parcels. Approximately 80 per cent of the people who purchased avocado property were all-adult or retired families between 45 and 65 years old. Essentially, the migration was a over-spill from the urbanizing Los Angeles Lowland to San Diego County by an affluent population. These people were attracted by climate (lack of smog and a greater number of sunshine days), access to cultural and business facilities in metropolitan Los Angeles and San Diego, and most importantly, a rural environment near resort and recreation facilities, especially golf courses. Such amenities have had much to do with the location of retirement residences and second homes.[6] Additional reasons for migration to

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[6] Development Potential of Rancho Monserate, San Diego County, op. cit., p. III-22.

outlying areas of San Diego County include the desire of the migrants to escape business pressures, traffic problems and accelerated living pace of the cities.

Several young absentee owners, while retaining Mid-County residences, have purchased avocado acreage in rural areas. Rural San Diego County offers future security, especially for retirement purposes, while land and overhead costs are much less than they will be in future years. Absentee owners either manage the orchard on weekends or utilize grove care services. Many business-minded individuals perceive the avocado landscape as a place to combine rural living with land speculation. Oftentimes, the speculator continues to be involved in other business or general investments while utilizing the meager avocado returns as supplemental income. The avocado returns may pay little if anything but water, labor, and overhead expenses. Many residents and absentee owners, including television executives and movie stars, utilize the grove as a tax shelter.

Money otherwise destined for tax payments may be used to acquire mature avocado and citrus acreage in areas where land appreciation is above average. In most cases, the acreage is held for a period of five to eight years in order to obtain maximum tax benefits. Subsequently, the grove is sold for residential or industrial development at

a considerable profit.[7] A simpler and less profitable version of this procedure often takes place in northern San Diego County. Here a grove, acquired several years ago, may be sold at a profit, but the property, instead of being transformed to an urban status, retains its orchard function.

The retired grove owner, like most other orchard owner types, perceives the Fallbrook-Pauma Valley-Valley Center-Vista-Escondido area as a place to acquire more personal space, "a place of country living, peace, and quiet." Because of this attitude, the owner is willing to purchase rural property at $3,000 to $10,000 per acre. Such a price for land is not considered as being exceedingly expensive, because several of the Los Angeles Lowland migrants have received $50,000 to $250,000 or more for their property.

In an effort to acquire rural personal territory, or the sense of land ownership and isolation from neighbors, the new owner constructs a personal barrier. The grove owner builds a $30,000 to $100,000 home, often with a swimming pool, on a small hill. Avocados are planted on the slopes of the hill to create a man-made green milieu which precludes a direct view from or contact with other property owners (Plate 18). The result is complete rural privacy, or personal territory in an area which may contain 17,000 widely

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[7]Donald F. Billhardt and Charles E. Juran, Citrus Tax Shelter Investors Handbook (Redlands, California: Southland Research, 1967), pp. 1-4.

Plate 18--An aerial view of a Fallbrook hillside landscape. The upper middle class homes, nearly surrounded by avocado trees, suggests an effort by the owners to acquire rural personal space (north is to the right).

Plate 19--A group of 100 or more enthusiastic 40 65 year old growers attending the "Olive Tree Amphitheater" avocado school in Fallbrook, California. The farm advisor in the left center lectures several times each year on general growing practices.

disseminated inhabitants with community services only a few minutes away.

Many families reside in northern San Diego County because avocado growing is a leisurely activity. The labor required to plant and tend a grove, to harvest it, and to manage a 10 acre orchard is not beyond the capabilities of an individual family. Because avocados mature, but are not edible directly from the tree, selective picking of Hass and Fuerte varieties can be carried on for as long as two to four months. Some part time, retired, or absentee owners have reduced labor requirements by installing an automatic irrigation system. Although initially expensive, it nearly eliminates labor output by a series of preset clocks which activate the water distribution and sprinkler system according to the needs of particular sections of the grove.[8]

A few property owners envision avocado growing as an occupation which combines exercise and a feeling of accomplishment, while still allowing sufficient time for recreation and community service activities. Another owner may grow the fruit on a commercial basis as a challenge. There might be some question as to how middle-aged farmers manage to produce even 50 million pounds of fruit annually on a predominance of one to four acre ranchettes in San Diego County.

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[8]G. L. Wolfin, "Some History of Earlier Automated Irrigation," California Avocado Society Yearbook (1968), pp. 55-58.

Out of this group of seemingly diverse San Diego County inhabitants there are underlying similarities. Most of the men and women have acquired a business sense as a result of previous employment. Unlike many farmers, avocado growers realize the need for education, and a sizeable percentage of them have obtained a college degree. One of the most enlightening experiences is to observe C. D. Gustafson's open air classrooms at the "Olive Tree Amphitheater" on the Von Norman Ranch in Fallbrook, California (Plate 19). Fifty to 100 growers, mostly over 50 years of age, can be seen sitting on wooden field boxes absorbing every word of a lecture with great enthusiasm. Such a school not only dispenses technical information but provides an opportunity for communication among growers and handlers. The most aggressive farmers, and those who are receptive to the best horticultural procedures available, are able to obtain high avocado yields with limited labor expenditures.

Northern San Diego County is characterized by rather inexperienced growers, who, despite some group interaction, are quite independent in spirit. This is best portrayed by describing the function of an organization known as the Avocado Growers' Council, formed in May, 1968, in Fallbrook.[9] The Avocado Growers' Council is composed of a group of farmers who are dissatisfied with the current fruit price

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[9]The Fallbrook Enterprise, June 13, 1968, p. B7.

per pound. The Council's purpose is to change avocado price decision making from an agreement between brokers and packers (based on the concepts of supply and demand) to prices agreed on by local growers. It is the Council's feeling that the concept of demand should not determine avocado prices. Growers intend to influence fruit prices by withholding avocados from the market until the price of fruit reaches $0.25 per pound or more. The council reflects the need for better grower returns. There is, however, a possibility of causing industry fragmentation because of the negative attitude toward this group by residents of other regions and districts. At this time it is too early to determine the effect of this organization on fruit prices and the dissension which could be created by it within the entire industry.

In conclusion, the San Diego Avocado Region is characterized by small well-developed groves with various systems and techniques for easy maintenance. The enthusiastic (mostly) part time, retired, and absentee owners prefer the leisurely rural milieu of rolling foothills covered with green Fuerte and Hass groves. They make use of well organized grove care services and share a desire to speculate in avocado acreage. The growers are mostly middle-aged adults who prefer the excellent recreational and climatic amenities. This business-oriented group could affect the future of the industry in the immediate periphery of Fallbrook by their intrinsic interest in land promotion and speculation. Most

grove areas under decline due to root rot or lack of proper care are giving way to housing construction which does not help maintain the green rural landscape. It appears that most land owners are more concerned with the day to day function of the industry, than with its long-term future growth pattern.[10] San Diego County farmers are serviced by a variety of independent packing houses including Calbrook, Foster, McDaniels, Pacificado, and Del Ray which compete with Calavo. The influence of Calavo in San Diego, in comparison with the other two regions, has been reduced mainly due to the independent spirit of the southern county avocado growers. This attitude is in direct contrast to that of the North Counties.

North Counties, a Professional Farmer Element

Growers in Santa Barbara and Ventura counties are quite homogeneous in attitude toward their avocado environment. As a result, these counties represent nearly the antithesis of the regional personality characteristics of San Diego County.

A survey of ownership in Ventura County indicates that 252 out of a total of 385 growers are full time farmers (Table 6). In contrast to the Mid-Counties and San Diego County, there are more corporation-type land holdings,

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[10]Joseph H. Engbeck, Jr., "The Vanishing Avocado," Cry California (Winter 1966-1967), pp. 10-11.

typified by the Limoneria Ranch and Rancho Sespe, with highly professional agricultural production programs. However, the average grower is less affluent than his counterparts in the south where enterprises other than agriculture are undertaken with equal vigor. Almost none of the grove owners are entirely dependent on an avocado income. Their monetary support often comes from large lemon acreage or secondary investments in stocks, bonds, and private enterprise. Therefore, while several growers in the other two regions are millionaires, few orchard owners of any type exceed $100,000 in annual income. What are the differences between the North Counties, exemplified by Ventura County, and San Diego County in both grove establishment and long term avocado production costs?

The costs of establishing a grove in Ventura County as well as the expense of producing avocados is lower than in San Diego County (Table 9). Ventura County's total investment at the end of five years is $6,451 per acre in contrast to $6,634 for San Diego. Furthermore, the total 1968 preharvest cost of producing avocados in Ventura County was $688 versus $972 in San Diego County (Table 10). The reduction in North County regional expenses is directly related to the larger and more consolidated orchards in which avocados augment lemons or other citrus acreage. The larger mean grove size leads to more efficiency in all facets of crop growing, because the available equipment and material can be

TABLE 9

1968 COST OF ESTABLISHING A 10-ACRE HASS AVOCADO GROVE IN VENTURA COUNTY

Cost Factors	Years				
	1	2	3	4	5
Labor and Field Power	177	78	67	62	60
Materials	400	84	95	100	101
Cash Overhead	174	132	132	132	132
Depreciation	124	124	124	124	124
Less Fruit Credit	-	-	-	150	300
Accumulated Total Cost	875	1,293	1,711	2,279	2,996
Land @ $3,000 per Acre	3,000	3,000	3,000	3,000	3,000
Irrig. Sys. and Equipment	951	827	702	579	455
Total Investment Value at End of Year*	4,826	5,413	5,858	6,858	6,451

*Interest on investment not included.

Source: California Avocado Society Yearbook, 1968, p. 83.

TABLE 10

1968 COSTS TO PRODUCE A 10-ACRE HASS AVOCADO CROP IN VENTURA COUNTY

Labor	112.00
Material, Equipment and Cost Per Acre	95.00
Overhead Costs	166.00
Depreciation	315.00
Total Pre-Harvest Cost	688.00*

*Interest on Investment ($355.00) not Included.

Source: California Avocado Society Yearbook, 1968, p. 85.

utilized for several activities in addition to avocado cultivation.

The lesser cost of establishing a grove and producing avocados in Ventura County is an indication of farmer characteristics and the general attitude of growers toward the agricultural environment. The majority of grove owners are longstanding professional farmers whose operation has been handed down through several generations. Whereas San Diego orchard owners have a diversity of interests, the North County growers are more specialized in their attitudes and needs to farming activities. The avocado grove design is directly related to previous farming activities in the district. Most avocado groves were interplanted with lemons when citrus prices began to decline. Therefore, North County avocado groves retained many characteristics of the former citrus grove such as: the retention of some overhead sprinkler and furrow irrigation systems (Plate 20); the employment of the dragline irrigation system; some experimentation with mechanical harvesting equipment for flat land harvesting; the utilization of more aerial application of fertilizer than in San Diego County; the use of eucalyptus and Bacon avocado variety wind breaks; and the retention of the old terrace system as well as lack of a cover crop (Plate 21). The professional farmer attitude is further exemplified by Santa Barbara and Ventura County growers who prepare their own avocado land. In contrast, San Diego

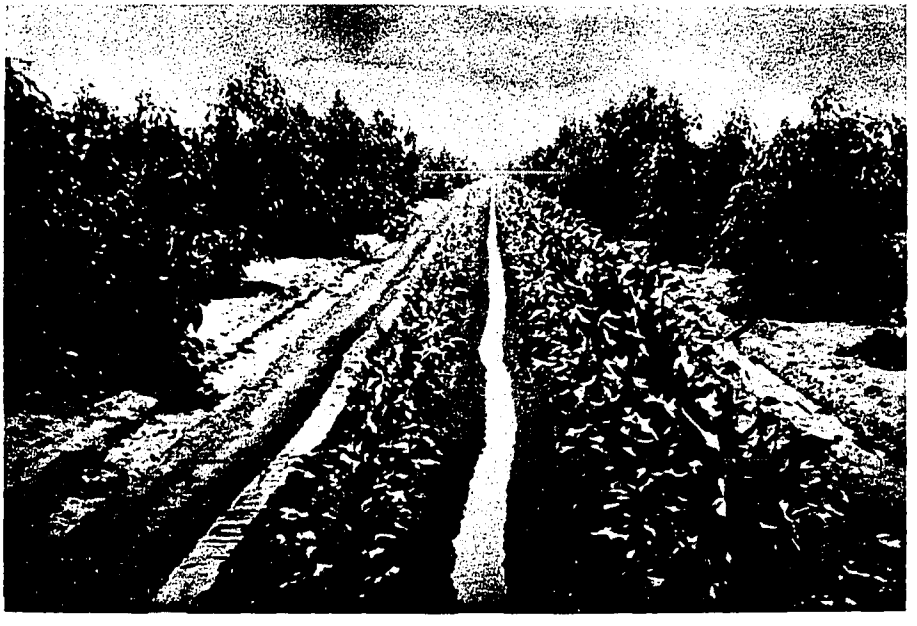

Plate 20--An intercropping pattern of corn and young Hass trees irrigated by the furrow system in Carpinteria, California.

Plate 21--A hillside avocado grove located in Goleta, California, which shows a young planting on an old terraced slope. The view looks southeast toward urbanizing Santa Barbara, California.

County growers employ land clearing and irrigation specialists to establish the grove. Farm advisers are equally as professional as their associates in San Diego County and perform similar educational functions.

The Camarillo District in Ventura County and several districts of Santa Barbara, such as Montecito, resemble the smaller acreage plots of northern San Diego. Camarillo, for example, is composed of ranchettes, about 2 acres in size, which are quite susceptible to urbanization. An element of land speculation among retired individuals with land-use attitudes similar to those of San Diego County is presumed to exist among the local inhabitants. On the other hand, Santa Barbara is one of two counties which has utilized the Land Conservation Act. Therefore, North County grower's prefer to retain agricultural land as long as possible.

Many differences in regional personality have been enumerated between the north and south regions, but perhaps two examples best portray the diversity of values and farmer philosophy. The Root Rot Committee, established to accelerate the process of solving the root rot fungus problem, is composed of avocado leaders from San Diego County. North County grove owners look upon the committee as an organization which has taken things into its own hands. It appears to be a matter of disagreement over the proper approach to getting a project accomplished. The aggressive southern group wants to find a solution at any cost, whereas

the northern faction feels that the committee should have channeled its efforts through the Avocado Society. Both groups have a common purpose, which is to find answers to the root rot situation, yet neither can communicate due to differences of grower attitude.

Feelings concerning the adoption of a prorate marketing system is another example of north-south psychological group differences. Since early in 1969, several of the North County avocado leaders have been promoting the establishment of a volume shipment control system for summer varieties. It is felt that current cooperative and independent systems of marketing fruit have not functioned to the best interest of the grower and the industry. There is no industry-wide orderly system to dispose of the fruit based on the amount of crop at hand, so that the best price can be obtained throughout the entire season. Many growers attempt to market their fruit during the high demand periods when the monthly shipment pools are at their peak. A prorate system would regulate the flow of fruit to the market throughout the harvest period. This would prevent handlers from flooding the market with fruit during the high price period, a practice which results in more supply than demand, and causes a price reduction. A prorating system has been debated for several years in the industry, but the younger less experienced growers in San Diego County have not reacted favorably to the plan. Thus, in 1969, the North

County growers put forth a prorate system for summer varieties predominantly grown in the north.

