RURAL CALIFORNIA

E. J. WICKSON

RURAL SCIENCE AND PROGRESS SERIES

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RURAL STATE AND PROVINCE SERIES

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Plate I. Relief map of California.

RURAL STATE AND PROVINCE SERIES

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BY

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Let California come in: California that comes from the clime where the west dies away into the rising east: California which bounds at once the empire and the continent: California the youthful queen of the Pacific, in robes of freedom gorgeously inlaid with gold, is doubly welcome!—William H. Seward of New York in the United States Senate, on the admission of California to the Union in 1850.

PREFACE

The purpose of this writing is to convey impressions of the characters, qualities and activities of California rural life and industries. It attempts to sketch formative conditions both of natural situations and resources and of factors influencing local individualism and sociology. It also presents, with some detail of character and method, concrete agricultural achievements which are unique in American progress. Thus it is hoped to reveal the characteristics of the rural life through which natural conditions have been translated into industrial accomplishment.

Two reasons may be cited as justifying this effort. First, it has not been hitherto undertaken in a comprehensive way. Second, California is so young that more than two-thirds of the whole span of her life as an American state have passed under the adult observation of the writer; and his knowledge of the preceding portion was chiefly derived from personal acquaintance with those who had participated as young men in its earliest enterprises and continued their efforts for the upbuilding of the state for several decades—many of them enduring until the dawning of the present century.

E. J. Wickson.

University of California, Berkeley,
May 1, 1922.

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CHAPTER I

THE PHYSICAL AND CLIMATIC SETTING OF CALIFORNIA

THE name "California" was probably first used as a geographical designation by some Spaniard, now unknown, soon after the discovery of the peninsula of Lower California by Ximenes in 1533. As this peninsula is widely separated from the mainland of Mexico by the Gulf of California, it was natural that the early explorers should conclude that they had alighted upon an island. As there had been published in Spanish about 1500 a heroic novel describing the deeds of an imaginary knight who received assistance in his adventures from the queen of an imaginary island of fabulous wealth which the ancient novelist called "California," it was natural enough that the name should be applied to this new country which was supposed to be an island. This conception was widely accepted and sixteenth century maps of the possessions of the Spanish Crown in the new world record the name California upon an insular area with its southern portion well enough defined and its northerly extension indefinite.

This rational explanation of the origin of the name California is important because fanciful accounts of the source of it have received such wide publication. One of these is that the name was derived from two Latin words "Calida" and "fornax" meaning "hot furnace." Concerning this conception it need only be pointed out that the name was actually recorded when the Spanish discoverers had experienced only the moderate temperature of a narrow strip of land between two ocean areas and where they probably found a beach fire very comfortable. They knew nothing of the heat of the interior valleys, far to the north of their landing place, of which the name California has been supposed to be descriptive.

The State of California is the extreme southwest of the continental United States and its south and west lines are parts of the national boundaries in those directions. Among the United States, California stands second in area which includes practically a hundred million acres of the earth's surface. According to the reports of the United States Secretary of the Interior, California has an area of 158,297 square miles or 101,310,080 acres, of which 156,092 square miles or 99,898,880 acres are land surface (20,000,000 acres being described as "arable" by the United States Geological Survey), and 2,205 square miles or 1,411,200 acres are water surface. In addition to these water areas, claim is made to jurisdiction over all Pacific waters lying within three English miles of the coast.

California lies between the parallels of 32°30′ and

42° north latitude, thus occupying nine and one-half degrees of latitude. The most westerly point in California is Cape Mendocino with 124° 26′ of west longitude: the most easterly point is in San Bernardino County, in an eastward bend of the Colorado River, with 114° 9′ of west longitude. Therefore, if extremes of latitude and longitude were alone considered, California might claim to be 9.5 x 10.15 degrees dimensions, but the east and west boundaries of the State do not run north and south, as such calculation would require. California is cut approximately on the bias, or obliquely, between these extremes. The northeast portion of such a square as parallel boundaries would inclose comprises the state of Nevada, while the southwest portion is occupied by the Pacific Ocean. The greatest width of California is a line drawn from Point Conception in Santa Barbara County eastward to the point of least longitude in San Bernardino County (noted above) and the distance is 235 miles. The least width of the State is a line drawn eastward from the Golden Gate to the south end of Lake Tahoe in the Sierra Nevada (which is bisected by the State boundary line), the distance being 148 miles. The average width of the State is, therefore, 191½ miles. Its length calculated on its stretch of latitude is 660¼ statute miles, but owing to its oblique extension between its parallels of latitude, its actual length, in an air line drawn from its northwest to southeast corners, is 775 miles, and its coast line, following indentations therein, is 1200 miles. The coast line of Cali-

fornia constitutes approximately two-thirds of the national boundary of the continental United States on the Pacific Ocean exclusive, of course, of Alaska.

Disregarding the obliqueness of California, it is usual to designate the boundaries of the State as follows: on the north, the state of Oregon; on the east, the states of Nevada and Arizona from the latter of which it is separated by the Colorado River; on the south, Mexico; on the west, the Pacific Ocean. It is the western environment of California which is overwhelmingly important. The Pacific Ocean is the dominating factor in determining the climate of the State: it is, in historical and economic ways, also the father of the State and it will be the architect of the future of California, not only in its own development and its relations to national integrity of the United States, but in its service to the world as the front line of occidental civilization and enlightenment.

California is most eligibly situated and naturally endowed to discharge this world duty, for her frontage on the Pacific Ocean includes two natural landlocked harbors in the bays of San Diego and San Francisco, the latter being popularly estimated to have capacity enough to hold at anchor all the ocean-crossing craft, both naval and merchant marine, of all Pacific border countries. Government engineers have also given California a third safe harbor at San Pedro (Los Angeles) and several other indentations of the coast line are available for harbor improvement. The coast line of California lies but a few

hundred miles east of the great circle route from the Panama Canal to the chief Asiatic ports and has the natural ports of call for all ships which will be engaged in the vast future traffic between the two hemispheres via Panama. However, to embrace her geographical opportunity to act as an adequate American factor in homologizing the two great eastward and westward moving civilizations, which must be accomplished on the shores of the Pacific Ocean, California must advance to ten or twenty fold her present development in population, industry, learning and the humanistic arts and sciences. It will be one of the purposes of this writing to demonstrate that California has the natural endowments, the capability and the lofty purpose to justify her tenancy of such a place and to discharge such a function on the earth.

THE STRUCTURAL GEOLOGY

From the point of view of geology, California, and adjacent Pacific Coast territory of course, is a new country as compared with the area from the Rocky Mountains eastward, as formations conceded to be most ancient and preceding the appearance of life on the planet are not widely discernible. Although the most ancient tokens of earth structure are not abundant and must be intelligently sought for, the Pacific Coast is very rich in records of more recent geologic time. As has been picturesquely said, "The history of the relatively recent periods, of the geo-

logic yesterday, is written in more detail than elsewhere in the world. It treats of marine, terrestrial and glacial conditions: of the base-leveling of mountain ranges followed by vulcanism, earth movements and the re-birth of mountain systems." For what is, therefore, rare in California of the uplift of primeval rocks that have entered into the visible structure of older parts of the continent, there is compensation in the greater extent and variety of geologic action in later periods which these older parts have not so richly experienced, or, at least, of which they do not present to the trained vision such clear and complete record.

Æons ago, in times which geologists call "tertiary" because two great geologic epochs preceded them (and furnished materials visible in the structure of the Atlantic side of the continent), there arose from the primordial world-spread of waters on what is now the Pacific Coast, ridges of earth-crust lifting above the flood the sediments which had for millions of years been collecting beneath it. These ridges separated the waters on the east from those on the west and created an ancient inland sea which has been called the "Great Basin Sea," covering the vast region lying west of the Rocky Mountains and which was designated the "Great American Desert" on the United States maps of more than half a century ago. These first uplifts of the earth-crust were not the mountain ranges of California as we now know them but were in a way progenitors of them. Upon their eastern sides lashed the waters of the Great

Basin Sea and on their west rolled the waves of the primeval sea which was in a way the progenitor of the Pacific Ocean. These waters and the cloud-deluges that drained into them scoured from the ascending ridges the sediment which they brought up, depositing it to a depth of thousands of feet in the depressions the uprising ridges left undisturbed. However, this first effort of the earth-crust to form a California was a failure. In the course of geologic time its uplifts were again submerged, carrying beneath the primeval flood its shallow river-beds to be buried under renewed sedimentation. After a few more millions of years, the earth-crust made a new effort. The Great Basin Sea was drawn off toward the north. The most potent creative agencies were invoked. By a stupendous uplift the Sierra Nevada arose, carrying thousands of feet aloft the old stream-beds and other tokens of the primitive land which failed. Volcanoes broke out, raised high cones to form great mountains and to spread lava crusts of great depth over thousands of square miles. Then came new upward movement carrying the Sierra Nevada much higher than at present, and the local occurrence of the ice age. Glaciers ground down the igneous rocks that had arisen and cut deep gorges in which ran new rivers carrying new depths of sediment to form broader valleys between and around the mountains. The Sierra Nevada was ice-clothed. The Coast Range had many of the growing-pains of the Sierra Nevada but in less degree. Later an era of subsidence dropped the coast region of the State

a few hundred feet, severing the southern California islands from their shore connections and allowing the Pacific Ocean to fill a shore valley and form the bay of San Francisco and other bays along the coast. Out from the present Pacific beaches of California, there are sharp and deep cliffs in the ocean floor that are believed to be the old shore of the primeval sea when California was in the making.

Somewhere in geologic time, California assumed a form recognizable as the progenitor of the State as now seen. The Sierra Nevada and its north and south connections dominated its eastern borders and the ridges of the Coast Range looked down on the western ocean. Between the two, covering what is now called the "great valley of California" was an expanse of waters that later broke through the Coast Range and uncovered the foothills, the wide valley plains and enabled the great rivers to build up the lower central areas to reclaimable marshes which are now recognized as rich delta regions. While this was going on centrally in the State, glacial sculpturing, volcanic outpourings and meteorological agencies were developing topography in the mountain encirclement of the great valley which brought the State nearer and nearer to what we now recognize as outstanding local features of hill, mesa and valley areas supporting growth of plants and ministering suitably to the higher classes of animal life and later still to the uses of mankind.

While such changes were taking place and previously submarine activity perhaps had more to do

with the upbuilding of the California of today than surface agencies. It has been estimated that more than half the land surface is of sedimentary substances. These include sandstones, shales and clays of inorganic origin. The ancient waters of the State, however, not only received and held fast these scourings from the uplifts by stream, wind and glaciers but supported a submarine growth of coral and other lime-collecting organisms which gave limestones literally thousands of feet in depth in some places. The other chief component of the California surface is of igneous origin. Less than one-half is counted as being chiefly granitic (of which the Sierra Nevada Mountains are a great irregular block of granite), and lava flows productive of other rocks and of volcanic ash. This line of creation is still active in the recent out-pours of Mt. Lassen in northern California, although the adjacent higher cone of Mt. Shasta has not been active.

In the possession of animal and plant life in geologic time, the vestiges do not indicate that California was particularly rich as compared with other parts of the earth's surface, although in special interest of some of the forms, and in the unique manner in which the remains have been preserved, the paleontology of California is very notable from a scientific point of view.

Owing to the multiplicity of geologic agencies and the diversity of materials they produced and transported, not only within narrow geographical limits but by superposition, because of alternating eleva-

tion and depression of the crust upon which they worked, the geological map of California is a complex which baffles popular exposition, even though the owner of a single farm may have between his own fences almost an epitome of it. The popular wonder and significance of the geology of the State are embodied in the soils which have been created for the development of California agriculture and of which a sketch will be undertaken in Chapter II.

TOPOGRAPHY AND CLIMATE

From the brief outline of its geological history, it can readily be inferred that the surface conformation of California would be strikingly diverse in both general and local features. Within the boundaries of California stands the highest mountain of the continental United States[1] (Mt. Whitney, 14,501 feet above sea level); the deepest valley (Death Valley, 278 feet below sea level); the greatest stretch of latitude of any state (9½ degrees); the longest sea coast of any state (1200 miles). In addition, California has the only active volcano in the continental United States and it is still making new topography. These and many similar facts are suggestive of great topographical variety. Four transcontinental railway lines start at sea level on San Francisco Bay and run northerly, easterly and southerly, traversing distances of 100 to 300 miles without rising more than

[1] The term "Continental United States" as used by the U. S. Census excludes Alaska and Mt. McKinley, which is higher than Mt. Whitney.

200 feet above sea level, while in the next 100 to 300 miles they must rise from 4,000 to 7,000 feet to reach the lowest crossing places in the mountain barriers. This is a good indication of central California's great stretches of low valleys and the height of the mountain ranges that encircle them.

Study of the relief map (Plate I) will impress these facts, viz: (1) that California is thickly set with high mountains closely connected into continuous ranges roughly parallel and having a general trend from northwest to southeast; (2) that associated with these mountain ranges are wide open spaces which are for the most part broad valleys of relatively low elevation, although some of the open spaces, chiefly on the east side of the central and northern regions of the State, are high plateaux; (3) that such a multitude of mountains suggests that there must be innumerable smaller valleys at various elevations; (4) that in nearly all parts of the State there are mountains in sight, towering above the small valleys and discernible even from the central parts of the largest valleys as features of the horizon lines; (5) that such variation in topography, generally within short distances, indicates great diversity in elevation, exposure, soil and other natural conditions which expresses itself in corresponding diversity in agricultural production and in the comforts and hardships of living.

Such observations might lead to a conclusion that California must be incongruous, narrowly antagonistic in its natural conditions and unfitted for great

surpluses of standard food commodities. Such a conclusion would be incorrect, for at least two reasons: first, California is so large that many subdivisions may still include considerable areas; second, owing to peculiar topography, and conditions largely dependent on it, corresponding conditions are multiplied through hundreds of miles of distance and ensure to hundreds of thousands of acres similar producing capacities, though they may be geographically far apart. This fact is demonstrated by the wide distribution of the numerous large products that are now creating the wealth of the State and is made intelligible by a review of environment and topography in their relation to local climatic conditions.

Concrete illustration of agencies determining the climate of California will be secured by reference to the requirements of the orange, which is not only a world token of salubrity but is (next to hay) the greatest single crop produced in California, the "farm value" in 1920 being fixed by the United States Bureau of Crop Estimates at $51,425,000.

Natural conditions befitting the growth of the orange exist in suitable situations in the interior valleys at the north, and in coast valleys at the south all the way from Shasta County to San Diego County. It is surprising that similar climate should be found through a distance of between seven and eight degrees of latitude. If the north and south distance of over 500 miles that separates Shasta and San Diego counties be laid off in corresponding latitudes on the Atlantic Coast, Georgia would be at one end

and New York at the other. Between these two localities on the Atlantic there is a vast difference in climate; within the two points named in California there is so close a similarity that both meet the temperature requirements of the orange. The difference on the two coasts is due to the following factors: First, owing to ocean influences predominating over land influences, the west coasts of continents in the northern hemisphere are warmer in winter than the east coasts. Second, northern California is additionally protected from low winter temperatures by the mountain barrier of the Sierra Nevada, extending southward from the multiplied masses of protecting elevations in the Shasta region, while southern California enjoys the protection of the Sierra Madre and other uplifts on the north and east of her orange region. Northern blizzards are, therefore, held back from entrance to California and are forced to confine themselves to their natural southerly and easterly direction over the interior parts of the Pacific slope, while the great blizzards of the northwest traverse the Mississippi Valley and, if they have sufficient impetus, extend to the Gulf and carry destruction to semi-tropical growths even in northern Florida. The ocean bringing warmth and the high mountains defending against cold combine to give nearly the whole length of California semi-tropical winter temperatures. Latitude becomes, therefore, a small factor in the California climates. Third, the several ridges of the Coast Range, with their inclosed small valleys, serve as a colossal windbreak

against northwest winds, which might otherwise, now and again, bring a temperature too low for citrus fruits, where now they are safe from injury. The chief effect of these mountains is to protect the northern interior valleys and foothills from the cooling winds of early spring, and to allow the sun to expend the increasing heat directly in promoting vernal verdure. The result is quick growth in all lines, early pasturage, early grain harvest and early fruit ripening. The valleys of the coast side of southern California have no high range between them and the ocean. This is not so unfavorable as such an opening would be at the north, because ocean winds are gentler and warmer here. However, the absence of high barriers against ocean influences retards the springtime and causes a slow development of summer conditions and later ripening of fruits The high barriers at the north so hasten spring and summer heat that early summer fruits in California are shipped from the north to the south, which does not occur anywhere else in the northern hemisphere.

There is in southern California, east of the mountains, a district consisting of the Imperial and connecting valleys, which has, during the last decade, rapidly and extensively developed, where protection from ocean influences tends to early ripening of fruits and early growth of vegetables and field crops. The same is true of some parts of Arizona adjacent and early fruits and vegetables move westward and northward. In that region the effects of local environment

are supplemented by the influence of much less north latitude.

The orange has been chosen as an exponent of climatic characters that prevail over most parts of California, not alone for its own sake but because of its demonstration of an all-the-year salubrity which meets the requirements of many plants in several ways. It demonstrates a winter temperature which can go but few degrees below freezing nor stay there long and that indicates suitability for winter growth of most vegetables, grains, grasses, and other evergreen fruits which resemble the orange in temperature requirements. It testifies to a long continuance of adequate summer heat, indicating a long frostless growing season which favors the fullest development of tender summer vegetables, grains, forage plants, as well as of fruits of deciduous trees.

It has also been demonstrated that climatic conditions favoring continuous or long seasonal growth of plants are suitable also to the earliest and fullest development of domestic animals and the largest yields of products from them with the least expenditure of money for their adequate shelter from stormy weather and the least time required for winter feeding and care.

For a general understanding of California climate, it is necessary to recognize the following facts:

1. The climate of California is insular or marine and not continental, except as interior influences may touch the high plateaux which constitute the northeast borders of the State. It is stated on au-

thority that "a common feature of continental climates in all latitudes is their large range of temperature. Marine climates, on the other hand, are characterized by a small annual range. . . . The temperatures in a littoral or an insular climate are characterized by a greater uniformity, *i.e.,* by smaller variations about the mean, than in a continental climate." [1]

The practical demonstration that California shares in these qualities of an insular climate is found in the fact that the occurrence of a temperature below 20° Fahrenheit is exceedingly rare at any point in California valleys and then only of short duration; ground freezing is also rare and only superficial. In the mountains, however, lower temperatures are reached and a natural ice crop of considerable importance is secured.

2. The demarcation of a four-season year, common to the temperate zones, is displaced by division into two seasons, wet and dry. The wet covers fall, winter and spring, as rains are to be expected at any time from September to May, and the dry season corresponds to summer.

3. The California wet season is the period of greatest activity in vegetation. All plants except those which can endure no touch of frost make their chief growth then. All important grains except corn and rice proceed from seed to harvest; all extensively grown forage plants advance from seed

[1] "Handbook of Climate," Julius Hann (The Macmillan Company, New York, 1903), pp. 139, 148.

to hay, except alfalfa which in most places rests from January to March; evergreen fruits, oranges, lemons, olives and many other semi-tropicals, ripen their fruits; all northern fruits awaken from a short dormancy to bloom from January to March and ripen from June to November; all vegetables, except those counted tender, such as beans, melons and tomatoes, from an early start in the rainy season may come twice to edibility before the close of it. The term rainy season does not mean that rains are continuous. In fact, they are often lighter and more intermittent than is desirable and, therefore, irrigation is frequently called for in some of the nine months as well as during the dry season.