The reason for a regional dichotomy over the prorate system is largely due to attitude differences. Most northern growers are seasoned farmers with sizeable citrus production which has been successfully marketed by a prorate program for many years. The highly integrated farmers in the north, realizing the value of grower cooperation, contrasts sharply with the attitudes of less farmer-oriented San Diego growers. In addition, it is suggested that San Diego growers are too independent to be structured by a rigid set of marketing rules which would give them less personal freedom of choice.

In summary, it appears that although the avocado industry is well integrated, there are three distinct regional personalities, as defined by the behavior of the growers within the districts. The values, needs, and preferences of the urbanizing Mid-Counties contrasts with the diverse and individualistic south county, and the stable well organized conservative farmer attitude of the North Counties.

The future is not, however, as attractive as a preliminary analysis might suggest. As with most things, there are many variables which can direct the industry in a negative path. From a human viewpoint, there are personal dislikes and jealousies between handlers. Many growers distrust Calavo because of its aloofness at the administrator level

and its inability to communicate effectively with avocado owners in general. In San Diego County, the initiation of the Avocado Growers' Council represents a grower dissatisfaction with fruit prices per pound at the packing house. In addition, there is an air of disillusionment toward university researchers who have failed to uncover the answer to the root rot fungus problem in the past 25 years. If the avocado industry fails to overcome such problems as root rot, urbanization of avocado acreage, and labor problems, the last remaining stronghold of avocados in the United States is seriously threatened.

CHAPTER VIII

FACTORS CONTRIBUTING TO THE POTENTIAL DISINTEGRATION OF THE CALIFORNIA AVOCADO INDUSTRY

The coordination influences and the regional personalities within the California avocado industry have provided unity to some degree between the avocado districts. As in most primary agricultural industries, there are several physical and economic factors which growers must overcome. The forces which could combine to effectively result in a disintegrating influence include labor shortage, root rot acreage infection, and urban encroachment. Other variables including natural hazards, pests, and floral diseases are minor in comparison. The overriding problem, then, is whether the many physical and cultural factors within the avocado environment will permit the industry to continue as a highly productive agricultural business in the future.

Labor Problems

Unlike in most orchard crops, the labor demand in raising avocados is somewhat minimal due to small land holdings, a long harvesting period, limited care needed, and the

small number of people employed in marketing. Nonetheless, a mature orchard requires approximately 50 hours per acre per year for irrigation, fertilizing, pruning, and weed control. An additional 65 man-hours are required during harvesting for a crop of 4.5 tons per acre.[1]

The termination of Public Law 78, providing for the "bracero" program, on December 31, 1964, did, however, have a limited effect upon individual producers and packing plants, especially owners of groves of 10 acres or more. The main reason for the elimination of the program was to provide more employment at higher wages for the unemployed domestic United States farm population. In general, braceros, seasonal contract laborers from Mexico recruited by the federal government, were employed mostly in the southwestern United States for about six months per year. In the avocado areas, Mexican workers attained wages of $50 to $60 per week and lived in a barracks usually equipped with a small chapel.[2] Unfortunately, most domestic laborers would not work as diligently as the Mexicans, and many of them were urban dwellers who would not accustom themselves to strenuous rural farm work. Moreover, many were alcoholics, derelicts, or otherwise physically unfit for rigorous picking tasks.

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[1]G. E. Goodall, "Planting Avocados: A Check List," The California Citrograph (February, 1966), p. 168.

[2]Personal interview with William McDaniel, Packing Plant Owner and Operator, June 10, 1968.

Large-scale field crop farming in the Southwest remedied part of its labor deficiency by mechanization and consolidation of farm units.[3] The avocado industry underwent slightly different adjustments. Unlike in large-scale agriculture, expansion of farming units in the avocado industry is impractical due to the limited suitable agricultural land adjacent to the groves and the exceedingly high land values. Harvesting machines, utilized to a very limited extent on the lowlands of Santa Barbara County, are not feasible on the rolling avocado topography. Furthermore, most of the small grove owners can manage their acreage without additional labor except during the harvest period. Severe competition to acquire qualified laborers during harvest time and a slight rise in the price of fruit were the most obvious effects of reduced labor due to the ineffectiveness of the domestic laborer and the restrictions on alien sources.[4]

Since the demise of the bracero program, the cost of avocado labor has risen slightly, from $.90 per hour in the late 1950's to a minimum of $1.40 per hour as required by federal law. However, most California farm laborers receive a minimum of $1.65 per hour, and the average is probably in

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[3]W. E. Martin, "Alien Workers in United States Agriculture: Impacts on Production," Journal of Farm Economics, 48 No. 5 (December, 1966), pp. 1137-1145.

[4]Personal interview with O. Atkins, Nursery Owner and Operator in Fallbrook, California, June 18, 1968.

the vicinity of $2.25.[5] A result of the labor shortage has been an increase of permanent resident Mexican aliens or "greencard" workers. Green card holders, mostly ex-braceros, are permitted to enter the United States under the Immigration and Naturalization Act (Public Law 414), if they have a skill which is in demand, or if they have a valid offer of approved employment.[6] The green card holder obtains much greater pay as well as personal freedom under the work permit system.[7]

In the past few years, the avocado labor problem has become continually more acute. Most growers and packing house field representatives concur that the Mexican green carders are generally good workers. However, the Mexican alien's concept of work as a day-to-day rather than a yearly function gives rise to a good deal of transiency. Picking crew foremen, employed by packing houses, often find it difficult to acquire a full crew of pickers. Once the worker feels that a sufficient amount of money has been earned he returns to Mexico.

A few illegal immigrants are still employed in the avocado industry. When they are available, these alien laborers perform their assigned tasks diligently in order to retain employment. In 1969, however, immigration

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[5] Calavo Newsletter, February 1, 1968.

[6] Agricultural Potential of San Diego County (San Diego: Forbes Stevenson and Company, 1966), p. 44.

[7] W. E. Martin, op. cit., pp. 142-143.

authorities closely scrutinized picking crews, and the word to this effect has been disseminated in Mexico. Thus, most potential illegal aliens are remaining in Mexico or are working in the more profitable strawberry fields where a greater monetary return is available in less time.

Moreover, several of the aliens have turned to semi-skilled employment in the large metropolitan districts of Los Angeles and San Diego where hourly wages greatly exceed those obtainable in agricultural employment. Furthermore, there are efforts at the state and federal levels to restrict greencard agricultural laborers. If the greencard system is eliminated, a severe strain will be placed upon the avocado grove owners and handlers. The lack of available dependable labor, and the large number of part time, retired, and absentee owners, has resulted in a general trend toward grove care and management services performed mostly by packing houses.[8]

Root Rot Problem

Phytophora cinnamomi is by far the most serious disease and probably the most important problem confronting the avocado industry. Over 5,000 acres[9] of avocados have

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[8]Personal interview with J. Shepherd, Calavo Public Relations Officer, July 17, 1968.

[9]Avocado Root Rot Survey conducted by Robert G. Platt, Agricultural Extension Service Subtropical Horticulturist at University of California at Riverside, December 1, 1968.

been affected to some extent by the soil-borne fungus, and the condition continues to grow worse each year.

The fungus was initially reported in 1929 on the island of Puerto Rico, and the first knowledge of the disease in California was in 1942. Growers, however, had suspected the existence of root rot several years earlier. As a result of extensive studies carried on by Dr. George A. Zentmyer and others, the root rot fungus has been isolated in every country with significant avocado acreage except Israel.[10] Phytophora cinnamomi attacks 207 varieties of plants in addition to Persea americana. Included among these plants are coniferous trees, evergreen and deciduous broad-leaved trees, and numerous perennials and annuals. Plate 22 displays the destructive potential of root rot in the Fallbrook District and its economic impact.[11]

Since 1950 most growers have expressed concern over the root rot hazard. However, since that time little more than $20,000 has been funded through the California Avocado Society for root rot research. Most research activities have been conducted at the University of California at Riverside.[12] Since 1957, more than 50 papers have been published

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[10]G. A. Zentmyer and W. A. Thorn, "Hosts of Phytophora Cinnamomi," California Avocado Society Fallbrook (1967), p. 177.

[11]Ibid., pp. 178-186.

[12]F. S. Shepherd, "Report of the President," California Avocado Society Yearbook (1968), pp. 12-13.

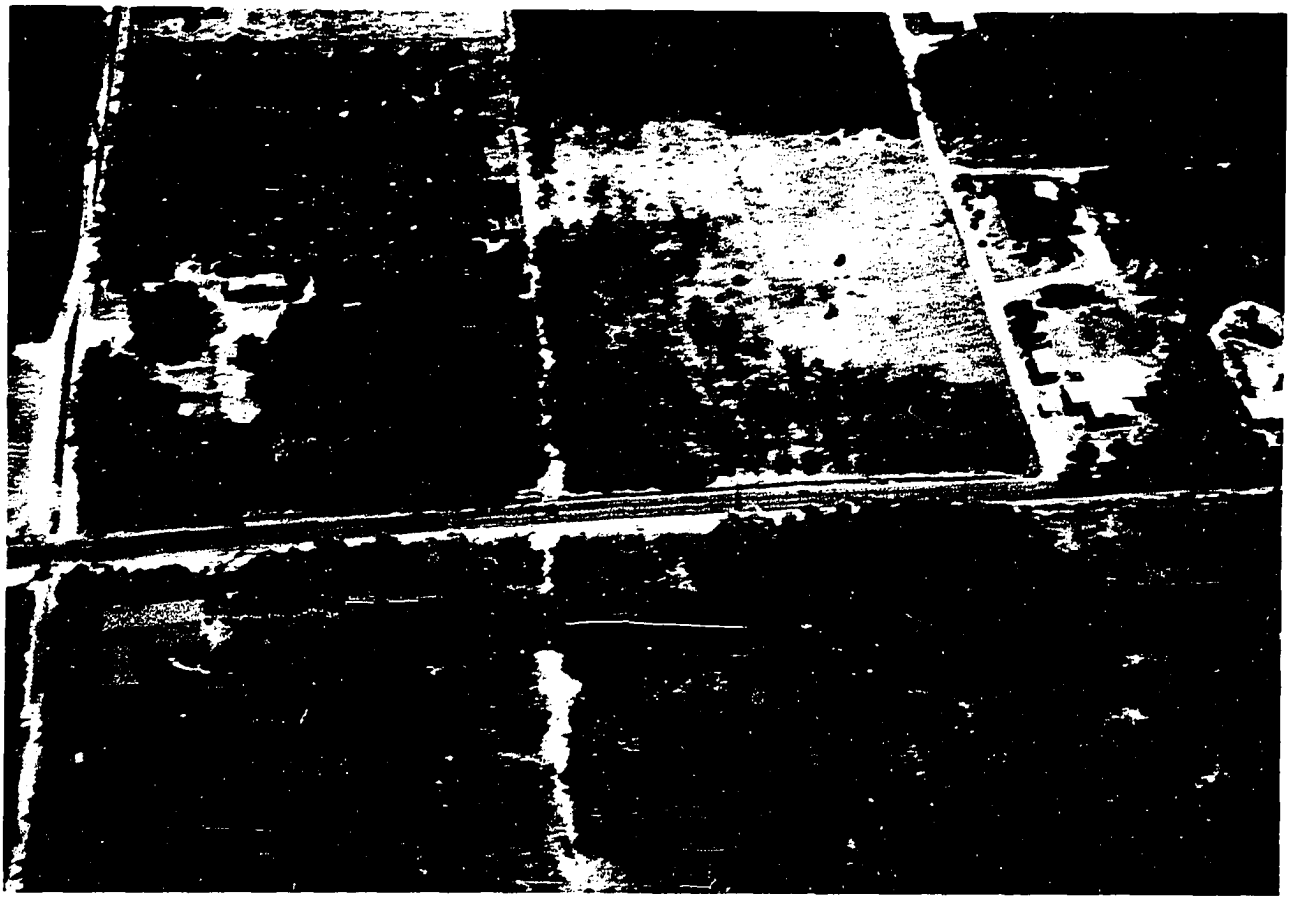

Plate 22--This color infrared aerial photograph displays the destructive power of root rot fungus in the Fallbrook Avocado District. The bright red color indicates healthy avocado trees, whereas the green tinted trees lack enough chlorophyll in the dying leaves to reflect a red color.

in the California Avocado Society Yearbook on various phases of the research mostly by agricultural extension employees. The diversity of the investigation is exemplified by publications on soil conditions, seed studies, resistant rootstocks, and the areal distribution of root rot within the major producing counties. Despite these research undertakings, the findings are discouraging. One of the reasons for the doubling of Avocado Society dues in 1969 was the need for additional funds with which to increase research activities.

In the spring of 1968, the situation seemed so serious that an Avocado Root Rot Committee was formed in San Diego County. The organization is composed of 10 growers, two packer representatives and three ex-officio members of the University of California including Dr. Zentmyer. As a result of their efforts, a monetary reward of $50,000 was advertised in an effort to stimulate intensive research efforts by private individuals and research firms. More specifically, $25,000 has been pledged for a short-term chemical control, and a similar amount of money has been put forth for a long term solution which would require the development of a resistant root stock.[13] In general, the Root Rot Committee has the dual purpose of stimulating further research and of educating growers and packers as to the proper grove care to protect against the disease.

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[13]Personal interview with C. D. Gustafson, San Diego County Farm Adviser, June 9, 1968.

One of the initial projects of the Avocado Root Rot Committee was the initiation of an extensive root rot survey under the direction of agricultural extension horticulturist, Robert Platt (Table 11). A questionnaire was distributed to 5,290 grove owners in all South Coast avocado areas, plus Tulare and Fresno counties. Twenty-eight per cent of the cards were returned, representing growers who control a total of 49 per cent of the state avocado acreage. From the survey cards returned, it was concluded that approximately 5,124 acres have some root rot. San Diego led the county acreage infested by root rot, with 3,561 acres, whereas Santa Barbara, Ventura, and Orange Counties followed closely behind in terms of relative acreage. The Root Rot Committee hopes that results of this survey will stimulate new grower interest and help promote the idea that there is enough demand for chemical controls to warrant considerable research by private industry.[14]

Over the past two decades information has been published on the symptoms, spread, prevention, and control of the fungus. Phytophora cinnamomi infestation is evidenced by small leaves with a yellow green color, wilted leaf appearance and blackened feeder roots. The non-indigenous soil fungus may contaminate the grove in several ways, i.e. by the introduction of infected host plants and avocado

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[14]Root Rot Committee Meeting, Pala Mesa Club House, June 28, 1968.

TABLE 11

AVOCADO ROOT ROT SURVEY

	COUNTIES								
	San Diego	Orange	Los Angeles	Riverside	San Bernadino	Ventura	Santa Barbara	Tulare Fresno	Total
Number of Orchards Reporting	875	100	83	12	8	138	188	12	1,423
Total Acreage With Some Root Rot	3,561	306	154	20	0	378	682	6	5,124
Number of Trees Known to be Infected	17,202	2,559	4,257	42	0	786	6,065	41	30,993
Known Infected Trees Converted To Acres*	287	43	71	0.7	0	13	101	0.7	516
Number Trees Suspected of Infestation	9,892	2,264	1,544	91	0	1,963	2,195	0	17,989
Suspected Infected Trees Converted To Acres*	165	38	26	1.5	0	33	37	0	300

*Acreage Based on 60 Trees to the Acre.

49 percent of state acreage represented in this survey

Source: R. C. Platt, University of California Extension Horticulturist in Association with the San Diego County Avocado Root Rot Committee, 1968.

nursery stock; through the horizontal movement of infected water in the soil; or by the exterior transportation of moist contaminated soil via equipment, man, or animals.

Preventive measures include planting avocado trees on well drained soils, the use of disease-free nursery stock, and eliminating fungus dissemination from one grove to another. Control of already established Phytophora root rot is accomplished in the following ways, i.e. carefully irrigating infected areas; fumigating small isolated site;[15] constructing a physical barrier such as a ditch and/or a chemical fumigant barrier to prevent fungus spreading via runoff;[16] utilizing a resistant root stock such as Duke No. 6; using an organic soil fungicide such as Dexon, which does not affect the growth of the tree; and replanting infested root rot sites with nonhost plants such as citrus, cherimoya, persimmon, or macadamia.[17]

All of the above methods are currently employed in Southern California, but unfortunately, none has proven successful when used over a period of years. The Duke No. 6 rootstock offers minor resistance, but its performance is

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[15]G. A. Zentmyer, et al., Avocado Diseases, Circular 534 (Riverside: University of California Agricultural Extension Service, 1965), pp. 4-5.

[16]Personal interview with Randolph Matson, San Diego County Commercial Barrier Control Agent, June 19, 1968.

[17]Report of the Avocado Research Advisory Committee, Citrus Experimental Station, University of California Riverside, April 13, 1957.

hardly satisfactory for the entire industry. Dexon has had some success when the disease has been isolated at a very early stage, but its value after heavy infestation is minimal. In fact, Dexon trial plantings in Santa Barbara County have been discontinued.[18] The expensive combinations of physical and chemical barriers have been able to prevent downslope fungus spreading for several years, but eventually it is found beyond the barriers.

No prevention or control techniques have been effective to a degree that is satisfactory to the avocado industry. The root rot hazard is magnified by the fact that Dr. Zentmyer, and his University colleagues at Riverside, have researched the subject for 27 years without finding a satisfactory solution to the problem. Even though some avocado districts seem to be more severely affected than others, the root rot fungus is well disseminated throughout the entire South Coast Region. Unless a resistant rootstock is found, or a phenomenal chemical cure is discovered, the future of the industry appears to be dismal.

Impact of Urbanization on the Avocado Industry

Competition does not seem to be a significant factor affecting the avocado industry, and West Coast growers will not readily admit to urbanization problems. However, a

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[18]Personal interview with George Goodall, Santa Barbara County Farm Adviser, June 5, 1969.

closer examination of the industry reveals a possible future trend which contradicts most present-day opinions. It is assumed that Southern California's population increase will be perpetuated by diversification of employment opportunities. But what are the assessible elements which should help provide significant insights into the future of the avocado industry?[19]

Some of the most important answers can be extracted from the concepts of urbanization. Southern California's rapid growth rate began in the early 1940's when an economic impetus was provided by military, defense, and eventually aerospace and service industries. In-migration and natural birth increases were most evident in the Los Angeles Lowland. Thus, Los Angeles became a nodal center for government, cultural, financial, transportation, business, retailing, and distribution functions.

By 1950, the general affluence had given rise to a new middle class element. These people desired to live in single-family dwellings being constructed on the relatively unoccupied, yet agriculturally developed, coastal plain. In every direction, newly completed transportation arteries provided a means of physical communication to diverse employment centers. The result, in addition to in-migration

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[19]William S. Kerr III, "A Qualitative-Quantitative Synthetic Projection of Spatial Patterns in Southern California's Avocado Industry," to be published in the Professional Geographer in 1970 or 1971.

from out of state areas, was an expanding population perimeter of concentric circular design from Los Angeles County toward the north, east, and south.[20] For example, the seven South Coast counties contained about 2.9 million people in 1930, but by 1960, the area totaled nearly 9 million, and it is expected to triple by 1990 (Table 12).[21] Thus, population increase has played an important role in avocado acreage fluctuations during the past decade when urban sprawl reached the foothills where the fruit is grown. There are several ramifications associated with urban expansion which affect agricultural development.

TABLE 12

POPULATION TREND IN THE SEVEN SOUTH COAST COUNTIES, 1930-1990

Population	Year	Population	Year	Population	Year
2,872,000	1930	5,558,000	1950	12,500,000	1970
3,613,000	1940	8,954,000	1960	19,900,000	1990

Source: 1985 Preliminary General Plan Report (Ventura County Planning Commission, 1962), 23; Population and Land Use Relationships, Regional General Plan, San Diego County 1990 (San Diego: County Planning Agency, 1968), 3.

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[20] Employment Projections Regional General Plan, San Diego County 1990 (San Diego: County Planning Agency, 1968), pp. 6-7.

[21] 1985 Preliminary General Plan Report, Ventura County Planning Commission (Los Angeles: Welsey, Ham, and Blair, 1962), p. 1.

As urban areas expanded, county administrators found it necessary to increase property taxes in an effort to support the demand for additional urban services. Agricultural property values on the urban periphery rose to as much as $25,000 per acre for some industrial acreage. In addition, farm labor wages were increased in an attempt to compete with industrial pay scales. What are the underlying reasons why avocado grove owners are forced to dispose of their property under the pressure of urban growth?

Most farmers, who may eventually sell grove property for urban use, justify the retention of their property on a net income from the grove which is commensurate with its market value. Almost all land adjacent to urban areas is assessed by the county tax agent at the urban value of the land. The magnitude of this value depends on the type of the juxtaposed urban property, the intensity of the development, and the urban demand. An avocado grove owner whose property has acquired an increased evaluation must obtain a greater annual return per unit area to correspond with the increased worth of the land. In order to facilitate this return it is necessary to increase crop quality, yields, and net return while reducing operating expenses.

The general increase in cost of water, buildings, equipment, cultivation, irrigation, supplies, and labor has not given rise to healthy agribusiness conditions. The result has been an increase in cost of growing avocados at

the same time that land values have risen. A shift to higher valued crops is one alternative, but this is impractical because the avocado is the highest valued subtropical fruit in Southern California. In addition, the topography is not conducive to the development of intensive truck farming. If the annual avocado income does not exceed the long-term monetary return available by selling the grove, it becomes more economically feasible to dispose of the property rather than compete with urban encroachment.[22]

A special type of urbanization, known as "leapfrog subdivision," or piece meal urbanization, can seriously affect agricultural land values. Leapfrogging is a technique practiced by land developers who wish to establish large housing tracts in agricultural areas sufficiently distant from the urban fringe where land is more expensive. Once the tract is developed the value of the surrounding agricultural land increases sharply due to the assessment of the land according to its saleable urban value (ad valorem tax structure). Several poorly located urban developments of this nature can render a large agricultural area economically untenable.[23] By considering the degree to which urbanization has affected the avocado, it is

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[22] Agricultural Potential of San Diego County (San Diego: Economic Research Bureau, June, 1966), pp. 34-35.

[23] Agriculture, Regional General Plan, San Diego County 1990 (San Diego: County Planning Agency, 1968), pp. 11-12.

possible to subdivide the coastal zone into middle, north, and south county regions.

The Mid-Counties, An Advanced Stage of Avocado Decline

Much of the South Coast's future avocado spatial pattern can probably be related to the historic and present conditions in the Mid-Counties. Los Angeles County's population, which increased over 3 million people between 1940 and 1960 is a prime example of the increase of urban land at the expense of agricultural acreage. By the time its population increases to 9.5 million in 1990, the State Department of Water Resources, Southern District, indicates that no significant irrigation acreage will exist.[24]

Avocado acreage follows a somewhat similar pattern to general irrigation agriculture in Los Angeles County. The total avocado crop in Los Angeles reached a peak of 3,458 acres in 1945. Since that time it has declined rather rapidly due to urban encroachment. In the five years following World War II, there was a mean reduction of 500 avocado acres per year, and the decrease continued in the 1950's at a reduced rate after the major avocado districts had diminished strikingly (Table 12). The inner margin of the Los Angeles Lowlands became thickly settled during the 1960's. As a result remaining hillside plantings along the

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[24] Historic, Present, and Projected Land Use in the South Coastal Area (Los Angeles: State Department of Water Resources, Southern District, 1968), pp. 3-4.

TABLE 13

HISTORIC RELATIONSHIP BETWEEN POPULATION AND TOTAL AVOCADO ACREAGE IN SEVEN SOUTH COAST COUNTIES

	1945*	1950	1960	1965[1]
Midcounties				
Los Angeles				
Population	3,000,000	4,151,687	6,038,771	6,878,200
Acreage	3,456	2,924	2,610	2,010
Orange				
Population	170,000	216,224	703,925	1,157,900
Acreage	2,195	2,478	2,842	1,424
Riverside				
Population	137,000	170,046	306,191	415,400
Acreage	76	234	511	427
San Bernadino				
Population	221,000	281,642	503,591	637,500
Acreage	67	71	179	120
North Counties				
Ventura				
Population	92,000	114,647	199,138	302,900
Acreage	507	1,179	2,927	2,720
Santa Barbara				
Population	84,000	1,000	1,646	2,281
South				
San Diego				
Population	422,000	556,802	1,033,011	1,200,800
Acreage	9,535	12,561	13,616	11,981

Acreage Includes Both Bearing and Nonbearing.

*Estimated population.

[1]Acreage adjusted to complete tree census in 1965.

Source: The Growth and Economic Stature of Riverside and San Bernadino Counties (Los Angeles: Economic Research Division Security First National Bank, 1966), pp. 46-47 R. C. Rock and R. G. Platt, Economic Aspects of Marketing California Avocados (Riverside: University of California, Agriculture Extension Service, 1968), p. 12.

Santa Monica and San Gabriel foothills began a process of rural lot split or subdivision. Decline due to population pressure, therefore, was clearly evident on the last remaining rural land.

The trend of nonbearing acreage is one of the best early indicators of an avocado region's growth rate because it is indicative of the new plantings which are taking place. For example, Los Angeles County's nonbearing acreage has declined from 409 in 1950 to 20 in 1968, indicating the meager interest in new avocado groves. Figure 10 displays a regression line, representing Los Angeles County acreage, sloping toward zero in the 1970's. This county's trend could very well indicate the future pattern of avocado acreage in most of the other six counties, especially Orange County.

Orange County, California, one of the nation's most rapidly growing Standard Metropolitan Statistical Areas, is a later reflection of Los Angeles County's agricultural vicissitudes.[25] Prior to 1940, the population of Orange County increased steadily but moderately due to the predominance of irrigation agriculture and the growth of primary industries. As in Los Angeles County its population began to increase markedly after the Second World War.

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[25]William S. Kerr III, "Impact of Urbanization on Agriculture in Orange County, California," Currently under consideration for publication in the Association of Pacific Coast Geographer's Yearbook, pp. 1-2.

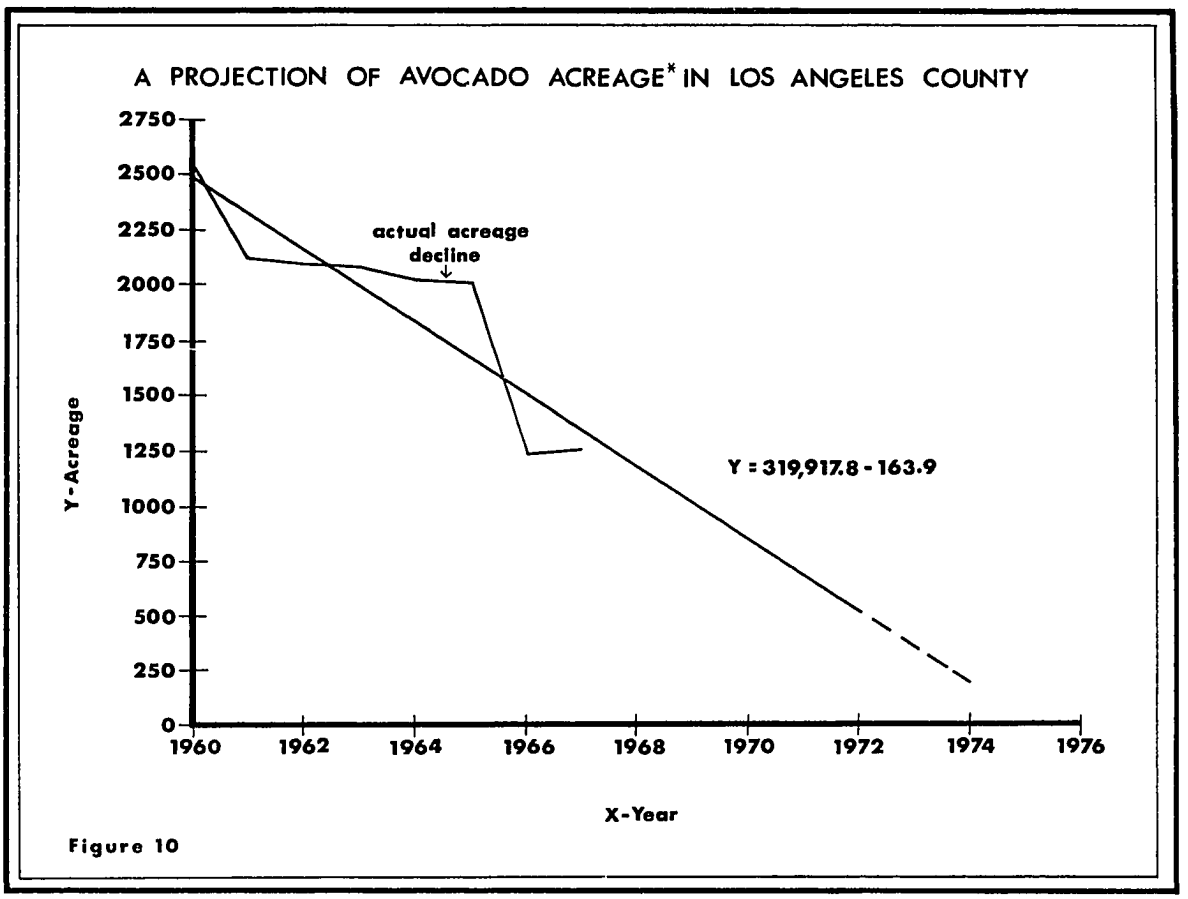

Figure 10

*The regression line is based on data representing a limited number of years. Moreover, the analysis makes the assumption that the conditions which have caused an avocado acreage decline since 1960 will continue through the mid 1970's. It is possible that urbanization during the 1970's may not continue at its current pace. Therefore, the regression line represents what could take place in Los Angeles avocado acreage if historic and present conditions continue in the future.