4. As the rainy season is the chief period of plant growth, so it is also the best time for field work. Even harvesting of hay and early grains is largely accomplished before the dry season begins on June 1 and harvesting and sun-curing of late fruits is done after the rainy season begins on September 1. Thus California farmers have no closed season and need have no idle days except when rains are actually falling in their own localities, for the occurrence of rain is not widely synchronous and the actual number of rainy days varies in different parts of the State. The annual average number of days on which rains fell for sixty-two years in San Francisco (which is approximately an average for the State) is sixty-seven, while in parts of California producing the greatest amount of crops the number is much less. With so few rainy days, with no ground

freezing and no snow except in the mountains, California is an ideal place for a man who wishes to keep busy in the open air during nearly all the year, and to secure maximum results from annual activity of men, animals and machinery.

It is obviously beyond the scope of this writing to undertake presentation of detailed data of California climatology or to discuss its salubrity from the points of view of physical comfort or escape from invalidism. The reader may draw inferences for himself from the somewhat new arrangement of meteorological data (set forth in Appendix B) which draws records from end to end and from side to side of the State—collocating them to show variations due to longitude, elevation, distance from the ocean, and the like. The arrangement also emphasizes the characteristics of the several regional subdivisions of California indicated in Plate III. Considering the geographical area included and the long periods of time covered, the tabulation in Appendix B comprises a summary of volumes of meteorology and by citing extremes as well as means of temperature for each month of the year, indicates with great definiteness what may reasonably be expected at any season in any region which the records represent. The data thus set forth, in connection with the descriptions of phases of rural life and the different requirements of various plants included in crop production, which will be undertaken in later chapters, can readily be translated into terms of significance to other phases of human life and industry.

REGIONAL AGRICULTURE OF CALIFORNIA

Although general statements based on the climatic satisfaction of the orange will apply to vast areas of California, as indicated, there are some parts in which such generalization is less true and some other sections in which it does not apply at all. It is this departure of the local from the general which gave rise to the claim that California has not one but many climates: in fact, from slight variations in temperature, moisture and soil conditions, measured by the particular requirements of different plants, there may be several climates on a single farm of a few hundred acres. Of course, soil suitability, moisture, exposure and the like, must be more or less closely prescribed and provided everywhere. The problem, however, is more complex in California than in most other farming states because a diversified topography makes more elevations and exposures, each with its own special characters, available for choice; also because crops are widely grown by two great water systems, rainfall and irrigation: and because California undertakes practically all the crops which are grown in the United States and adds to these some for which all the remainder of the country claims no adaptation. Realization that similar producing conditions group themselves in all parts of the State, not by degrees of latitude but by similarity which runs largely along lines parallel to the coast line and to the trend of mountain ranges, can best be attained by tracing resemblance from the

point of view of crop production through several subdivisions of the State as indicated on the accompanying regional map (Plate III). The descriptions of the divisions that follow will also include references to the meteorological factors [1] of temperature, rainfall and the resort to irrigation when needed to meet the moisture requirements of different crops.

The following statement of agricultural subdivisions of California, prepared by the writer after four decades of local observation throughout the State, was first published by the California Experiment Station in 1914 and is presented herewith with revisions suggested by later experience. Grouping local climatic conditions in their relation to crop production, the State may be divided into five regions, in which there will be some climatic features common to all, though they severally manifest sufficient differences of climatic conditions to determine roughly particular agricultural adaptations in all of them, viz:

1. Northwest Coast region.
2. Central Coast region.
3. Southern Coast region.
4. Interior Valley region.
5. Mountain and Plateau region.

The Northwest Coast region.

This section is hilly and mountainous, being covered principally by the Coast Range and its foot-

[1] Appendix B is arranged to show typical differences at similar latitudes and striking similarities, according to topographical conditions, with great differences in latitude.

hills. The valleys are relatively small and irregular, although the Eel River Valley has great area and the flat lands at Humboldt Bay are broad and rich. The important climatic features are the moderate temperatures throughout the year, the high annual rainfall, and the prevalence of high winds and fogs along the coast. In most parts the rainfall varies from 40 to 100 inches, the variation being mainly due to elevation. Rains begin earlier in the fall and continue later in the spring than in other divisions of the State, but the rainfall is always smallest in July and August.

This region most nearly resembles the East North Central and Middle Atlantic states in its agricultural operations and possibilities. It is eminently suited for the production of forage grasses and clovers, though alfalfa is less grown because of cool summers. Grains chiefly raised are barley and oats; corn and sorghums are likely not to ripen for lack of heat. The chief industry is dairying with grazing and root-crops. Apples and berries succeed admirably.

The Central Coast region.

This region includes coast slopes, many small valleys, a few of considerable size, and a large area of foothills and mountains west of the high ridge of the Coast Range, which at several points attains an elevation of about 4000 feet. Among the valleys are those of the San Francisco Bay district, the pioneer regions of commercial crop-growing and which now

constitute one of the largest highly developed and densely populated agricultural sections of the State. Central in this district lies the city and county of San Francisco, which enjoys the unique distinction of having produced the tallest sky-scrapers and the broadest cabbage fields in California. North of San Francisco the coast valleys are great producers of dairy and poultry products, fruits and field crops. South of San Francisco are the bay-shore valleys long noted for truck crops, fruits (the prunes of Santa Clara and the apples of Pajaro valleys) and the hay, grain and sugar-beets of Salinas and Santa Maria valleys, while adjacent hill lands are largely used for grazing and, on the coast side, for the dairy industry. The southern end of this region, comprising valleys and coast slopes, produces, in addition to grazing and dairying, sugar-beets and beans in abundance, and several situations are famous for their apples.

The Central Coast region is very diversified in topography, intermediate in temperatures and rainfall between its neighboring coast districts north and south. It has a range of products wide as the State itself, except that citrus fruits are not commercially produced, although grown by amateurs at favoring elevations and exposures.

The Southern Coast region.

This region extends from the point where the coast takes a sharp eastward turn and proceeds southward to the southern boundary of the State. Its width

is determined by the distance of the high ridge of the Coast Range from the ocean, narrow at the west, increasing toward the central part, where the San Gabriel and Santa Ana valleys extend northerly and easterly sixty miles or more from Los Angeles to the mesas and foothills of the high range on the east, and then narrowing again to its southern limit just below San Diego Bay. Owing to its environment and exposure, as well as its latitude, this region has more heat than the more northerly coast sections, though in its extensions away from the ocean it has had, in some places and at long intervals, a brief drop in temperature to a degree as low as other valleys with similar elevations. It is on the whole, however, most equable in its temperature and by this widely known characteristic has attracted settlement and development in some respects beyond other districts of the State. The products are large and various, including most of the present output of citrus fruits and walnuts, most of the beans, much of the sugar-beets and truck crops for overland shipment, and dairy, poultry, hay, grain, and orchard fruits for a part of its local consumption. It is for the most part an irrigated district, though some crops are successfully grown along the coast by rainfall and on the uplands away from the coast good results are attained by dry-farming. The rainfall average varies locally from 10 to 18 inches, part of which comes from the Mexican storm system in summer and early fall showers which are of little account except in truck fields and flower-gardens, and occasionally in-

terfere seriously with harvesting of beans and other field crops.

The Interior Valley region.

This region extends from the north end of the Sacramento Valley southward through the length of the San Joaquin Valley to the Tehachapi Mountains, which form its southern boundary. This pair of connected valleys constitute what is properly called "The Great Valley of California," about 400 miles long and from 40 to 60 miles wide. It contains a larger body of productive land than any other subdivision of the State. Central on the west side of the Great Valley are the deltas of the two great rivers whose names designate their respective valleys. The break in the Coast Range which gives outlet for their waters to the Bay of San Francisco, also admits an interior extension of coast influences that modify climatic conditions over these deltas and adjacent lands, as is indicated by the circular intrusion of Division 2 into Division 4 as shown on Plate III. This circular area is somewhat different in climatic characters, however, from those of either of the divisions to which it is related, for it is a blending of the two.

In the extreme southeast part of the State another area marked Division 4 is connected with the Great Valley because it has closer resemblance thereto, both in characters and products, than to any other region. It comprises the Imperial Valley and other valleys adjacent to the Colorado River. It differs from the Great Valley in having a higher tempera-

Plate II. The main geographical features of California.

ture both in summer and winter and in its smaller rainfall, which is practically negligible, as all cropping is conditioned on irrigation.

The Great Valley differs from the coast regions west of it in having a lower winter temperature, because its dominating environment is the snow-clad Sierra on its east side and the Coast Range on the west. This contrast is more marked through the central and southward stretches of the Great Valley. Another contrast is in summer temperatures which may average more than twenty degrees higher on the east than on the west side of the Coast Range, as the ocean then has a cooling effect on the regions open to its influence.

In rainfall the Great Valley has such marked differences that generalization is impossible. Roughly speaking, the Sacramento Valley may be said to have from 20 to 40 inches on different years, while the San Joaquin has from 4 to 16. This variation in rainfall is, however, overcome by irrigation which is practiced in the Great Valley over a greater acreage than in any other section of the State. The products include all grown anywhere in California. The Great Valley has always produced the chief part of the grain and hay products of the State. Its more recent development has included all of the raisin output and the chief part of the alfalfa, on the basis of which it now leads in dairy industries. It stands first in the production of shipping and canning fruits and in all fruits grown for drying except prunes and on the edges of the valley the citrus fruit product

is large and increasing. Its central delta region leads in all truck crops and field vegetables except lima beans and sugar-beets, although for the latter it has immense capacity and excellent adaptation. The Great Valley raises nearly all the rice and its southerly extensions, both the San Joaquin and the Imperial valleys, produce all the rapidly increasing cotton crop. The diversity and the producing capacity of the interior valley region of the State are beyond description and estimate.

The Mountain and Plateau region.

It has been found by observation during many years that what are known as valley conditions prevail to an elevation of about fifteen hundred feet over the rolling region known as the foothills, which are the steps up to the high ranges. Above this elevation winter temperatures fall lower, rainfall increases, snow flurries begin, and thence upward mountain valleys and plateaux are found at different levels to six thousand feet, which is about the top of California's agricultural lands, and above four thousand feet such lands are used principally for summer pasturage. This mountain region has a winter like that of the eastern states with precipitation of rain and snow ample to cause great rivers to flow down the west side of the Sierra and give the State its invaluable water supply for power and irrigation. In the valleys among the great snow mountains there are farming districts of considerable present production and great future promise. The most marked charac-

ter of these high lands is the limitations placed on cropping by the short growing season and the frequency of frosts during the spring and, at the higher elevations, even during the summer months. Therefore, this division differs most markedly from other California regions and has closer resemblance to some of the interior states than to the coast and valley areas. In this region there is a modification of temperatures from the north to the south, as it is more open to the influence of north and south latitude and is not so fully dominated by local topography and ocean influences, which give to the remainder of the State its unique climatic characters.

CHAPTER II

THE SOILS OF CALIFORNIA

THE soil of California was a puzzle to the pioneers. Their first conclusions and comments on its character and value varied according to the time of the year at which they first viewed it, but their conclusions were similar. If they came to California early in the rainy season, they saw valleys and hillsides covered with grasses, clovers and flowering plants in such areas that the whole country resembled a park. If they arrived late in the rainy season, they saw wild oats and other plants so tall that they could be tied across the horns of their saddles. Early in the dry season there was no verdure, except in the moist river-bottoms, and the plains and hillsides were yellow or brown with plants dried to death as they stood—hay made without hands, curing where and as it grew, nutritious because untouched by rain and eagerly eaten by horses and the wild herbivora with which the country abounded. If the pioneers came late in the dry season or later (until the rains began) they beheld bare landscapes, hill and valley uniformly sere and yellow with vestiges of sun-parched vegetation largely wind-swept into water-runs—mile after mile of bare soil seeming also to move with the

wind and the wide plains and hill slopes apparently barren and inhospitable to plants. The limitless park of him who came early in the year had changed to the boundless desert of him who came late in the same year.

From the two points of view the conclusion was at first similar—that such a country was of no agricultural account. Those who saw the park of the rainy season condemned the country for agriculture because the plants died in June and left the summer verdure-less just at the time of the year when the humid lands whence they came were green-clothed most abundantly. Those who beheld only the desert of the autumn did not know that the country was ever green and when told of it were not deeply impressed for, supposing that it had been green, what farming value had a country which would not stay green? And so California passed at first, in the minds of the tens of thousands who came seeking gold, as a country hopeless for husbandry, and the soil was chiefly blamed for it. Was not the soil which they crossed in their rush from the landings at San Francisco to the foothills of the Sierra Nevada, where the gold was, largely shifting sand and was it not like the shifting sand which those who rode for gold across the Great American Desert told them about, as the two streams of weary people met in the gold diggings? And are not all deserts caused by shifting sand, when the same sky covers both the deserts and the lands of permanent pastures which they all knew from childhood? So it was that the pioneers, no mat-

ter whence they came, concluded at first that California was not a farming country because the soil either could not sustain permanent verdure or would not keep plants green just at the time of the year when the landscape should be green.

These first general conclusions about the agricultural unsuitability of California were not seriously shaken by the observation of other newcomers who sought the gold after visits at the Missions, ranchos of the Spaniards who had gained Mexican land grants or the farms and gardens of the Americans who had established themselves before the gold discovery. At all these places these visitors saw in the dry season nothing green except alongside ditches in which water was running, and the trees and plants were largely unfamiliar to them. The demonstration that strange plants would grow in a way strange to them was taken to be a demonstration that away from these ditches, which could be provided of course only in a small way, the land would not support plant growth and surely would not grow those crops indispensable to American farming as they knew it. It is true that ample evidence was at hand at the Missions and elsewhere that the country would grow live-stock without irrigation. However, that fact was not very significant, for cattle-ranging was not then fully recognized as a phase of American agriculture and a piece of land with cattle-pens but no barns, hay-stacks nor cow-sheds could not be counted a farm. They blamed the deficiency chiefly to the soil, which was obviously that of a desert and not of a farming country.

The depth of error into which the first Americans fell in their misconception of the agricultural capacity of California soils was well matched by the speed with which they arose from it. Only a year or two elapsed before daring adventures on the part of a few discerning men, in both coast and interior valley locations in the central part of the State, demonstrated that the soil was unusually rich and capable of incredible production of plants which would make their growth at the temperatures prevailing during the rainy season and could be carried along to full maturity after the rains had ceased; that tender plants requiring frost freedom and summer heat could be grown without a drop of rain from seed-sowing to harvesting, if the moisture of the rainy season were conserved in the soil by tillage. It was the first demonstration of the efficiency of dry-farming principles and policies in the United States, a whole generation before dry-farming prophets began their work, both for good and evil, in the prairie states.

When the pioneers observed more closely the soils with which they had to deal and the behavior of plants upon them, they soon reached several important practical conclusions:

First: That the soils were, as a rule, different from those in the states and countries whence they came.

Second: That there was great variation in the soils of different locations and that in many cases these locations were so near together that there might be several diverse soils within the limits of an ordinary farm—just as, judged by the behavior of the same

plants at various elevations and under different exposures there might be several "climates" on the same farm, as has already been stated.

Third: That the soils were, as a rule, light, mellow, naturally well drained and easily worked, although local areas might be quite otherwise.

Fourth: That the soils were usually very deep, "deep as a well" as frequently expressed, because well-digging gave the pioneers their first evidence of depth. Occasionally bed-rock or impervious hardpan was encountered very near the surface.

Fifth: That in deep soils there was little difference in fertility between the surface soil and the subsoil; that in some mysterious way the soil had been "weathered" all the way down as shown by the fact that earth thrown out in digging ordinary wells or cellars would grow as good plants as the old undisturbed surface. This was a surprise to those who came from humid regions where even too deep plowing would bring up subsoil which had to be made fertile by manuring and aeration.

Sixth: That in spite of these widely prevalent facts there were considerable areas of land on the valley floors which might be either light or heavy, deep or shallow; which in the rainy season looked rich and productive but would either grow no useful plants at all or else would start them along well in the rainy season only to destroy them soon afterwards before they could come to profitable maturity.

Practical conclusions from the experience of the pioneers were that California soils were, as a rule,

deeper and richer than any they had ever known elsewhere and would grow grains, garden plants and fruits-trees to a surprising size and abundance, but that there were cases in which such results could not be attained. Almost from the first there arose a demand for scientific study of soils. After a few scattering soil determinations by chemists whose chief work was for miners and who accompanied their analyses by such exposition of soil characters as they could draw from European sources, a systematic and exhaustive study of California soils was begun in 1875 by E. W. Hilgard, founder of the University of California Experiment Station, and continued by him and his successors for about forty years. This undertaking not only placed California in the leadership of all states in soil investigation and understanding, but it also resulted in an interpretation of the relations of climates and soils both in formative agencies and characters and in requirements of tillage and cropping. This gave the work world-wide significance in the contrasts which were made of soils formed under humid and arid and semi-arid conditions and the natural superiority of the latter when a system of agriculture which provided irrigation and tillage, as conditions might require either or both for different classes of plants, is faithfully pursued. Fortunately Dr. Hilgard lived to put his wide-reaching results into generally available form.[1]

On April 1, 1900, in the latter part of the period

[1] Soils: Their Formation, Composition and Relations to Climate and Plant Growth, by E. W. Hilgard. The Macmillan Company, New York, 1906.

of Hilgard's work, soil surveying and mapping was begun in California by the Division of Soils of the United States Department of Agriculture under the direction of Milton Whitney, which in 1913 was merged into coöperative soil investigation with the California Experiment Station. Thus, California has had continuous field and laboratory soil study for forty-five years and the greater part of the agricultural area of the State has been covered.[1] In addition, the area of the National Forests in California, comprising about nineteen million acres in 1918, has been covered by the forest land classification of the Division of Forestry of the United States Department of Agriculture. These National Forests and their agricultural significance will be considered more specifically in a later connection. The regions for which soil surveys have been made are indicated in Plate IV.

By reason of their uniqueness and diversity and their adaptation to such varied production; because of the association of rainfall and irrigated agriculture; and because the latter presented demonstrations of great suggestiveness in the reclamation of arid interior states, California has presented a very attractive field for soil research from the points of view of actual crop production and of soil science. The results of such research by a score of investigators are succinctly presented by C. F. Shaw, who has had charge of the government and state coöpera-

[1] A list of the areas covered by the Division of Soils of the U. S. Dept. of Agr. and of which soil maps and descriptions are available, is given in Appendix C.

tion in soil work since 1913, in a station publication [1] from which the following statements, leading to a correct understanding of the origin and nature of California soils, are selected:

"In the humid regions of the world, and especially in the humid region of the United States, practically nine-tenths of the soils are either of residual or of glacial origin. The glacial soils have been transported and deposited by ice, and while the glacial deposits may be very deep, the true soil is not deep. The subsoil is usually heavier than the surface, often clayey, and the practical feeding depth of roots is usually less than four feet. The residual soils are much more extensive than the glacial soils. They are formed by the destruction of rock masses, the disintegrated and decomposed fragments accumulating on the surface of the hard rock to form the soil mass. Residual soils usually have a surface soil six or eight inches deep, resting on heavier material that grades to a clay at two or three feet in depth. At greater depths rock fragments are found in the clay and these grow more numerous until the mass is largely broken or 'rotten rock,' and finally the solid rock mass is reached. The total depth of the soil mass above the rock varies greatly, but usually is less than four feet.