Source: R. C. Rock and R. G. Platt, Economic Aspects of Marketing California Avocados (Sacramento: University of California Agricultural Extension Service, 1968), p. 12.

The influx was largely due to the following factors, i.e. spillover from Los Angeles County increased employment opportunities in Orange County; low cost subdivision housing construction on the coastal plain;[26] and a nation-wide recognition of Southern California's climatic amenities. By 1960, the population had grown to 704,000,[27] an increase of 225 per cent since 1950, and the January, 1969 population estimate is about 1.26 million (Table 13).

A population projection for Orange County, calculated by the trend established over the last three decades, predicts an increase to 2.3 million by 1980, and to approximately 3.58 million by the year 2,000.[28] Based on the 531 habitable square miles in the county (including avocado acreage), the population density will be about 6,750 persons per square mile. In a county in which urbanization is becoming so well established it is important to discover the manner in which the avocado crop has been affected by urban growth.[29]

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[26]The Growth and Economic Stature of Orange County (Los Angeles: Economic Research Division, Security First National Bank, May, 1967), p. 4.

[27]Byron D. Stern, Projections of Irrigation Agricultural Acreage in Orange County (Los Angeles: Department of Water Resources, Southern Division, October, 1967), pp. 1-3.

[28]Orange County Land and Water Use Survey, 1964 (Los Angeles: Department of Water Resources, Southern Division, June 12, 1967), pp. 14-19.

[29]Kerr, op. cit., p. 3.

Orange County is in a less advanced stage of avocado decline than Los Angeles County because most of the current acreage is on the foothills of the Santa Ana Mountains. A reduction in acreage first became apparent during the early 1960's. To illustrate, the county's avocado acreage declined from 2,441 in 1960 to 1,250 by 1968, whereas nonbearing acreage was reduced from 401 to 10 acres during the same eight-year period. There is little doubt that the inherent factors of urbanization have given rise to rampant avocado orchard degradation in Orange County on the foothills and the inner edge of the coastal plain.

Much of Orange County's avocado future is inextricably related to the Irvine Ranch. By the mid 1970's, this ranch will occupy one of the last prime settlement areas in the county due to its location on flat land conducive to subdivision development. Further stimulation to urbanization is the solid employment base expanding at the Irvine Industrial Complex and the University of California At Irvine, with a 1990 projection of 27,500 students. Because of the capable Irvine Ranch Planning Department it is suspected that efficient urban development and orderly growth within the central portion of Orange County will take place as further expansion is needed in the 1970's. A residential, commercial, and industrial time table, plus the planned development of green belts and a variety of recreation projects, should help prevent an early and inadequately

conceived urban growth. However, large agricultural corporations with high annual taxes may not be able to continue growing crops due to the urban resale value of the land. Therefore, the possibility to retain avocado acreage beyond 1985 seems less than certain.[30]

San Bernadino County has never been a significant avocado region due to the limited area which is physically conducive to avocado growth. In general, the cooler winter temperatures on the foothills within the county are not conducive to the development of an economically profitable operation. Thus, avocado acreage has never exceeded 150 acres, and there was no record of new plantings in 1968. Most of the remaining 110 acres are in the warm foothill sectors of Upland and Alto Loma, which are, in reality, an eastern extension of the Los Angeles Lowland.[31] The communities along Interstate Highway 66 between the San Gabriel Valley and San Bernadino, are expected to urbanize rapidly due to population spillover from the west. Fortunately, the avocado groves of San Bernadino County are not in areas which will be developed for residential living at a rapid pace, unless a severe Santa Ana condition or root rot infestation occurs.

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[30] Ibid., pp. 8-9.

[31] Robert L. Rackham, "San Bernadino County Avocado Industry," California Avocado Society Yearbook (1968), pp. 41-42.

A similar situation prevails in Riverside County to the south. The land between the Santa Ana Canyon on the west and Riverside to the east, once a highly developed agricultural area, is undergoing population spillover. The establishment of secondary industries has perpetuated in-migration. Currently, the majority of the 400 bearing acres of the county are located in the Corona-Riverside area. Unfortunately, Corona is one of the fastest growing cities in Southern California.[32] As avocado acreage is removed in the Corona-Riverside District, it is expected that more foothill acreage will be established in the Temescal Canyon to the south of Corona. This area, however, does not offer a great deal of large scale growth potential until irrigation water is made available via the California State Water Project sometime after 1972.[33]

Future avocado acreage depends a great deal on the commercial, residential, and agricultural corporation known as Rancho California. There may be ample space for several hundred acres of avocados in southwestern Riverside County. However, the results of recent plantings in the area have not provided a favorable picture. In the winter seasons of both 1967-1968 and 1968-1969, large sections of groves were

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[32]Byron D. Stern, Projections of Irrigated Agricultured Acreage in the South Coast Area of Riverside County, Preliminary Technical Information Record (Los Angeles: Department of Water Resources, 1966), pp. 1-2, 10, 13.

[33]Leonard M. Cantor, "The California Water Plan," The Journal of Geography (September, 1969), p. 370.

severely damaged by freezing temperatures. In 1967, temperatures dipped below 18°F, and in December, 1968, it is speculated that some areas may have experienced temperatures as low as 11°F.[34] The southwestern sector of Riverside County offers one of the best prospects for future avocado development due to its location at a sufficient distance from population influx. It would appear, however, that unless favorable microclimatic sites can be located, there is little prospect of transfer for the 550 acres currently being grown throughout the county.

North County Avocado Future

The expanding population perimeter of Los Angeles County via San Fernando Valley and the Ventura Freeway has influenced the growth of Ventura County to some extent since the 1950's. Since 1962, however, the annual growth rate has increased rapidly due to decentralization of commercial, service, and supply enterprises from the Los Angeles metropolitan area. Moreover, growth can be attributed to the military establishments at Oxnard, Port Hueneme, and Point Mugu as well as onshore-offshore petroleum developments and climatic amenities.[35] All of these factors are reasons for

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[34]Personal interview with Paul Hanson, Calavo Field Representative, June 2, 1969.

[35]Ventura County and Upper Santa Clara River Drainage Area Land and Water Use Survey, 1961, Bulletin 122 (Los Angeles: Department of Water Resources Southern Division, April, 1965), p. 7.

the rise in population from 199,138 in 1960 to 340,710 in 1967 (Table 13).[36] This eight-year period may indicate the future urban trend in the lowlands and adjacent foothills of western Ventura County where the avocado crop predominates.

Recent observations suggest that the continental climate influence east of a north-south line from Fillmore to Moorpark precludes favorable avocado production (Appendix II). The restriction of suitable avocado land, the limitation provided by the dispersed root rot fungus, and the rapidly expanding urban growth may significantly reduce avocado acreage by the mid 1970's. This hypothesis conflicts with many opinions that the avocado has great potential in Ventura County. Several growers feel that the increased availability of irrigation water from the Feather River Project in the early 1970's will assist avocado acreage expansion. Ventura County Farm Advisers have indicated that the reduction of lemon groves at the expense of the more profitable and easier to manage avocado orchards may increase acreage from the current 3,370 acres to 4,700 acres by 1975.[37] This estimate is based on the assumption that avocado land area will increase. But an examination of

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[36]B. W. Lee, et al., The Projected Environment in Ventura County (Ventura: University of California Agricultural Extension Service, July, 1967), p. 9.

[37]Population Growth Ventura County, California (Ventura: County Planning Department, 1966), p. 7.

Ventura County statistical data indicates that the acreage increases since 1960 averaged less than 50 acres per year. It appears that new plantings are being offset to a large degree by removal due to urban land-use transformation or disease. Perhaps a 300 to 800 acre increase per year is more logical. By 1980, when the population is projected to exceed 1.0 million people,[38] it is envisioned that only a few scattered avocado clusters will persist in the Santa Paula foothills, the Ojai Upland District, with some scattered groves to the east and west of the Casitas Reservoir.

The South Coast of Santa Barbara represents the northern extension of large-scale avocado development. Although the geographic area between Gaviota and Rincon Point is increasing in urban growth, it is not directly affected by the Los Angeles overflow concept. Santa Barbara's incentives for growth include the following, i.e. its location on a major north-south scenic highway (Route 101 between Los Angeles and the San Francisco Bay area); its function as a large retirement and tourist center; and the rapid expansion of the University of California at Santa Barbara.[39]

Population expansion in Santa Barbara County is determined to a great extent by the growth of the area which

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[38] B. W. Lee, et al., op. cit., p. 8.

[39] San Luis Obispo and Santa Barbara Counties Land and Water Use Survey, 1959 (Los Angeles: Department of Water Resource, 1964), p. 15.

lies to the east and west of the linear metropolitan strip of Santa Barbara. Prior to the 1950's, the county increased in population on an average of 15,000 per 10-year period. However, the decade of the 1950's experienced a growth of 70,000. By 1962 the Gaviota-Rincon Point area had a total of 105,860[40] people, in spite of the fact that civic leaders in Metropolitan Santa Barbara are opposed to large scale subdivision and industrial expansion. Avocados, grown on the alluvial fans, coastal plains, and foothills, have felt the influence of urban sprawl. Unfortunately, there is little room for avocado expansion beyond present limits.

In addition to urbanization, all of Santa Barbara's avocado districts have been severely infested with root rot fungus. Approximately one-fourth of the groves are affected by the disease, especially in the Montecito-eastern Carpinteria location. Thus, acreage expansion since 1962 has barely been able to keep pace with urbanization and disease. Nevertheless, a sincere farmer dedication, the high value of the crop, and the recent establishment of agricultural preserves should act as a deterrent force to avocado removal. By 1990, however, the negative variables are expected to reduce the acreage to a few scattered groves. Many elderly farmers will find it more advantageous to sell their land for profit. Some of the younger members of established

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[40] Santa Barbara General Plan Studies (South Pasadena, California: Simon Eisner and Associates, 1967), p. 35.

family orchards are already beginning to look elsewhere in the county for lower-valued land with avocado potential.[41]

Shifting Spatial Pattern of the Southern District

Coastal San Diego County, representing 58 per cent of the total California avocado acreage, has also experienced urban blight. The pattern is evident more in dramatic spatial shifts than in terms of acreage decline or stabilization. Avocado districts have shifted from the San Diego urban fringe and the county's coastline to an area serviced by Fallbrook, Escondido, and Vista to some extent. The question remains: what pattern will develop in the dominant Fallbrook District?

Although San Diego County is expected to increase in population from about 1.0 million in 1960 to 2.3 million by 1990, county planning officials feel that there is sufficient time for orderly and well planned growth. Human sprawl and overflow phenomena, therefore, will not occur to the same degree as in the Mid-Counties. Urban expansion is expected to have its greatest impact on the periphery of metropolitan San Diego, the extreme coastline along Interstate Highway 5, and in previously established recreation

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[41] Personal interview with George Goodall, Santa Barbara County Farm Adviser, June 3, 1969.

and service centers in the northern part of the county.[42] This northwest county avocado zone includes Oceanside, Carlsbad, Vista, San Dieguito, and Escondido-San Marcos. As a point of contrast, these areas are expected to attain 31.0, 45.4, and 22.3 per cent, consecutively, of their maximum holding capacity,[43] whereas the Fallbrook, Pauma Valley-Valley Center statistical areas will probably acquire only 9.4 and 2.3 per cent, respectively.[44]

There are several reasons why this northwestern county area will probably remain rural, i.e. (1) the interior foothill zone of the Agua Tibia Mountains is somewhat isolated from the San Diego or the Los Angeles-Orange County metropolitan areas; (2) it is outside a reasonable commuter distance to the major urban centers previously mentioned; (3) it lacks the potential of establishing a large industrial employment base; (4) it is impractical to develop tract style housing on slopes of 21 to 30 per cent.[45] It

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[42]Byron D. Stern, Projection of Irrigation Agriculture in Coastal San Diego County (Los Angeles: Department of Water Resources, 1967), pp. 2-9.

[43]The population saturation level (holding capacity) of an area is the maximum number of residences it will hold if it were completely developed in accordance with current trends in density.

[44]Population and Land Use Relationships, Regional General Plan, San Diego County 1990 (San Diego: County Planning Agency, 1968), p. 10).

[45]Developing Potentials of Rancho Monserate, San Diego County, California (Los Angeles: Economic Research Associates, 1965), pp. 5-18, 22.

seems logical to assume that the newly expanding Fallbrook, Rainbow, Pala-Pauma, and Valley Center districts may become the last major avocado production areas of Southern California by 1990.

Besides urban removal, it is suspected that root rot fungus is hastening a land-use change, in spite of the fact that San Diego County grower's plant more new trees per year than any other region. This trend is supported by the fact that acreage has fluctuated between 12,500 and 14,000 acres since 1960. Escondido and its peripheral areas are experiencing similar signs of root rot destruction comparible to Vista less than 15 miles away. The recent root rot survey reveals that over one third of San Diego County's total acreage is undergoing some fungus infestation.

Several planners have estimated that the San Diego County avocado land is capable of increasing to 23,000 acres by 1980,[46] yet current figures do not indicate this trend. It is suggested that if such expansion takes place, hard and fast solutions to the root rot and urbanization problems must be forthcoming (Figure 11).

Political Program for the Preservation of Avocado Land-Use

Urbanization, evident in each of the seven avocado counties, has produced an unstable agricultural land-use

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[46] Agriculture, Regional General Plan San Diego County, 1990, op. cit., p. 31.