"In the humid regions, the transported soils, other than those formed by glacial action, are of little extent. The flood plains and bench lands along the rivers and creeks are exceedingly productive, but

[1] Circ. 210, Calif. Exp. Sta., Berkeley, March, 1919.

their total area is small compared with the residual and glacial soils.

"In California, as in all arid regions, the residual soils available for agriculture are of relatively limited extent, forming about 10 per cent of the arable lands of the state. They are found on hill slopes and on mountain sides and their topographic position makes irrigation exceedingly difficult or impossible, while the shallow soil mass makes dry farming precarious.

"By far the larger portion of the agricultural lands in California are transported soils. For uncounted ages the winter rains have been washing the rock fragments from the mountain sides and carrying the material out to the valleys, spreading the mass out as broad sloping alluvial fans or as relatively flat valley floor. The accumulation of sediments in the valleys is often hundreds or even thousands of feet deep.

"Soils formed in this way may be quite uniform to great depths or may be made up of successive layers of varying texture, sands, silts, gravels, or clays. As the soils are laid down a little at a time, year after year, they have been acted upon by weathering agencies breaking up the particles and making the plant food quite available. Under the climatic conditions that exist, with the hot dry summers and the low rainfall in winter, the weathering action of air and water, the beneficial action of bacteria and the formation of humus in the soil, occur to considerable depths and roots ordinarily penetrate to

depths of six to eight feet below the surface. In studying the soil, it is necessary to consider at least a six-foot section, instead of the usual three-foot section of the humid regions. The climatic conditions of the region and the mode of formation of the soils have brought about many features that are not common to the soils of a humid region. Owing to the deficiency of rain, the soils have never been subject to any great degree of leaching and most of the soluble materials have been left in the soil mass.

"These transported soils fall into two groups—the *recent transported* soils and the *old transported* soils. The recent soils form about three-fifths of the arable lands of the state and represent the best and most desirable soils. The soil mass is usually quite deep, and uniform in general character. Nearly two-thirds of these soils have excellent textures, ranging from sandy loams to clay loams. These soils are easy to work and take irrigation water readily, making them very desirable for almost any type of farming. About 10 per cent of these soils are of a sand or gravelly nature, loose and open, and of a 'leachy' character. Because of the low rainfall and consequent lack of leaching, however, the sands are much more productive than are similar soils in a humid region. Properly farmed, these sandy soils prove very productive and desirable.

"Less than 3 per cent of the recent transported soils are heavy in texture—clays and clay adobes. The term 'adobe' does not indicate a specific kind of

soil, but refers to the structure. There are clay adobe, clay loam adobe, and loam adobe, although the latter is very rare. The name is given to any soil which on drying shrinks markedly and breaks into blocks with wide cracks between. An adobe structure is undesirable because the soils dry out, not only from the surface but also from the sides of the wide cracks. The adobe soils are difficult to till and maintain in the proper state of granulation, but with good farming methods a good structure can be maintained. These soils are very rich, giving high yields of the crops that are adapted to such heavy soils, especially grains and grasses.

"The recent transported soils occupy level to sloping positions, and are readily put in condition for irrigation farming. They are productive and are desirable above all the other soils of the state.

"The *old transported* soils form about one-third of the arable soils of California. These soils occupy undulating or rolling topography with some hilly and broken areas. They have subsoils that are distinctly heavier and more clayey than the surface soils, and over one-half of their area is underlaid by hardpans at depths of from two to four feet below the surface. In most cases the material beneath the hardpan is loose soil very similar to that above the hardpan, and if the pan is broken by dynamite or other means, irrigation waters and plant roots may readily work down into the underlying soil mass. In such cases the hardpan is not a serious factor as it ordinarily

re-cements very slowly. In some cases the hardpan is underlaid by a compact, semi-cemented layer of soil, sand, and gravel that is practically impenetrable to water or to plant roots. With such soils, dynamiting the hardpan is of little or no value as there is no good soil beneath for the roots to penetrate and no opportunity for drainage or aeration through the substratum.

"There is another class of hardpan that occurs where variations in the soil-forming activities caused a layer of soil to be deposited, then a layer of material that cemented to a hardpan, then another layer of soil, another layer of hardpan, and so on. These hardpan layers are hard to handle, as blasting is not satisfactory unless each of the layers is broken. The hardpan layers do not, however, exist as continuous sheets because in the process of formation of the soil, portions were washed away, the space being filled with other soil materials. This, together with the fact that the hardpan is often cracked and sometimes rather soft, gives opportunity for irrigation water and plant roots to penetrate to considerable depths.

"Most of the old transported soils have medium textures, with about one-third of a heavy texture and with very few areas of coarse sandy nature. The soils are productive but root and water penetration is retarded by the heavy subsoils or by the hardpans, and their uneven topography makes irrigation difficult and expensive. They give good results with most of the crops of the state, and when their natural

handicaps are overcome, they closely approach the recent soils in agricultural value.

"Wherever drainage conditions are poor and there is a larger amount of water passing from the surface by evaporation than passes down through the soil mass, there is the possibility of an accumulation of soluble material or 'alkali' on the surface. The term 'alkali,' as ordinarily used, includes any soluble inorganic salts present in sufficient quantity to be injurious to plants. The most common materials are sodium chloride or common salt, sodium sulphate or Glauber's salt, and sodium carbonate or washing soda. This 'alkali' is not necessarily brought into the soil from some other location. It is merely a result of a regrouping of the chemicals that existed in the original rock, and the concentration of these compounds in the surface soil because of excessive evaporation.

"If the soil has good natural drainage, any excess of water will percolate through the soil and will seep out to the country drainage channels, carrying with it in solution, small quantities of the soluble salts. In such cases, the waters evaporated from the surface cannot exceed the amount that passes down through the soil, and alkali accumulations cannot occur. If the natural drainage conditions are not good, artificial drainage will be necessary if the land is to be irrigated and farmed. In arid regions, the irrigation of poorly drained lands will ultimately bring about the accumulation of injurious amounts of alkali.

"The soils of California taken as a whole are exceedingly productive. They may be compared to the rich bottom lands of the humid regions. The unfavorable conditions that may exist, such as hardpan, alkali, poor drainage, poor structure, etc., can be readily recognized; but a superficial examination of the soil is not enough. Soils should be examined to a depth of at least six feet, bearing in mind that plants that would in a humid region send their roots two or three feet into the soil, are advantaged in California by having a root penetration of six to twelve or more feet."

The reader may perhaps be assisted to a fuller realization of the unique characters of California soils and their diversity within exceedingly narrow limits by considering the foregoing carefully drawn details of their occurrence in connection with the references to topography in Chapter I. Let him remember that above the timber line he may stand upon many peaks and ridges of perfectly bare granite and look down upon valleys, fifty miles away and ten to fourteen thousand feet below, in parts of which borings of two or three thousand feet through the soil mass have not reached bed-rock. With such extremes within sight it is perhaps easier to realize the diversity at various elevations and inclinations between them.

Determination of the adaptations and capabilities of California soils by the pioneers through their introduction and trial of plants from all parts of the earth, followed by definite understanding of general and local soil characters and qualities resulting from

scientific study, have exerted a marked influence not only in stimulating general diversification and building up great outputs of special products not largely undertaken elsewhere in the country, but have also profoundly influenced rural life and development. Actual sight of what the soil could do induced many of the argonauts of 1849 to forsake their quest of gold for agricultural enterprises. Reports of their achievements by residents, tourists and expert investigators during the first decade of California's statehood were published in popular and scientific journals and books and attracted immigrants of good mental capacity, experience in projecting new enterprises and possessed of adequate capital to invest in land and enlist in agricultural production both staple and unique. As these undertakings attracted persons of all nations, they brought to the new country knowledge of plants and products beyond the American range of cultures and productions, confident that California's natural conditions favored success with them. Soil characters and capacities have always been considered influential factors in determining human development and progress, and the soils of California are probably to be counted among the best of the natural advantages of the State.

CHAPTER III

OTHER RESOURCES OF CALIFORNIA

ALTHOUGH from the agricultural point of view California is a state of open lands, requiring no clearing or at most the removal of a few scattering trees from large areas, it possesses forest of great extent, comprised of trees which add to large economic values unique characters of longevity, majesty, symmetry and beauty and biological habit which have induced science, literature and art to qualify them as the most remarkable trees in the world. These forests constitute one of the natural wonders of the State. Description and portraiture of them have been presented in nearly all popular publications for the last half century. Most exact exposition of their species, singly or in groups, has been made by botanists in text-books, monographs and reports. The United States government has reserved its right of continuous possession of vast areas so that coming generations may see living things which really began to grow on the face of the earth when Solomon was building his temple, three thousand years ago. Although the "big tree of California" *(Sequoia gigantea)* stands in the Sierra Nevada Mountains the supreme manifestation of arboreal size, age, impressive

grandeur and creative power, this conifer is not itself the embodiment of California's greatness in trees but only an exponent of it. A sister species, the redwood *(Sequoia sempervirens),* of the northern coast region has specimens that are actually taller and have greater area. On the whole, the redwood is incalculably greater in its service to mankind and it also has the power which no other great conifer possesses, to restore the forest from sprouting stumps. Nor are the "big trees" comparable, in their possession of area and industrial value, with either of several pines, firs and cedars which attain a stature, bulk and lumbering value in single trees and acre-product beyond the attainment of these species in any other state except in Oregon and Washington. Scientific interest has been centered in the "big trees" as survivors of a genus which in geological time was so wide-flung over the North American continent that it lived in Greenland, and yet it has now no living species on the continent except in California. Out of three hundred species of oaks in the whole northern half of the world, California has exclusively for her own fourteen species, of which single trees have achieved world fame in both popular and scientific publications. W. L. Jepson of the University of California writes in his "Silva of California": [1]

"Even today scientific knowledge of the forests of California is still in its infancy, although it can now

[1] "The Silva of California," page 9: by Willis Linn Jepson: Memoirs of the University of California, Vol. 2, Berkeley, Calif., 1910.

be said that we have here the most remarkable development of coniferous forests to be found anywhere. While this statement is not true as to any one characteristic it is believed to be true as to the sum total of their characteristics, their richness in species, the features of their geographical distribution, their biological history, and their commercial value both as to relative quantity and actual quality."