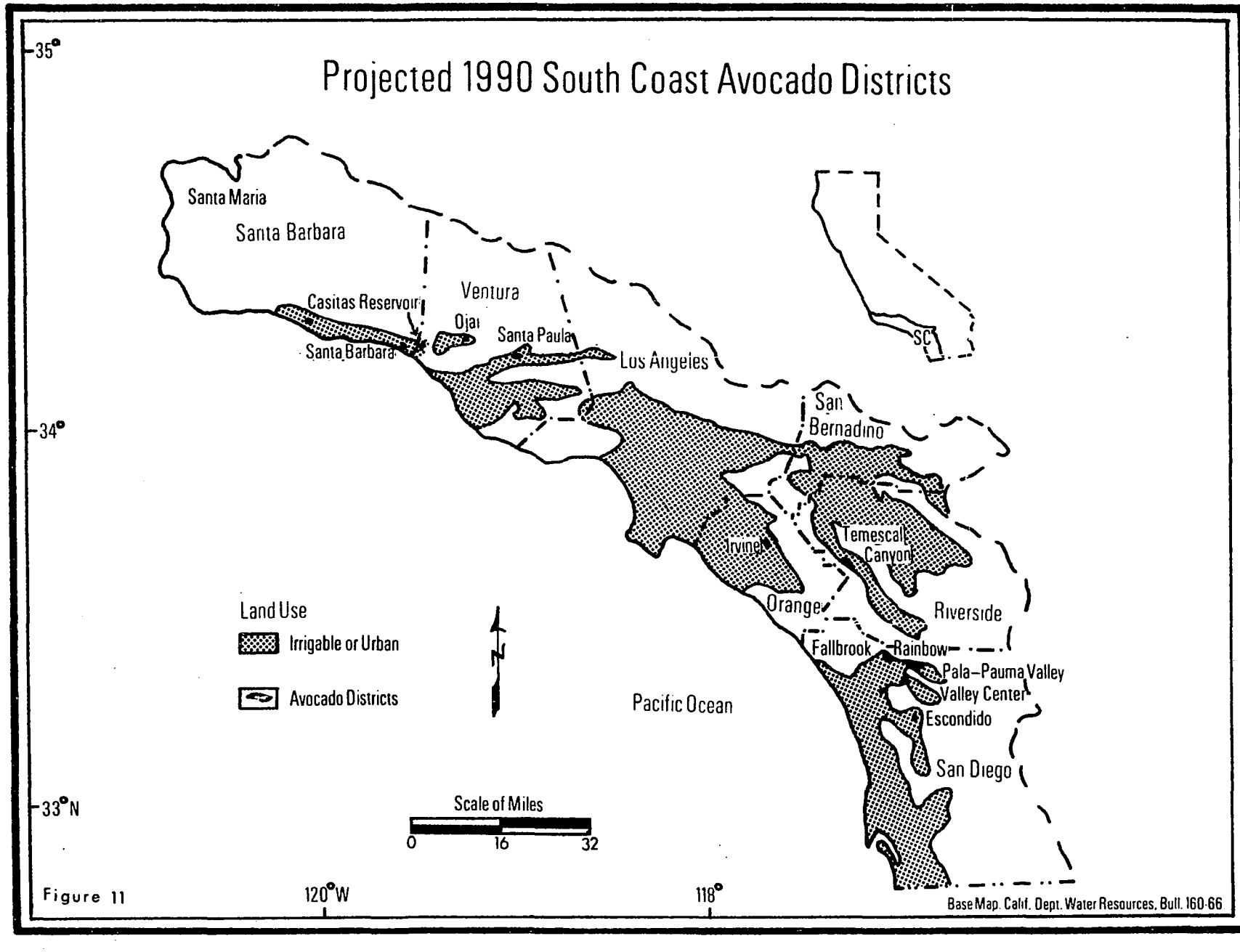
Projected 1990 South Coast Avocado Districts
35°
34°
33°N
120°W
118°
Santa Maria
Santa Barbara
Casitas Reservoir
Ventura
Ojai
Santa Paula
Santa Barbara
Los Angeles
SC
San Bernadino
Irvine
Temescal Canyon
Orange
Riverside
Fallbrook
Rainbow
Pala–Pauma Valley
Valley Center
Escondido
San Diego
Land Use
Irrigable or Urban
Avocado Districts
Pacific Ocean
Scale of Miles
0
16
32
Base Map. Calif. Dept. Water Resources, Bull. 160-66

Figure 11

situation. The increase in property taxes on the urban fringe due to a higher assessed valuation by county tax assessors has given rise to the premature sale of avocado acreage. The urban conversion of avocado groves by land speculators and grove owners has caused great concern among responsible leaders in the industry. Several programs have been suggested to reduce the pressure on agricultural land caused by the intrinsic factors associated with population expansion.

The ad valorem property tax, once considered a favorable tax measure for agricultural land, has become a problem since local and county governments have increased taxes in an effort to acquire modern services. The ad valorem tax no longer bears a direct relationship to the income productivity of avocado property. In the past 15 years, the cost-price squeeze and the urban assessment of agricultural land on the fringe of expanding urban acreage has severely threatened the industry's stability. These factors have led to the evaluation, conception, and enactment of programs designed to alleviate the urbanization process which is influencing the avocado industry. Four schemes were conceived as an answer to the urbanization of agricultural land, i.e. a preferential assessment program, a tax deferral plan, a planning and zoning approach, and a scenic easement plan.[47]

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[47]Thomas F. Hady and Thomas F. Stinson, Taxation of Farmland on the Rural-Urban Fringe (Los Angeles: Economic Research Service, 1966), pp. 2-4.

In 1965, after several years of limited success with the previous plans, a legislative program known as the Land Conservation Act was passed combining the best features of the four previously mentioned programs. The Act requires that land placed in a voluntary preserve for a minimum of 10 years must be tax assessed according to its agricultural land-use rather than its potential urban value.[48] In 1967, an amendment to the revenue and tax code, the Veneman Bill (A.B.211), was passed to force county tax officials to assess the land properly.[49]

The Land Conservation or Williamson Act contains several advantages: (1) it temporarily preserves at least a portion of the agriculture business in the counties involved; (2) it provides more time for officials to plan and legislate for an orderly urban expansion; (3) it has the potential of preserving badly needed open space. Most urban planners concur that open space preservation is more important to Southern California than agriculture.[50]

There are several factors, however, which may prevent an effective implementation of the Williamson Act. Many officials who have a voice in county government are from the

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[48]William S. Kerr, "A Qualitative-Quantitative Synthetis Projection . . ." op. cit., p. 67.

[49]Personal interview with Mr. Thompson, San Diego County Tax Assessor, July 31, 1968.

[50]William S. Kerr, "Impact of Urbanization on Agriculture in Orange County, California," op. cit., p. 9.

urban element where little interest in agriculture has been fostered. Also, many of the urban dwellers have retained a distasteful impression of agriculture as a result of the dust, insecticides, and unpleasant fertilizer odors associated with the local farming activities. Even speculators take a dim view of the agricultural-preserve concept, because it could prevent the sale of highly marketable agricultural land for urban use. As a result of the new tax assessment criteria for agricultural preserve members, there has been a significant shift of the tax burden away from the large multipurpose ranches to the non-preserve and urban landowner. It is a matter of speculation whether factors tending to eliminate the groves will eventually override the cultural and aesthetic values in preserving the avocado land of Orange and Santa Barbara counties.[51]

By the fall of 1969, four Southern California counties had established agricultural preserves, but only Santa Barbara and Orange counties are engaged specifically in avocado preservation. Santa Barbara has 150,000 acres under a preserve program with a total of about 62 ranches, an increase of 44 ranches since 1968. Most of the land under the program includes some lemon and avocado acreage.[52] The urban taxpayer has felt the impact on the $5.0 million annual shift

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[51] Ibid., p. 10.

[52] George Goodall, personal interview.

in tax burden, and it is, therefore, somewhat doubtful whether the program will be retained for more than 10 additional years.

Orange County implemented a large-scale land conservation program in the spring of 1969.[53] Most of the acreage is associated with the large Irvine Ranch and Rancho Viejo. Although there are approximately 12,000 acres in a preserve status on the Irvine Ranch alone, it is estimated there may be little more than 100 acres of avocados benefiting from the preserve concept in Orange County. Currently, a small percentage of the South Coast avocado belt is controlled by the Land Conservation Act. It is doubtless true that many non-preserve owners who are, in effect, land speculators will eventually sell their groves. If the combination of urbanization and root rot should preclude the expected avocado growth, the question arises: is it possible to transfer the fruit to other locations beyond its present boundaries?

Avocado Boundary Expansion Potential

The query as to whether the avocado has reached its northern latitudinal limit has been of concern to Southern Californians for decades. Test plots and small commercial groves have been established in Tulare and Fresno Counties in the southern San Joaquin Valley as well as at Indio in

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[53]Paul Hansen, personal interview.

the Coachella Valley. Although over 170 acres are planted in these areas, it is estimated that as little as 10 acres may be bearing fruit.[54] There have been at least 100 acres planted in the San Joaquin Valley since 1960, yet nearly every year, winter temperatures drop below 32°F. Many varieties have been tested, but the meager success has been limited to the Zutano and Bacon varieties. There is little hope of establishing a commercial district in the San Joaquin Valley unless a more tolerant variety is developed. The persistence of the growers in attempting to develop new plantings is probably related to the fact that an alternative crop must be found to replace citrus which is currently being overproduced in the United States and the world.[55]

Additional test plots have been established in northwestern Santa Barbara County in the Santa Maria area and also in adjacent San Luis Obispo County. Trial plantings by speculative farmers will probably be established in some sites where the direct influence from the westerly winds is minimal and the land is inexpensive. Extensive grove operations will be limited due to the lack of areas where the combination of soil and microclimate is satisfactory.[56]

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[54]Rock and Platt, op. cit., p. 12.

[55]James H. LaRue, "Central California Tries for the Fall Market," California Avocado Society Yearbook (1968), pp. 39-40.

[56]George Goodall, personal interview.

Mr. Marvin Miller has planted 30 to 40 trees in a trial plot in the Coachella Valley in an effort to determine if the Persea americana can tolerate the extremes of a tropical desert condition (BWh). The Zutano variety is one of a few which will grow into a sizable tree, but the small production, frequent watering, and generally much greater care prevents consideration for commercial development.[57]

Doctor B. O. Bergh[58] has spent years of intensive research trying to discover more climatically tolerant varieties. He has been unsuccessful in finding a single variety which meets the requirements necessary for a commercial exploitation in either the San Joaquin Valley or the eastern deserts. After enumerating the general considerations in the fate of the avocado districts to the year 1990 perhaps it is necessary to consider more tropical locations such as Florida or Mexico.

Florida Avocado Acreage Potential

The Florida Avocado Industry with approximately 5,120 acres in 1965, is in direct competition with California only during the months of August through October.[59] The

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[57]Personal interview with Marvin Miller, Riverside County Farm Adviser, June 25, 1968.

[58]Personal interview with B. O. Bergh, University of California at Riverside, Plant Geneticist, August 26, 1968.

[59]R. M. Burns, "Florida Avocados--By a Californian," California Avocado Society Yearbook (1965), p. 85.

state's avocado instability is evident in the great production fluctuation of the past seven years. Production figures have varied from a high of 13,900 tons in 1963 to a low of 1,800 tons in 1960. Crop values in the same years fluctuated from $2.2 million to $400,000.[60] Drastic variations are largely the result of inclement weather, such as (hurricanes). In addition, there are several other factors which limit expansion of the industry. Specifically these are Phytophora root rot, several mites and insects, an inadequate marketing system, lack of effective advertising and promotion, labor shortages, increased production costs extensive absentee ownership, limited research activities, and urbanization in Dade County.[61] It seems logical to assume that Florida's avocado prospects are not entirely optimistic. Although there are several areas in Middle America where avocados may be grown commercially, Mexico appears to offer the most potential as a replacement for the California industry.

Mexican Avocado Expansion

Mexico's potential lies in the enormous amount of available avocado land in which soil, climatic, topographic, and labor conditions equal or surpass those of Southern California. Nearly every Mexican state has some avocado

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[60] Rock and Platt, op. cit., pp. 1, 2, 4.

[61] Personal interview with R. M. Burns, Ventura County Farm Adviser, July 10, 1968.

production, but the majority of the acreage is located in a belt between 19°N and 21°N, largely confined to the volcanic axis of the Mesa Central sometimes called the Neovolcanic Plateau Physiographic Province. (Figure 3). In addition, the Gulf Coast from Vera Cruz to the Yucatan and the South Pacific Coast contain significant acreage. In 1966, Mexican avocado acreage exceeded 25,000[62] nearly 3,000 more than its Southern California counterpart. Many of the Mexican avocado trees are seedlings which produce fruit below Southern California standards. Since 1961, commercial avocado plantings have increased markedly due to the activity of wealthy landowners and professional growers who have become cognizant of the high return per unit area. What, then, are the factors which provide Mexico with the potential to develop into a full-fledged agricultural industry?

Much of Mexico's modern avocado expansion is related to Southern California avocado knowledge, technical experience, and research. This information has been disseminated to Mexican avocado locations where soils, climate, and topography are suitable, and there is little concern for urbanization. Moreover, costs of land, labor, and overhead are considerably less than in Southern California. Even though equipment is generally expensive, little is needed to cultivate and harvest the crop. Unlike California, the cost of

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[62]Takashi Turu, "The Aguacate in Mexico," California Avocado Society Yearbook (1968), pp. 170-172.

production can help to lower the market price of avocado fruit in Mexico once extensive production commences on a state-wide or nation-wide basis.

The avocado or "aguacate" in Mexico is beginning to overcome some of its problems by utilizing modern cultivation techniques, nurseries, and the proper training of available labor, yet the production system is still highly inefficient. Backyard seedling plantings, with only a few trees per owner, prevent the development of an economically feasible marketing system. Nevertheless, since 1961, large new commercial groves of grafted trees are springing up in many parts of the country. The federal government has recently initiated an avocado grove promotional campaign (Plate 23).[63] Several of the more poverty stricken areas of Mexico, such as the Tarascan Highlands (below 6,000 feet) have begun to replace subsistence maize with an avocado cash crop as a means of improving their living standard (Plate 24). The Mexican Institute of Coffee has introduced avocados, along with other high-valued crops, as a means of diversifying the economy of the monocultural plantation crop system.[64]

The rise of a new affluent grower element has helped to successfully develop large plantings. These educated

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[63]C. D. Gustafson, "Summary of Our Trip to Mexico," California Avocado Society Yearbook (1968), p. 176.

[64]Takashi Turu, op. cit., p. 170.

Plate 23--A small Tarascan Indian village (Calzontzin) in the state of Michoacan, Mexico, ornamented with tall seedling avocado trees. Seedling trees are characterized by small fruit and an excessive alternate bearing habit which gives rise to an undependable cash crop.

Plate 24--A large well developed commercial Hass avocado orchard near Uruapan, Michoacan, Mexico. This absentee-owned orchard employs many modern techniques learned in Southern California and contrasts sharply with Plate 22.

business minded individuals realize the need for the development of associations, consolidation of acreage, and an organized marketing system. Currently, the Mexican crop is plagued by poor fruit quality, lack of uniformity among seedling varieties, the threat of extensive Phytophora root rot devastation, poor grove management, and general problems associated with large (200+ acres) absentee-owned estates. These shortcomings present a challenge to the future development of a Mexican crop as an integrated industry.

The problems, fortunately, are balanced by such positive aspects as the utilization of modern avocado techniques, the development of local and national movements to manage the crop more efficiently, the termination of the bracero program, and a very favorable consumer market potential presently in Mexico and eventually in the United States. If the avocado industry in California should diminish to the point that it could no longer meet United States demands, it would benefit the consumer to encourage Mexican avocado development. At this time, Mexican avocados are not permitted to enter the United States unless the seed is removed because of a seed weevil, Heilpus lauri.[65] Because of this hazard the fruit is entirely quarantined from California. It would appear, however, that the

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[65]Personal interview with Mark Cravens, Santa Barbara Deputy Agricultural Commissioner, July 8, 1968.

importation restriction would be removed if California production should decline.

The Mexican Government in the past 5 to 10 years has been making a concerted effort to attract United States business to Mexico by removing tariff barriers,[66] mitigating transportation problems, and providing tax incentives. It is expected that in the future capital from the United States will be available for the development of the avocado industry in Mexico. Therefore, the future of the Mexican avocado industry by 1990, looks exceedingly promising on the local, national, and international levels.

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[66]At this time no protective tariff benefits are received by foreign governments as an incentive to export avocados to the United States.

CHAPTER IX

SUMMARY AND REMARKS

Summary

To many authorities, the avocado industry in California appears to have a promising future. The estimate is based on such favorable aspects as a well organized industry, good cooperative marketing, a year-around harvesting season, and the considerable research that is being done in the field. On the other hand, these optimistic authorities seem to lack complete awareness of the many problems which the industry is confronted; perhaps because they envision it from less than a long-range viewpoint.

There are many limitations to favorable growth of avocados in Southern California. Leading Fuerte and Hass varieties are confined to a narrow coastal strip where microclimate is adequate for the growth of this sensitive subtropical crop. Little hope is expressed for the discovery of more climatically tolerant hybrid varieties. The root rot problem is of great concern and many locations are no longer suitable for avocado trees now that the soil is infected. The rapid urbanization of Southern California is

an equally discouraging factor. Although the avocado land speculator may obtain considerable profit, the industry seems destined to witness a serious decline in acreage and production. Other factors, such as labor, natural hazards, and internal fragmentation, could also direct the industry toward an unfavorable end. It is concluded that the physical, cultural, and psychological milieu makes a significant difference to the establishment and survival of the avocado industry, and the null hypothesis stated in Chapter I is rejected. There are several recommendations which might help the industry acquire greater stability in meeting future problems.

Suggestions and Conclusions

From a regional behavioristic point-of-view, the California avocado industry may lack the necessary cohesiveness to overcome intensifying problems which could affect future avocado survival. It is suggested that the industry's leaders discourage the establishment of additional small packing plants, and that the remaining marginal handlers be encouraged to seek private enterprise elsewhere. One to three large centrally controlled regional processing facilities, preferably of a cooperative nature, would be far more economical than several less efficient ones. Such packing plants would provide better physical handling and quality control of the fruit, as well as more efficient distribution to the broker and retailer.

However, these cooperatives should be cautious of employing too many high salaried administrators and buying expensive equipment which a small industry can ill afford. Large processing plants would have facilities for research and for testing new packing techniques and materials in an effort to remain up-to-date, whereas small organizations might not afford such undertakings.

Several industry-wide problems are associated with perception. Most members of the industry perceive it from a day to day or yearly basis rather than from a long term viewpoint of 20 to 30 years. Regional character resulting from different values, past and present experiences, and attitudes have led to unnecessary disagreements, especially between the North Counties and San Diego County. In most instances, the difference of opinion among regional growers concerns the method of action rather than human belief or cause, such as the root rot committee schism. It would seem wise to establish an interregional committee whose purpose would be to foster closer communication and understanding between the populations concerned.

Whether or not the above problems can be overcome, or at least minimized, must await future observation. One thing seems quite certain--whatever the outcome, the favorable influence of the Southern California industry to the international development of avocados is unquestionable. The knowledge acquired through farmer experimentation and

professional research has spread around the globe. The industry's farm advisers and researchers have traveled to all areas of the commercial and subsistence avocado world. The number of foreign members in the California Avocado Society attests to its widespread influence. Three foreign directors-at-large, including Takashi Turu of Vera Cruz, Mexico, Enrique Costes from the Puebla area in Mexico, and John Gordon of Renmark, South Australia have been added to the Avocado Society's Board of Directors.

Foreign growers have taken, and will continue to take, advantage of Southern California grove owners' successes and shortcomings. Certainly, the example of efficient orchards owned, managed, and guided by educated farmers, handlers, and researchers has set high standards to be considered by world-wide avocado industries. The fact that California growers freely experiment with new marketing techniques, attend educational avocado lectures, and constantly seek advice and guidance from Agricultural Extension Service employees should help to guide the future development of foreign commercial activities.

The influence of the California avocado industry is evident in the recent development of a similar industry in Israel. Initiated in 1953, this commercial activity has borrowed, modified, and applied many scientific avocado methods used in the United States. In the process, Israel has succeeded in developing a central production and

marketing agency, as well as highly productive groves which currently ship fruit to the West European market.

The establishment of commercial avocado acreage has assisted Israel's efforts to diversify its agricultural economy and acquire a high-valued crop which provides considerable export revenue.[1] It is suggested that several developing nations in tropical and subtropical locations could assume a similar pattern to that of Israel with similar success. Thus, it appears that the California industry will have world-wide consequences no matter what its own local fate may be.

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[1]Arthur Doerr, Jerome Coling, and William Kerr III, "Agricultural Evolution in Israel in the two Decades Since Independence," a manuscript currently being submitted for publication (1969).

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APPENDIX I

CALIFORNIA AVOCADO ACREAGE, PRODUCTION, YIELDS, AND GROWER RETURNS, 1919-1968

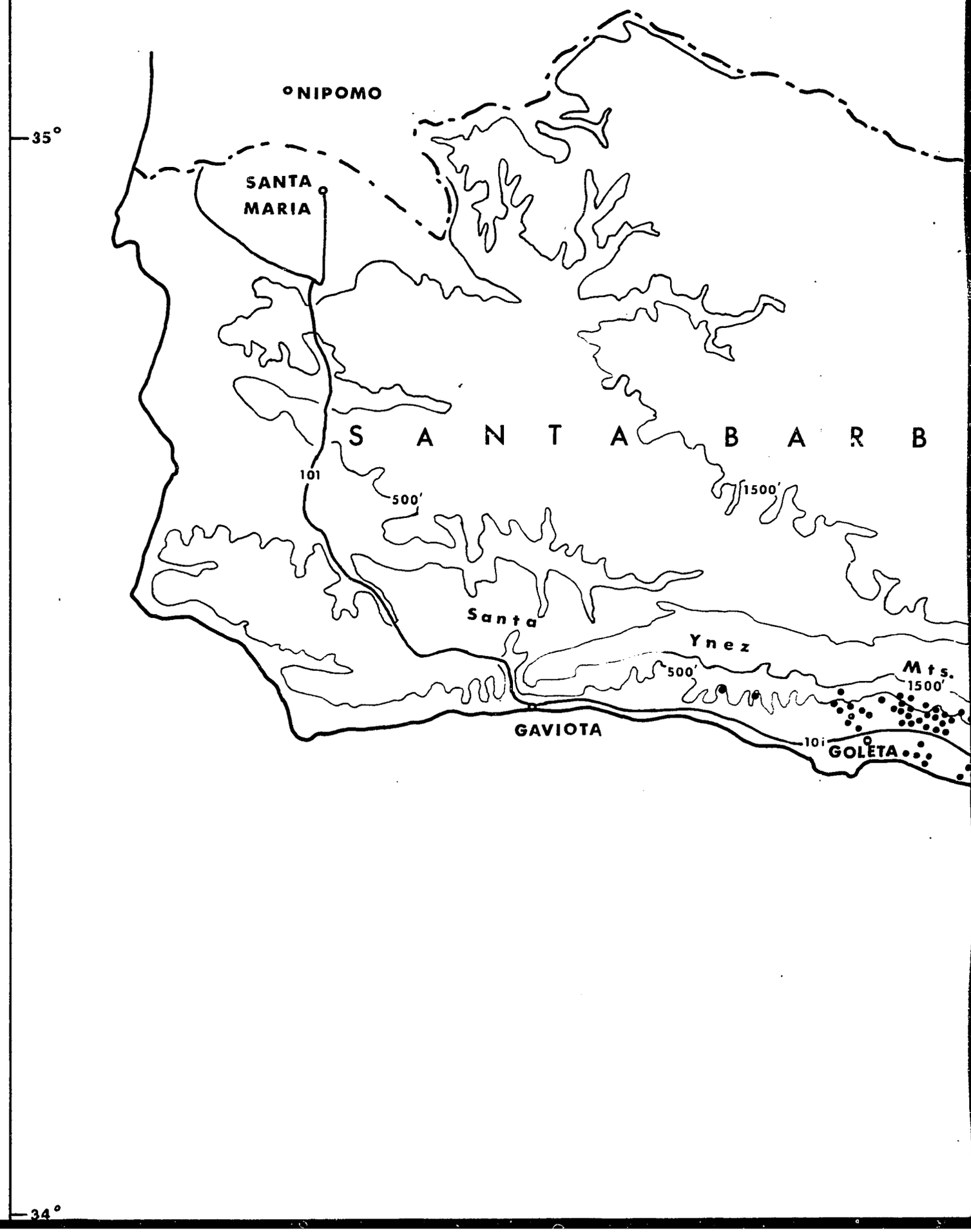
Crop Year[1]	Acreage		Total Prod.	Yield Per Bearing Acre	Growers' Returns			Value of Production
	Bearing	Non-bearing			Dollars per Bearing Acre	Dollars per Ton	Cents per Pound	1,000 Dollars
	Acres	Acres	Tons	Tons				
1919-20	280	235	--	--	--	--	--	--
1920-21	310	289	--	--	--	--	--	--
1921-22	350	380	--	--	--	--	--	--
1922-23	400	520	--	--	--	--	--	--
1923-24	450	809	--	--	--	--	--	--
1924-25	490	1,382	130	.3	192	720	36.0	94
1925-26	560	1,789	230	.4	221	540	27.0	124
1926-27	690	2,437	620	.9	359	400	20.0	248
1927-28	860	3,599	320	.4	253	680	34.0	218
1928-29	1,210	4,888	1,150	1.0	314	330	16.5	380
1929-30	1,830	6,069	400	.2	144	658	32.9	263
1930-31	2,310	6,550	2,150	.9	242	260	13.0	559
1931-32	3,040	8,572	2,600	.9	142	166	8.3	432
1932-33	4,217	9,000	1,700	.4	69	171	8.6	291
1933-34	5,609	9,196	2,500	.4	74	168	8.4	420
1934-35	7,303	7,993	9,300	1.3	111	87	4.4	809
1935-36	8,622	6,304	5,290	.6	104	172	8.6	894
1936-37	10,179	4,097	6,200	.6	79	130	6.5	806
1937-38	11,226	3,240	5,300	.5	72	152	7.6	806
1938-39	11,471	2,667	14,900	1.3	112	86	4.3	1,281
1939-40	11,930	2,541	7,800	.7	94	144	7.2	1,123
1940-41	12,132	2,636	14,600	1.2	129	107	5.4	1,562
1941-42	12,285	2,863	18,600	1.5	153	101	5.0	1,879
1942-43	12,399	2,995	15,500	1.3	267	212	10.6	3,307
1943-44	12,756	2,490	21,300	1.7	381	225	11.4	4,856
1944-45	13,077	2,812	11,600	.9	463	522	26.1	6,055
1945-46	13,403	2,884	24,000	1.8	532	297	14.9	7,128
1946-47	13,565	3,478	18,500	1.4	529	388	19.4	7,178
1947-48	12,765	4,443	18,600	1.5	583	400	20.0	7,440
1948-49	11,855	6,254	14,400	1.2	486	400	20.0	5,760
1949-50	11,292	7,131	15,500	1.4	612	446	22.3	6,913
1950-51	12,008	8,464	22,400	1.9	640	343	17.1	7,683
1951-52	12,579	9,108	28,000	2.2	601	270	13.5	7,560
1952-53	13,566	9,135	23,200	1.7	595	348	17.4	8,074
1953-54	15,040	8,023	21,300	1.4	524	370	18.5	7,881
1954-55	16,292	6,709	45,200	2.8	580	290	10.4	9,447
1955-56	18,036	5,127	20,000	1.1	459	414	20.7	8,280
1956-57	19,119	5,348	15,800	.8	364	440	22.0	6,952
1957-58	19,794	5,439	46,300	2.3	456	195	9.7	9,028
1958-59	20,205	5,061	51,500	2.5	428	168	8.4	8,652
1959-60	21,301	4,754	70,000	3.3	360	111	5.5	7,659
1960-61	20,945	4,378	35,500	1.8	496	280	14.0	9,940
1961-62	20,862	3,066	50,000	2.4	513	214	10.7	10,700
1962-63	21,194	2,628	40,000	1.9	506	268	13.4	10,720
1963-64	21,921	1,706	46,800	2.1	553	259	12.9	12,121
1964-65	21,574	1,224	24,000	1.1	578	520	26.0	12,480
1965-66	18,810	2,225	58,000	3.1	806	252	13.1	15,196
1966-67	18,620	2,860	74,500	4.0	808	202	10.1	15,049
1967-68	19,220	3,080	37,400	2.0	230	460	23.0	17,20-

[1]Crop year begins October 1 and ends September 30.

Source: California Fruit and Nut Crops, 1909-1955, Special Publication 261 (Sacramento: Crop and Livestock Reporting Service, 1956), p. 21; R. C. Rock and R. G. Platt, Economic Aspects of Marketing California Avocados (Sacramento: University of California Agriculture Extension Service, 1968) p. 10; Fruit and Nut Crop: Acreage Production and Value by Commodities, California (Sacramento: Crop and Livestock Reporting Service, 1969), p. 3.