The relations of the forests to the development of California rural life, both in its spirit and its industries, are notable. As an inspiration to nobler thoughts and loftier sentiments, the great temples and communities of trees have been and always will be a great uplifting influence in life. It is conceivable that the first great service of the forests to the agriculture of California was their testimony to the capability of its interior districts for the excellent growth of plants. Prospectors searching for gold almost always returned with incredible stories of strange trees, not merely hugging the edges of streams but growing in continuous profusion across their valleys up their inclosing slopes and upward and beyond over ridges and up mountain sides until they reached scant vegetation again near the lines of perpetual snow. There were abundant tales of looking from the floors of glacial gorges thousands of feet deep and seeing great trees perched upon the bare granite; wonderful trees rooted in crevices of outjutting rocks where no soil could be discerned and resisting by their own individual strength the forces of tempests against which trees in forests defend

each other. It is impossible to estimate now how great influence these early observations exerted against the conception that California, except where water ran, was a desert.

It was not long before the early California farmers and miners learned that these great trees were not only wonderful but that their companionship was salutary to both body and spirit. When the lack of sanitation brought serious trouble to those who were mussing below with water from the ditches either for gold or for crops, through ignorance that malaria was the result of mosquitoes rather than of the water which bred them, the settlers fortunately recovered health and courage by dwelling for a time in the forests beside the pure cold springs and streams of the mountains. It is a notable advantage that throughout a distance of at least four hundred miles in the great interior valley of California, and for less distances in shorter valleys, persons are nowhere more and generally less than fifty miles from mountain forests. Each year the government is extending roads and trails to supplement the State highways and make easy access to the well-ordered camping places and hostelries which are multiplying both at public cost and through private enterprise.

Details of forest policy and practice, of private owners, of the national government in the management of the national forests and of the State officials in protecting forest property, are beyond the scope of this writing. Estimates of forest areas, of standing timber and records of current production of

various kinds are given in Appendix E and furnish the reader data with which he can construct whatever specific conceptions of the industrial achievements and opportunities will serve his interest and purposes in connection with the forest resources of California.

The commercial output of the forestry industries may be valued at about $60,000,000 annually and investments in lumbering equipment reach nearly as large an amount, constituting them the greatest manufacturing industry of the State. They furnish a home supply not only of the materials for the construction of farm buildings, and structures of great area and capacity which minister to agriculture, as warehouses, packing-houses and the like, but of the containers in which about $250,000,000 worth of horticultural products are annually marketed. Boxing fruit products alone consumes 250,000,000 feet of lumber. California would have been seriously handicapped in establishing boxed goods from the farms and would have been largely denied the enjoyment of the safety, cleanliness and profit from such containers, not to speak of cross-ties for 7537 miles of railway within the State to roll them over, if the producing farms had not been so near large forests and timber production within her own boundaries. There is also a direct return to the State of the value of forest products marketed beyond state and national boundaries. Much of the one and one-half billion feet (board measure), which is the annual cut, goes by rail and sea to other states, even to

those of the Atlantic Coast, and many cargoes also to foreign countries.

California has four national parks, six national monuments and seventeen national forests (formerly called forest reserves), concerning all of which definite data are given in Appendix E. Although the national forests in California occupy the roughest and most mountainous portions of the State, they contain resources conservatively valued at $250,000,000. They contain about one-third the timber of the State; they provide forage for a large proportion of the live-stock; they include sources of vast water-power. None of these resources is reserved from use except in occasional cases in which one use is incompatible with another.

The mature timber in national forests is for sale, but the title to the land and the immature forest remains in the ownership of the people. Permits for grazing live-stock are sold from the point of view of the conservative use of all land adapted for grazing, the permanent good of the live-stock industry through proper care and improvement of grazing lands, and the protection of the settler and home builder against unfair competition in the use of the range. Permits for the development and use of water powers are granted under regulations which seek to prevent appropriation for speculative purposes, to secure prompt and full development, to prevent monopoly, and to secure beneficial protection to the water-shed. It is officially announced that the national forests are "open to all persons for all lawful

purposes. The timber, water, pasture, and other resources are for the use of the people, and the minerals are open to exploitation just as on the unreserved public land."

Claims for ownership of lands within national forests may be initiated under the mining laws, the coal land laws, and the forest homestead act. Prospecting is not interfered with in any way. Timber may be used free of charge by *bona fide* miners and homesteaders who may not reasonably be required to purchase and who have not on their own claims a sufficient or accessible supply. Thus, in addition to the general uses of the forests for timber, stock range, water power, summer-recreation resorts, the natural resources of the national forests wait on individual enterprise for development and will in coming years furnish homes and industries for a large mountain population.

Toward the realization of all these great public services from her forested area, California is advancing commendably. For administration of national interests and affairs, California is constituted District 5 of the United States Forest Service with offices in San Francisco whence proceed the transactions outlined above, through officials resident in the several forests.

California began legislative enactment and appropriation to promote forestry about forty years ago and has proceeded somewhat irregularly and intermittently, but on the whole progressively, since that date. The existing phase of State policy consists of

the activities provided for by the legislature of 1919, thus: "The Governor shall appoint four persons, one of whom shall be familiar with the timber industry, one with the live-stock industry, one with the hay and grain industry and one at large, who together with the State Forester shall constitute the State Board of Forestry, which shall supervise and direct all matters of State forest policy, management and protection." The enactment is unique in providing that a majority of the board consist of representatives of lumbering and agriculture, but the arrangement has worked so well that the legislature of 1921 refused to include this board in a general merging of special commissions which was largely accomplished by it. The functions of the State Board of Forestry are also somewhat unique, in that it has added to the usual undertakings of forest protection, promotion of tree planting along the highways (for which a State Nursery was established in 1921); the important work of county organization for subduing field fires and experimentation in the line of reforestation of cut-over lands, to demonstrate to private owners the practicability and profitability of such enterprise on their part.

Forest planting as a promising investment for future profit has been a popular topic for discussion ever since the pioneers began settlement on the treeless plains of California but, beyond scattered planting for local woodlots and for shade and ornamental purposes, very little has been accomplished. Now and then agitation arises for the planting of acacia

forests for the production of wattle bark for tanning, camphor forests for gum camphor, various eucalypts for hardwood as the native timber is practically all soft, but no considerable enterprise has resulted. This is chiefly because possible profit is necessarily remote and because the labor and water which such undertakings would require have always been too high priced to warrant entrance upon them. The only exception to such caution and conservatism was the boom in eucalyptus worked up by land speculators about 1905, in the course of which considerable losses were incurred by investors who allowed themselves to be persuaded that eucalypts required neither good land nor moisture supply to make profitable growth. In this way the eucalypts, which are, when properly placed, the most profitable and satisfactory timber trees ever introduced into California, were afflicted with a bad name through no fault of their own.

A concrete relation of the mountain forests to the foothill and valley development and prosperity lies in the service of these vast forested areas to the creation of power and supply of water for irrigation of rural, and for domestic and industrial uses of urban communities, in the valleys and along the coast regions where gravity transports it. If one will follow the outlines of the topography of California, as given in Chapter I and Plate I, it will immediately be suggested that California is singularly a unit in natural water storage and stream flow. The snow falls on the forested mountains and the streams from its

melting thread the valleys to the ocean. Thus California, speaking generally, receives water from no other state nor gives water to any other. It is true that in the extreme north of California the Klamath River rises in Oregon, but makes only a short run therein; that the Truckee River escapes into Nevada, but the latter owns half the lake of which it is the outlet; and that the great Imperial Valley of southeast California is irrigated from the Colorado River which is the boundary of the State in that quarter. With these exceptions California catches her own water and keeps it, excluding that which cannot be withheld from the ocean. Less will be lost in that direction as more is stored for various uses in the development of the State, and as the requirements of power, irrigation, domestic use and navigation are finally adjusted. It is of incalculable advantage that California owns her own catchment areas, and that her streams live their whole lives within her own geography. The condition that makes this advantage realizable lies in the forested areas which catch the snow and hold the water for prolonged outflow during the dry season. The maintenance of the forests and the prosecution of engineering works to supplement their beneficence by regulated distribution to the valley streams and irrigation systems will secure the California of coming centuries a density of population and an aggregate of production which will insure prosperity. The present generation is awake to its duty in this direction and all sessions of the legislature consider ways for discharging it.

MINES

Wholly apart from its relations to agriculture and agricultural people, some of which are indicated in Chapter IV, the California mining industry is great in its achievements, unique in its methods and varied in its products. Greatness and variety are demonstrated by the official outline of the products of 1920 (given in Appendix D) with a total valuation of $242,142,000. A few facts about the leading items in that statement are of popular interest and significant even in a book treating of rural affairs as showing the relations of California to other states and provinces in an industry often closely associated with agricultural development and a force therein.