APPENDIX II

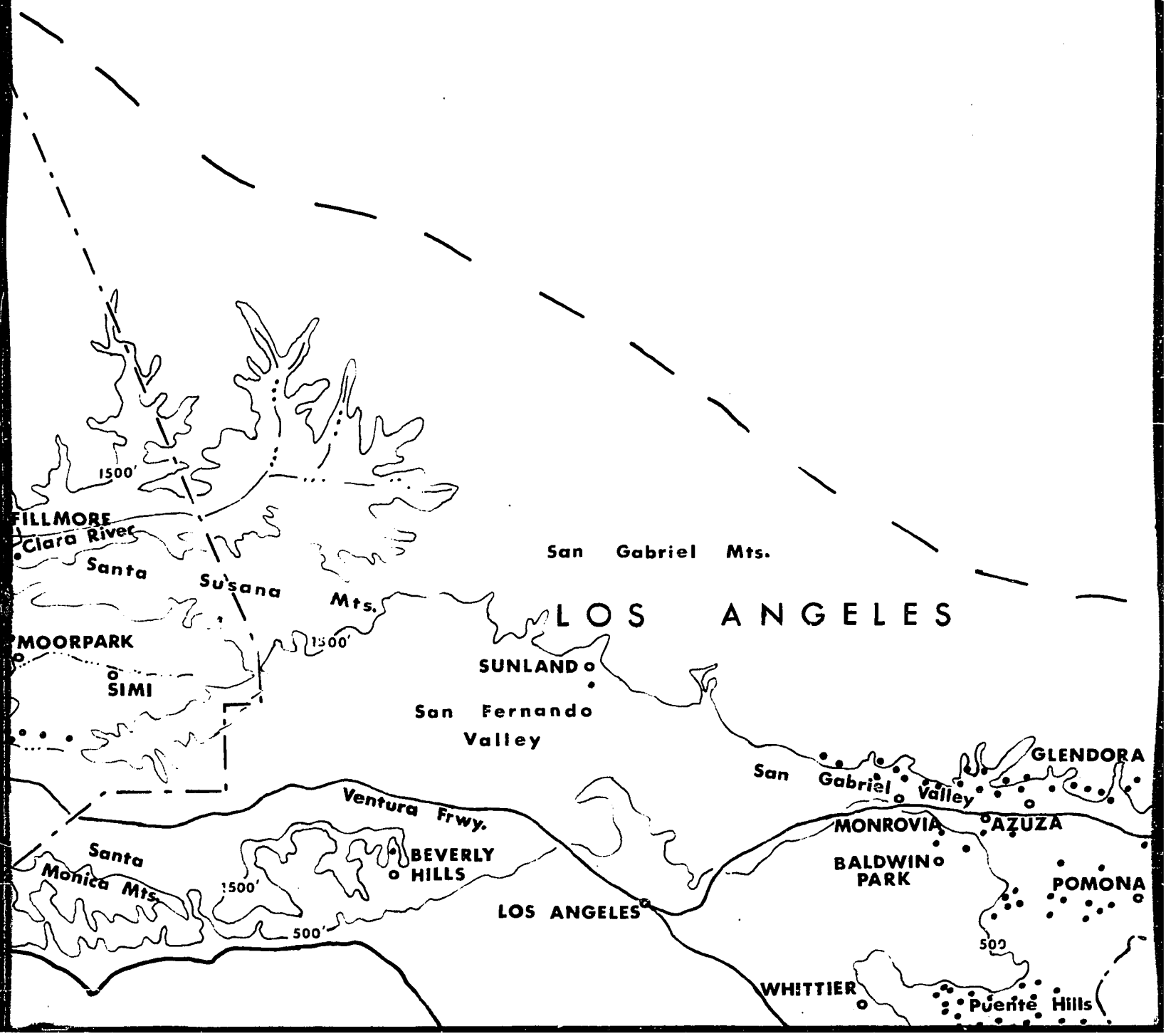
1969 AVOCADO PLANTINGS IN SOUTHERN CALIFORNIA


NIPOMO
35°
SANTA
MARIA
S A N T A B A R B
101
500'
1500'
Santa
Ynez
500'
Mts.
1500'
GAVIOTA
101
GOLETA
34°

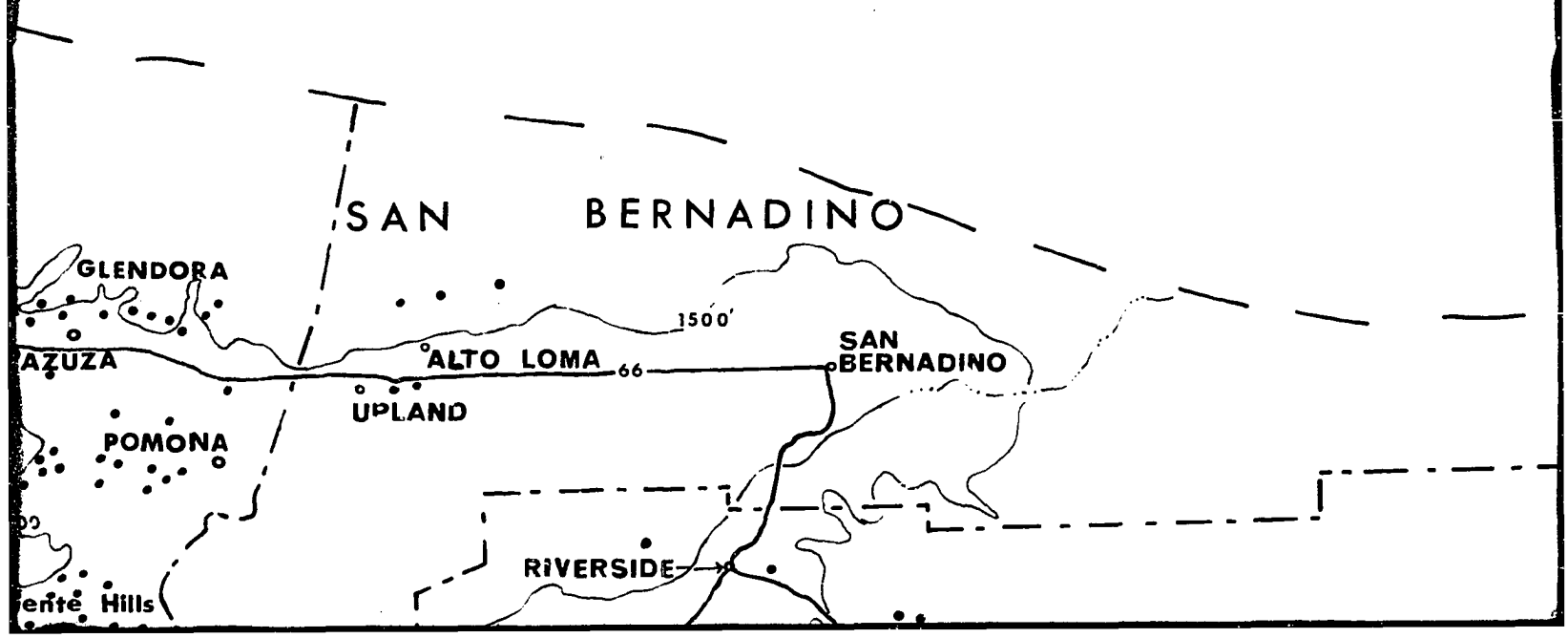

R B A R A
V E N T U R A
Topa Topa Mts.
Mts.
1500'
MONTECITO
GOLETA
SANTA BARBARA
CARPINTERIA
RINCON PT.
1500'
Ventura River
150
OJAI
1500'
FILLMORE
Santa Clara River
Santa
SANTA PAULA
500'
MOORPARK
500'
26
SATICOY
SOMIS
SIMI
VENTURA
CAMARILLO
OXNARD
Calleguas Creek
Santa Monica Mts.

1969 AV

SOU


1500'
FILLMORE
Clara River
Santa
Susana
Mts.
San Gabriel Mts.
LOS ANGELES
MOORPARK
SIMI
1500'
SUNLAND
San Fernando
Valley
San Gabriel
Valley
GLENDORA
Ventura Frwy.
MONROVIA
AZUZA
Santa
Monica Mts.
BEVERLY
HILLS
1500'
BALDWIN
PARK
POMONA
LOS ANGELES
500'
500
WHITTIER
Puente Hills

AVOCADO PLANTINGS SOUTHERN CALIFORNIA

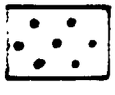


GS IN

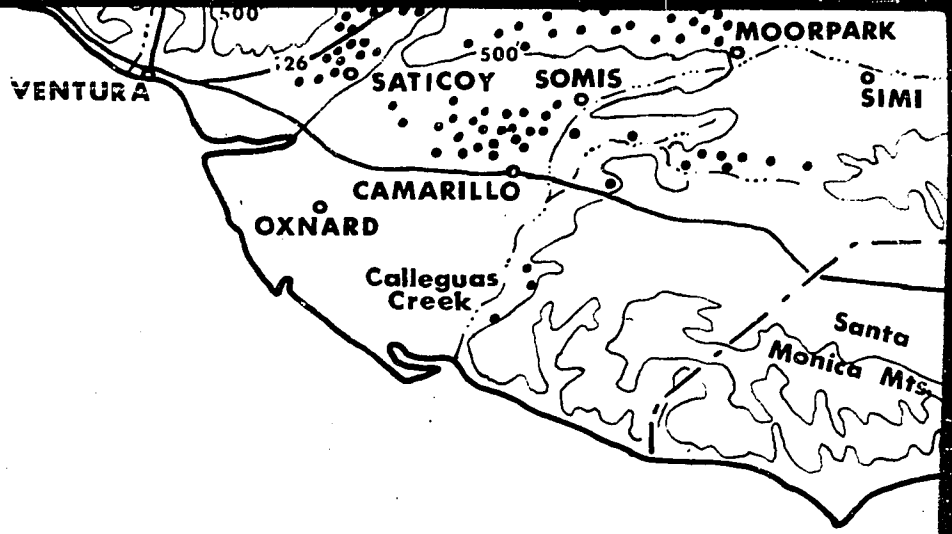
NIA

34°

SOUTH COAST DRA

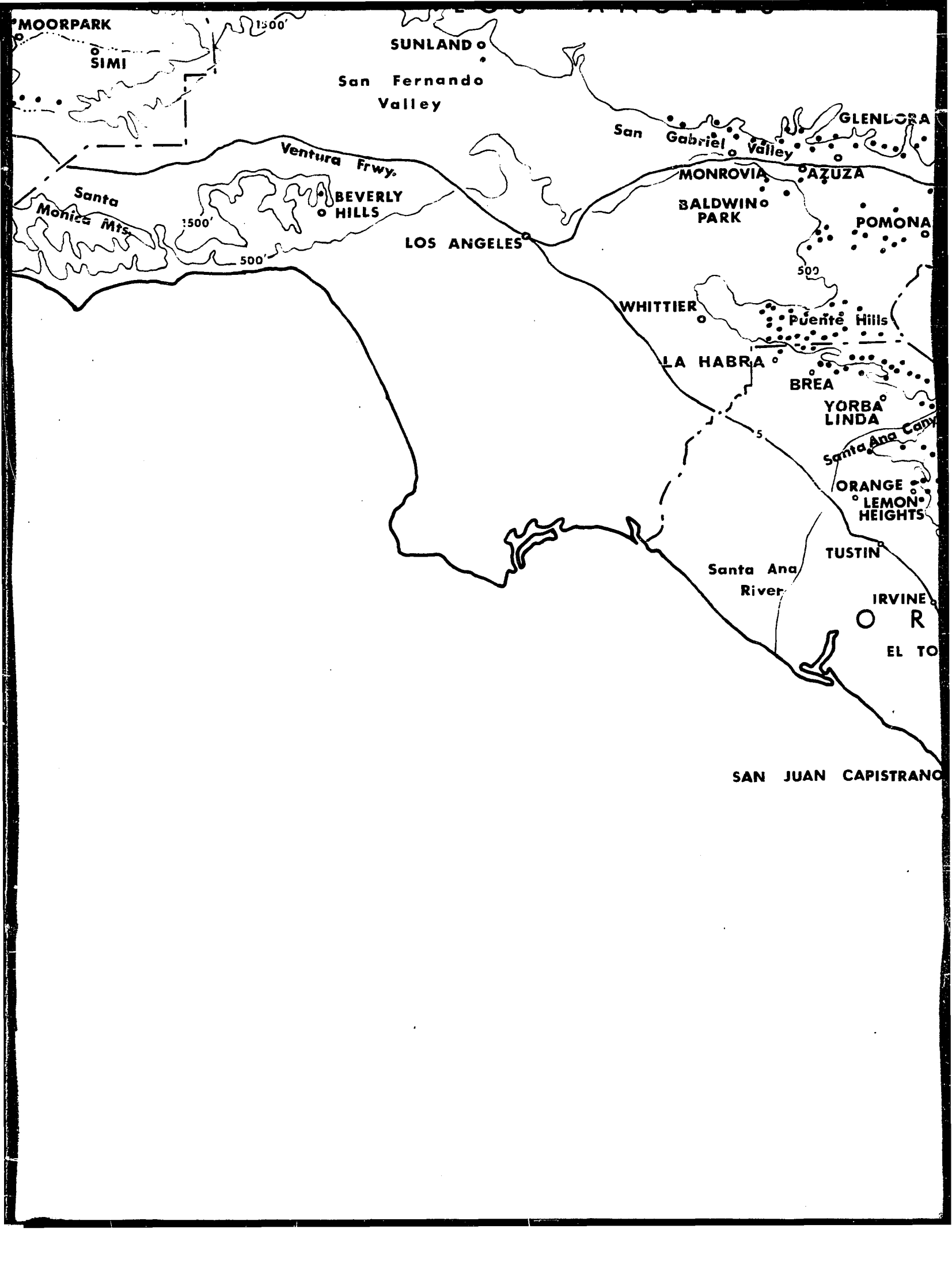


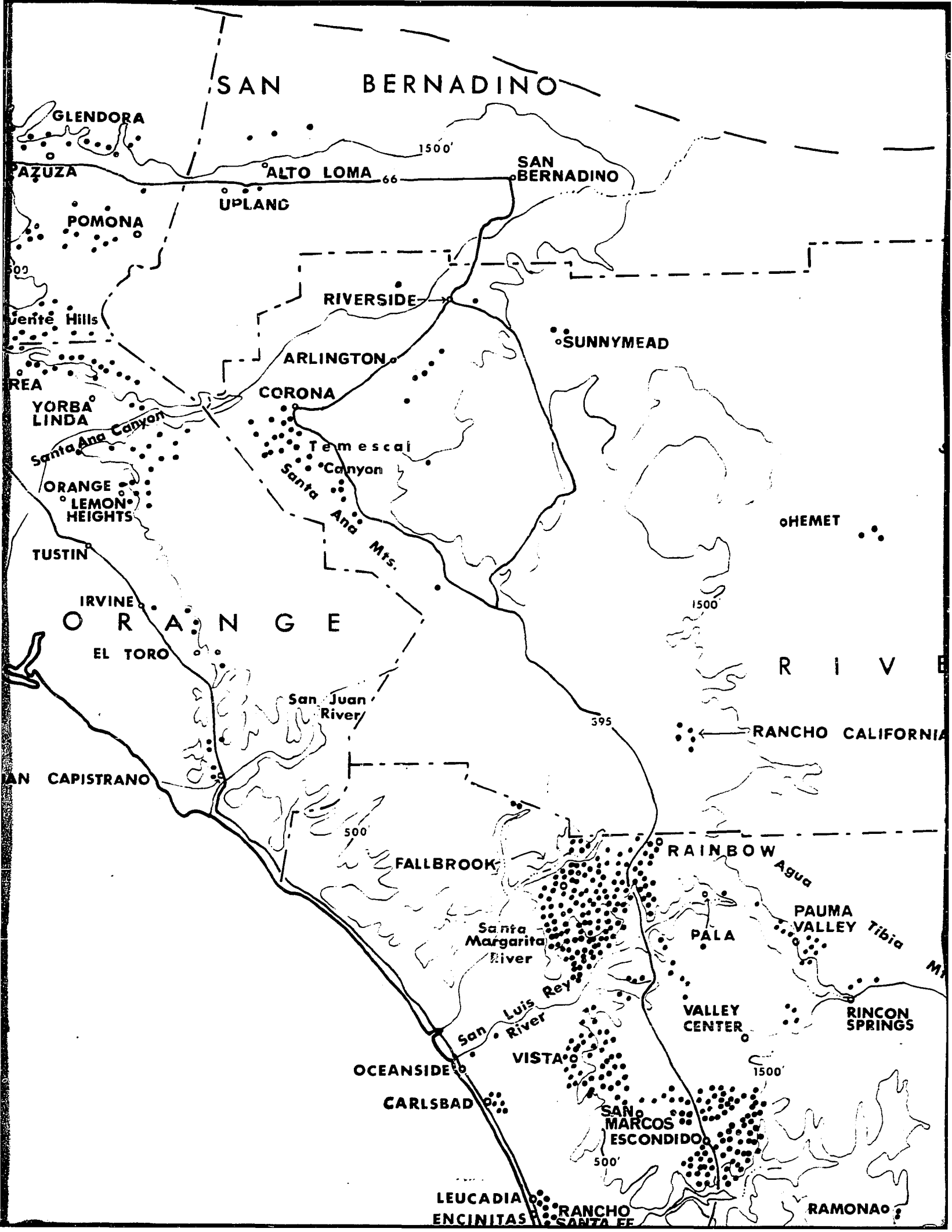
AVOCADO PLANTIN

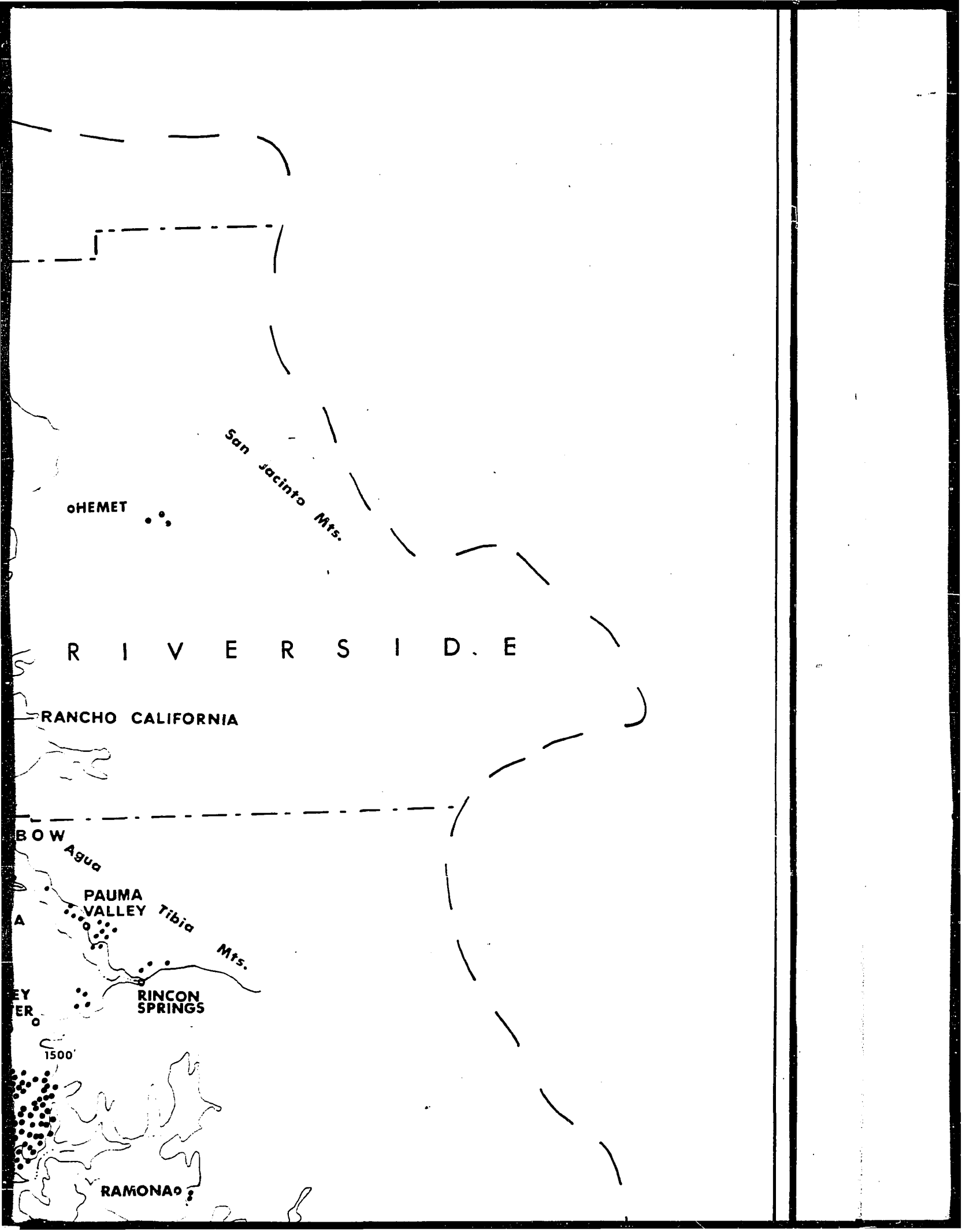


COAST DRAINAGE DIVIDE

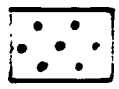
PLANTINGS


MOORPARK
SIMI
1500'
SUNLAND
San Fernando Valley
San Gabriel Valley
GLENDORA
Ventura Frwy.
Santa Monica Mts.
1500'
500'
BEVERLY HILLS
LOS ANGELES
MONROVIA
AZUZA
BALDWIN PARK
POMONA
500
WHITTIER
Puente Hills
LA HABRA
BREA
YORBA LINDA
5
Santa Ana Canyon
ORANGE
LEMON HEIGHTS
TUSTIN
Santa Ana River
IRVINE
EL TO
SAN JUAN CAPISTRANO


SAN BERNADINO
GLENDORA
AZUZA
ALTO LOMA
66
SAN BERNADINO
UPLAND
POMONA
1500'
500
RIVERSIDE
uente Hills
SUNNYMEAD
ARLINGTON
REA
CORONA
YORBA LINDA
Santa Ana Canyon
Temescal Canyon
Santa Ana Mts.
ORANGE
LEMON HEIGHTS
TUSTIN
HEMET
1500
IRVINE
O R A N G E
EL TORO
R I V E
San Juan River
395
RANCHO CALIFORNIA
AN CAPISTRANO
500
FALLBROOK
RAINBOW
Agua
PAUMA VALLEY
Tibia
Santa Margarita River
PALA
San Luis Rey River
VALLEY CENTER
RINCON SPRINGS
VISTA
OCEANSIDE
1500'
CARLSBAD
SAN MARCOS
ESCONDIDO
500'
LEUCADIA
ENCINITAS
RANCHO SANTA FE
RAMONA


San Jacinto Mts.
oHEMET
R I V E R S I D E
RANCHO CALIFORNIA
BOW
Agua
PAUMA
VALLEY
Tibia
Mts.
RINCON
SPRINGS
1500'
RAMONAo

SOUTH COAST DR



AVOCADO PLANTIN

33°N

120° W

COAST DRAINAGE DIVIDE

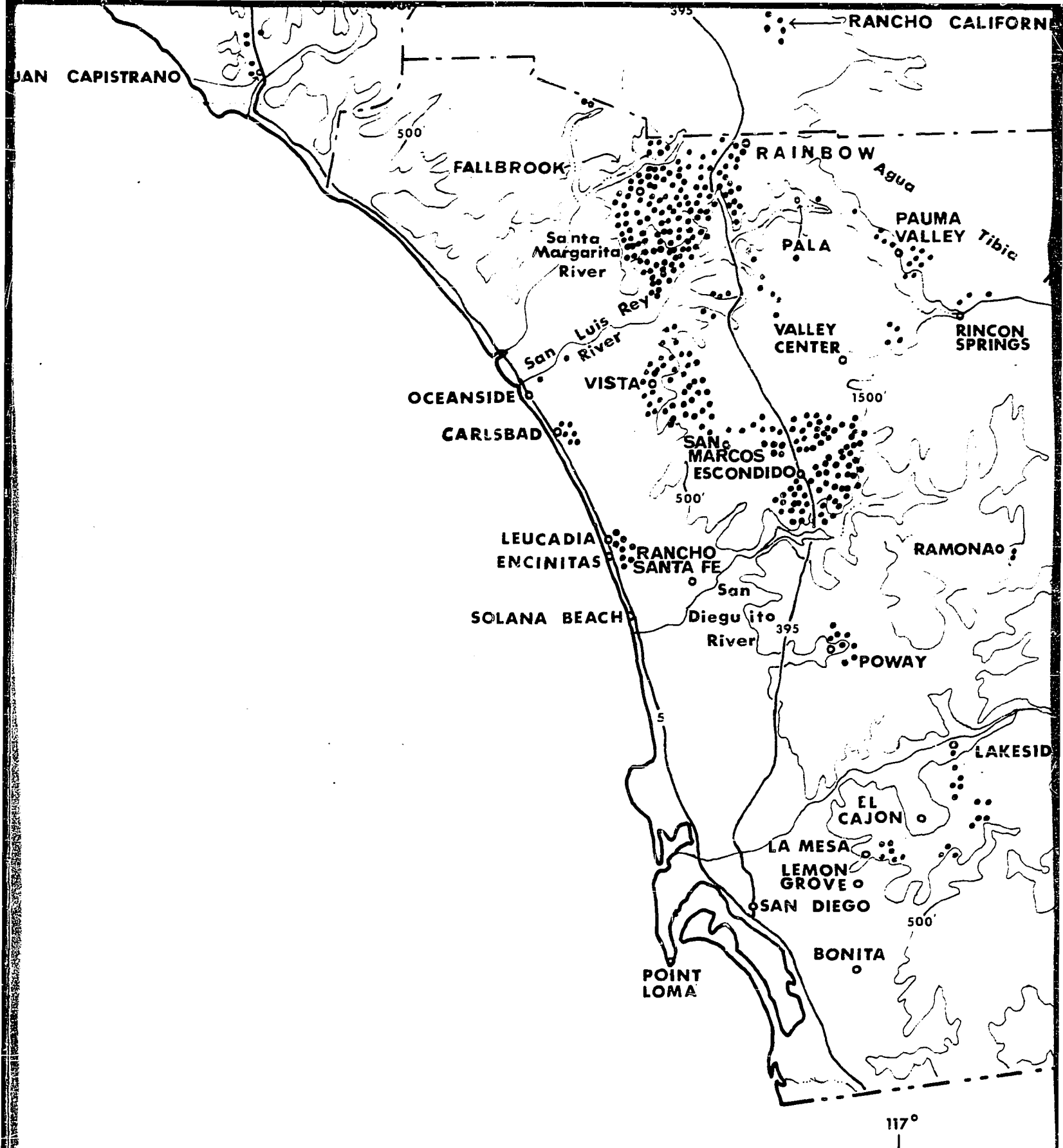
)O PLANTINGS

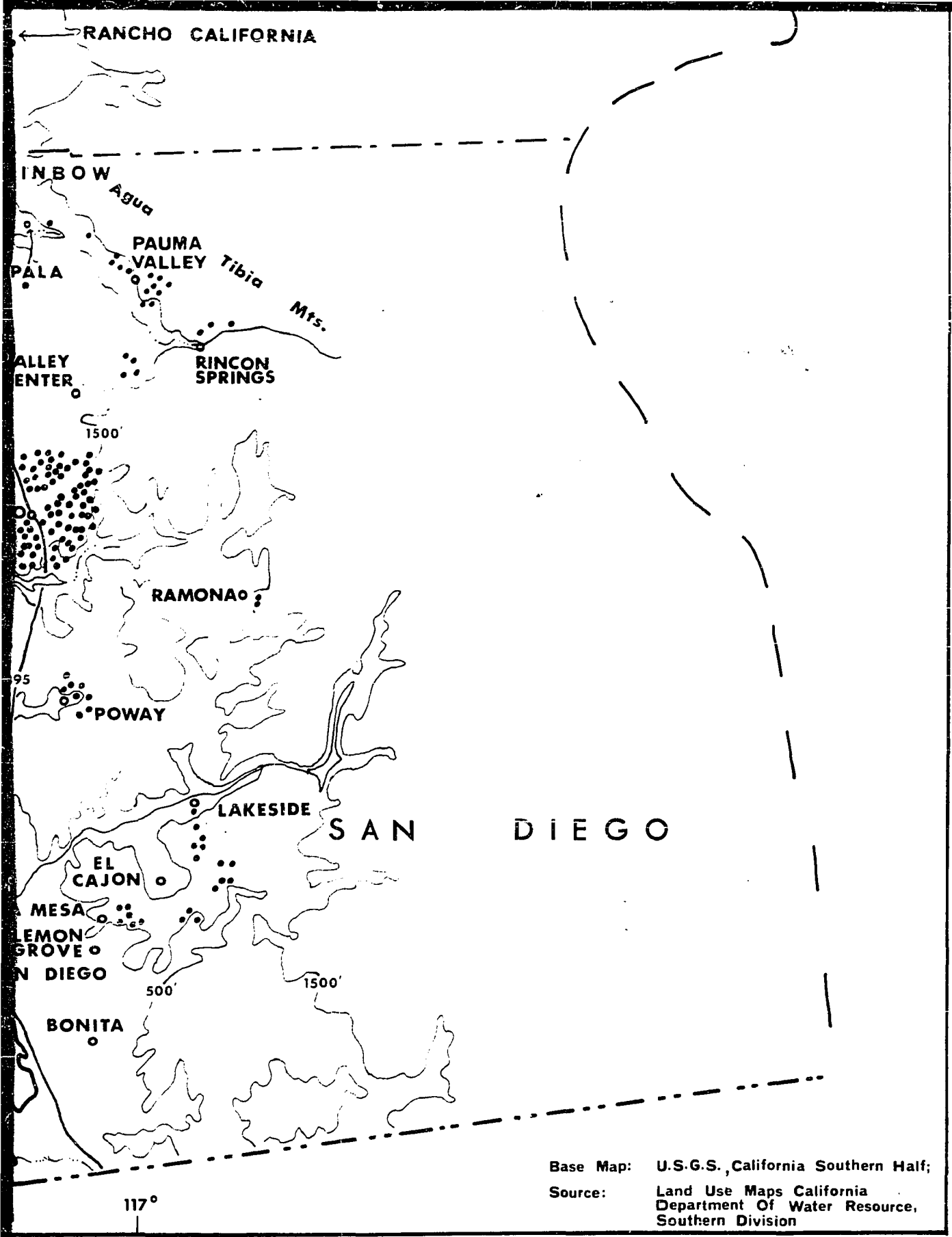
Scale Of

0 20

119°


Miles
40


RANCHO CALIFORN
395
JAN CAPISTRANO
500
FALLBROOK
RAINBOW
Agua
PAUMA
VALLEY
Tibic
PALA
Santa
Margarita
River
San Luis Rey
River
VALLEY
CENTER
RINCON
SPRINGS
VISTA
1500'
OCEANSIDE
CARLSBAD
SAN
MARCOS
ESCONDIDO
500'
LEUCADIA
ENCINITAS
RANCHO
SANTA FE
RAMONA
San
Dieguito
River
SOLANA BEACH
395
POWAY
5
LAKESID
EL
CAJON
LA MESA
LEMON
GROVE
SAN DIEGO
500'
BONITA
POINT
LOMA
117°



Base Map: U.S.G.S., California Southern Half;

Source: Land Use Maps California Department Of Water Resource, Southern Division