California has justified the name "Golden State" by leading in gold production for the last seventy-two years, except for a few years when Colorado held temporary leadership. California has yielded $1,720,139,958 during seventy-two years, nearly one-half of all the gold produced in twenty-two states of the Union since records began in 1792. The geographical and topographical prevalence of gold in California is also of striking interest as shown by the following statements: [1]

"California is still the leading gold producer among all the states of the Union and there is still a greater number of gold mines than in any other state.

[1] History of California by Zoeth Skinner Eldredge, Vol. V, p. 200. Special article, "California Mining History," by Charles G. Yale.

Gold is being mined in thirty-one of the fifty-eight counties.

"Among the twenty-five gold mining states of the Union California has, as a gold-producing region, the distinction of holding the records on all counts. California has made by far the largest aggregate yield; the largest output in a single year; the highest annual average; the lead as a gold producer for the greatest consecutive number of years; the greatest number of varied branches of gold mining and the widest distribution of gold deposits.

"Gold is mined in the highest parts of the Sierra Nevada, the foothills, the valleys and on the beaches of the ocean. Even in the wastes of the Mojave and Colorado deserts are many productive gold mines. In one county there are gold mines being worked at elevations of 9000 to 13,500 feet and at places more than 200 feet below sea level. In another county from the opening of a vertical shaft at 1500 feet above sea level they are mining to a depth of 3896 feet, or 2394 feet below sea level."

The climate of California favors mining, as it does farming, with a whole year suitable for working in the open. Even in surface mining there is no unpropitious season, if water has been provided for the period of dry streams. The combination of mining and farming helps to keep some men busy all the year. Yale says:

"In some of the foothills and upper valley counties men work in their orange and olive orchards and

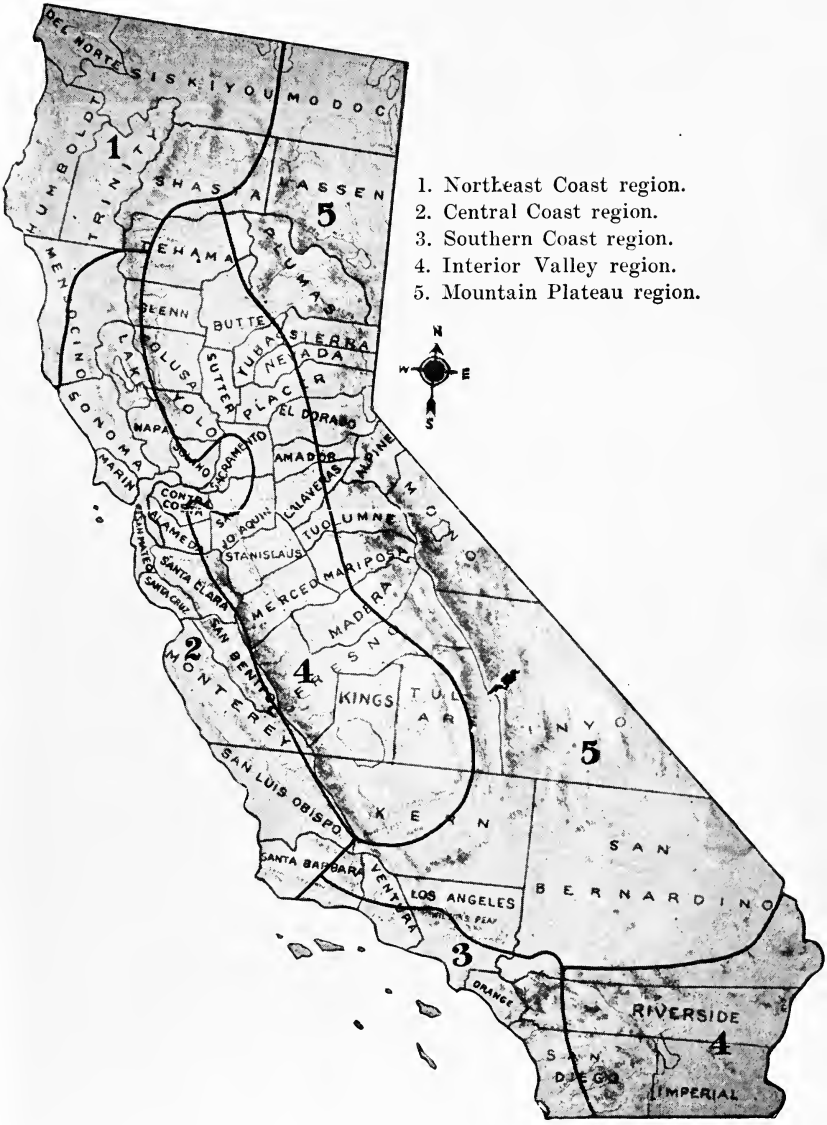

Plate III. Climatic regions of California.

vineyards during one season and drift under them for gold at another season."

Many times the value of the gold output is the petroleum product. The amount and valuation thereof for 1920 are estimated to be 105,000,000 barrels, valued at $194,000,000. This is not only larger than the output of any other state but constitutes 23.8 per cent of the total production of the United States. The oil product compensates California for her deficiency in coal, of which the supply is small in amount and of poor quality. Aside from general uses of the oil for heating, power in manufacturing, transportation and generation of electricity—all of which are of great value in State development—the contribution of the oil wells to agriculture is great and varied. California oil has chiefly an asphaltum base which distinguishes it from the oils of the older states. This has proved of large use in highway improvement both as a cover for concrete road-beds and for direct application to dirt roads; other petroleum products supply the motive power for irrigation and drainage pumping; for the engines of tractors and for farm motors generally, while the ample home supply of gasoline from oil wells is one of the factors which has enabled California to take the lead in the ownership of automobiles which are run with cheap lubricating oils also from petroleum. Thus the petroleum product furnishes what is needed to move with and move upon, most cheaply and efficiently.

Many important facts and influences could be cited in connection with other mineral products of

California, but they are not of primary agricultural significance. It is said that upwards of seventy metals and mineral substances are known to exist in California of which more than fifty are commercially produced. It is, however, agriculturally notable that California produces about 30 per cent of the potash now being derived from American sources.

FISH AND GAME

The formal reports of explorers and the gossipy narratives of visiting mariners, trappers and adventurers furnish ample evidence of the abundance of wild animal life in California before the American occupation. The aborigines had little prowess as hunters and did not seriously dispute possession of the country with the cougars, several kinds of bears and many less noble marauders which preyed on the immense herds of antelope and other grazing wildings which occupied the valleys. The Spanish and Mexican rangers of the early days did not undertake any serious conflict with the "big game" of the country—their cattle and sheep were so abundant and cheap that it seemed better policy to divide with their enemies than to fight them. In fact, this abundance was perhaps a factor of protection to their nearer grazing grounds which the beasts had little temptation to invade. Indeed the rancheros and the herders for the Missions made direct contribution to the support of the lordly carnivora of the country, as the horses, cattle, sheep and hogs which

escaped from their vaqueros were not thought worth pursuing. Instead of reducing the numbers of large, ferocious beasts, they probably multiplied them by filling the regions outlying the ranches with herds of domestic animals gone wild, which were more easily captured than the really wild grazing animals. The result was that at the time of the American occupation both the mountains and valleys of California were teeming with wild life—which was an inspiration to the early naturalists and was full of both sport and sustenance to the mining camps and pioneer farms.

Of course, as American development of the country proceeded, the aggressive flesh-eaters were either destroyed or driven back to haunts in strictly wild regions where bold hunters have now to seek them—although occasionally, even now, they may advance singly far enough into the borders of farming country to stir up the excitement of a neighborhood hunting party. In the counties which include mountain grazing country marauding wild life is still held in check by standing bounties for trophies of the hunt and the rangers in the national forests pursue systematic warfare for the protection of grazing animals. But on the whole, of the undesirable wild beasts of boldness and capacity there is little left but sport.

Of desirable wild life, mammal, bird and fish, California has been fortunate in conserving most creditable resources. Legislative provision for custodianship of local species and for introduction of supplementary species from other parts of the world,

was begun soon after the organization of the State government and has proceeded toward systematic regulation of sport and industrial hunting and fishing to the present time. For more than half a century there has been at work a very well-informed and energetic Fish and Game Commission which has secured new laws for the protection of species, either by limiting or prohibiting, as conditions might require, and by coöperating with the national authorities in provisions for introduction, propagation and distribution. The result is that such desirable animals as deer are reported to be increasing, although as many as 15,000 male deer are killed each year. Of wild ducks there is also an increasing supply although an annual kill of a million ducks is reported. It is not so notable that wild geese should also be numerous for the annual kill is only one-tenth as many. The abundance of quail is gratifying testimony to the efficacy of a closed breeding season, for this bird is multiplying in nearly every county, although uncounted thousands of quail-shooters go out after them as soon as the season opens and return heavily laden. Of stream and lake trout, owing to the maintenance of about ten hatcheries and the vast numbers planted out each year (estimated to be about twelve million small fry) it is possible that this fish is as abundant now as when the pioneers reported the streams teeming with them.

The commercial fisheries of California are of considerable moment, about 4000 licenses for such business being annually issued. The value of the catch,

direct from the boats, was estimated to be $4,000,000 a few years ago and since that time it has considerably increased, both in quantity and value. Of the product in commercial form canned salmon has also greatly advanced. The production of sardines in olive oil is the largest sardine output of the country and the great tuna of the Pacific seems to be just coming into its own as a canned fish.

Hunting and fishing are under State control in California and the issue of 250,000 licenses to individuals for hunting and fishing is the record of a recent year.

CHAPTER IV

HISTORY AND DEVELOPMENT OF AGRICULTURE IN CALIFORNIA

As it is the purpose of this writing to characterize the rural life of California as an American State and to indicate agencies and influences which prevailed in its development toward present conditions and achievements, it would not be germane to pursue affairs that made no contribution thereto even though they are of great historical or ethnological interest. One such question is the aboriginal population. It is estimated that when California was entered for settlement by the Spanish missionaries in 1769 there may have been a third of a million Indians, living in groups comprising hundreds of self-governing tribes speaking more than a hundred dialects, scattered throughout the State. Although this density of aboriginal population gave California the leadership of the states, for it has been estimated that "with one-twentieth of the area of the United States California held one-eighth of the native population of the whole country," these strange people contributed to the Spanish development only inducement and opportunity. The inducement was the saving of their souls from paganism: the opportunity was wide open

because they had nothing of the war-like self-assertive character of the other Indians of the Pacific Slope and made no fight against being civilized. Nor did they contribute anything to the agriculture of the State, for they practiced no agricultural arts. They subsisted on nature's bounty and were not even hunters with prowess against big game. They were contented with vegetable food which they gathered from wild trees and shrubs and with such land and sea animals as they could catch in the fields and forests or dig from the sea shore. If they had been fierce like the Indians of the great plains, California settlement by the white race would have been delayed and accomplished with difficulty. If these Indians had ancestral agriculture, there would have been vestiges remaining as there are now of prehistoric farming in Arizona and New Mexico. Although the pious padres may have reinforced the heavenly hosts with California Indians, they did nothing to improve their hold on the earth. The early Spanish and Mexican settlers reduced them near to slavery and though their successors, the Americans, had perhaps more regard for their manhood and employed them at good wages, they did not otherwise advance their interests until quite recently. Of the large aboriginal population there now remain only about 15,000 living peaceably on reservations or doing useful work for farmers and in a few cases engaging in successful farming on their own account in American ways.

There is wide agreement among historians that the chief contribution to the development of Cali-

fornia by Spanish possession (1769–1822) and by Mexican possession (1822–1846) consisted in holding the country for American occupation in 1846. It was loosely but still sufficiently held by Spanish possession and prestige to exclude adverse entrance. The agriculture and rural life was that of old Spain, expanded and rendered heroic by the abundance of rich land and of servile labor to be had for the taking and the very few adventurous settlers at hand to take them. These few naturally surfeited themselves with land and free labor and established over the areas they occupied a system of agriculture and a form of rural life wholly at variance with the American standards developed in the Atlantic states and being rapidly carried westward beyond the Mississippi River. California was as loosely held agriculturally by the people of Spanish birth and descent as it was politically, and both holdings disappeared together on American occupation.

Although the few Americans who came to California before the gold discovery in 1848 and the throng which poured into the State immediately afterwards included the most adventurous, the prevailing sentiment among them (except with a small percentage of the swash-buckling and criminal classes that was speedily suppressed) was to pursue undertakings honorably with regard to human rights, to establish enterprises on the basis of thrift and efficiency and to develop a State of high ideals, socially and industrially. In thrift and efficiency there were broader views and more expansive methods than in

the older states, and it is possible that an inheritance from the free life of old Spanish rancheros may have been added to the adventurousness of the American pioneers or have suggested new ways to embody the spirit of it. All the settlers felt, however, that the old way was not the method to farm, either for the success of rural life or for the up-building of the country.

The debt of existing California agriculture to the system that preceded it lies not in policies or in methods either of life or industry but in a demonstration of the producing capacity of the State for food crops and, in a few striking instances, for the introduction of agencies and materials of production which have rendered valuable service in the American development. A few of the old affairs, some of which have "passed in the night" and some endured, may be briefly cited:

The Spanish system of land grants and the confirmation of three-fourths of them to their holders by the United States compelled a new American State to set forth on its career with a handicap of feudalism. Spain was conservative and only made about twenty grants during fifty years and grantees were each restricted to three leagues (4,438½ acres) of land: Mexico was lavish and gave nearly six hundred grants during twenty years and raised the limit to eleven leagues of land to each. Besides proper grants there were about two hundred which could not be established.

Such large areas under single private ownership

and the creation of ducal establishments thereon may have been even desirable from the point of view of holding an unpopulated country with endowed landlords and a self-supporting army of retainers, but it was not only an anachronism after American occupation but a serious obstacle to development. Ownership of arable land in large tracts has always been popularly condemned in California and, although such holdings have been disintegrating for several decades, the inheritance of the Spanish grants and the aggregation of land in Spanish style by grant or otherwise have always been detrimental to the State. It was adding to the evil influence of the grants to allow the original owners of them to be robbed of the land by unprincipled lawyers and greedy speculators.

Although the Spanish conception of exemplary agriculture and rural life was not acceptable even to some of the early Americans who became citizens of Mexico, and although these policies and methods were almost universally rejected by the pioneers of the American occupation, it is indisputable that an inheritance from the old régime entered into the conceptions and forms of enterprise of the new. It consisted in a new point of view of largeness as desirable in individual enterprise. This largeness of plan embodied itself not only in a new idea of the amount of land that a man should acquire but of his supremacy over the agencies and methods employed in production. Under the Spanish system, a man could ride and drive great droves of stock

and rope from them such as would serve nearly all his purposes. To the American this seemed a very rude husbandry and it was largely abandoned. Yet when he worked the land he hitched more animals in a team and coupled on more wagons or plows than he had ever known to be handled by a single driver. Bringing such increased motive power under the direction of one man resulted in building for his use larger wagons, plows, harrows, and all kinds of harvesting machinery which became known as "California styles" of all such implements. It can be strongly maintained, therefore, that there came from the old régime some suggestion of largeness and freedom in conception and of the capacity of one man for largeness in operation. This suggestion gave a new character and purpose to care and thrift, and a new scope and variety to aims in production, greater freedom in thought and demeanor, and a more buoyant and satisfying spirit in rural life.

Of direct gifts to American agriculture from the preceding Spanish and Mexican systems, there should be cited the large numbers of domestic animals (horses, mules, sheep, goats and swine) which served a good immediate purpose with Americans, although, as will be shown in a later connection, these animals were inferior and were displaced as soon as possible by introductions of both pure-bred and common stock of the eastern states. In the general handling of range stock, however, the old methods prevailed for a long time and still influence practice. The "vaquero" still rides in defiance of the "cow boy" of

the interior range states and the "rodeo" has not been lost in the "round-up."

Although the padres were the founders of California agriculture because they entered at once on the production of foods for the sustenance of themselves, their military guards and their Indian wards, and although they gathered huge possessions of livestock and grains, grew many fruits and made much wine, their direct influence on the plans and practices of the American pioneers consisted of the demonstrations of the success of various fruits in their mission gardens. Mission farming and stock-growing had been destroyed about twenty years before American occupation by the secularization of the vast area of mission lands, ownership of which was transferred by grant to unclerical persons. These individuals had learned much of their agriculture from the preceding experience of the padres and they neither increased the products nor improved the husbandry of their teachers. Mission agriculture at the coming of the Americans consisted of remnants of the padres' gardening within the mission walls, for many of the establishments had been abandoned and were falling into ruin. There was enough land remaining in charge of the padres at some of the missions clearly to show the success of many kinds of fruits, although their apparent ignorance of propagation, except by seeds or cuttings, and of the relations of tillage to moisture conservation and plant thrift, either by irrigation or rainfall, made them rude gardeners. Of the mission fruits of which the cuttings were

brought into California from old Spain via Mexico in 1769, two are still in good repute and of commercial value, the Mission fig and the Mission olive, the latter now being more widely grown and profitable than any of scores of varieties introduced at much cost by Americans during the last half century. It may not be too fanciful to claim significance for the fact that the greatest gift which American agriculture in California still cherishes from the submerged Spanish husbandry is an olive branch.

Aside from her agricultural inheritance from Spanish precedence, California fell heir to nothing of an industrial character. It is stated that there were not more than ten thousand white people in the State before American occupation, that is one to ten thousand acres of her area. Although the citizenship given by Mexico was insignificant in numbers, there was clearly discernible a social atmosphere that influenced the lives and manners of the multitudes which gathered from all parts of the world when the American flag was unfurled. The Spanish Californians loved the land and joyfully accepted citizenship in a republic which they believed would make California great. Their chief gifts to the new State were the patriotism, deep human interest, courtesy and courtliness of manner and genuine and generous hospitality which characterized them.

THE AMERICANIZATION OF CALIFORNIA

California's acquisition of a cosmopolitan American population began long before the gold discovery. A

sea-faring man now and then took to the ranchero's swaying life in the saddle as more delightful than riding the waves and one case is recorded in which the skipper himself deserted his trading ship because he preferred to guide his course by the light of eyes caught in the fandango rather than by the stars of a marine midnight. Thus, while a few men came from the sea, a few others, in pursuit of peltry or the trade therein, wandered into California from the north and from the east and, finding the *dolce far niente* of the Mexican régime sweeter far than pioneering on the Mississippi Valley frontiers or trapping and trading in the wilderness northward even to Hudson's Bay, embraced the hospitality and the daughters of the new country and lived happily ever after as Californians. There were not many of these earliest foreigners on the whole, but they were of several nationalities including English, Scotch, Irish, Germans, French and Portuguese and they laid the foundation for cosmopolitanism in California to which subsequent events, however, made much greater contributions.

Americans prevailed in the affairs of the vast rich and open country of California from the first entrance of plains-crossing pioneers from the Missouri River in 1826, in the person of Jedediah Smith who is recorded by historians as "the first overlander." Others soon followed and within two decades considerable companies of men were seeking individual fortunes in a country they believed would soon be a part of the United States. Both for personal advan-

tage and from patriotic motives, they were eager to lend their assistance toward that end, until war demonstrated its mastery and California was ceded to the United States by Mexico in a treaty of peace, which closed a war between the two countries, in February 1848, the month following the gold discovery by Marshall at Coloma, in the Sierra Nevada foothills, about fifty miles from Sacramento.

The interest which in this connection pertains to the gold discovery centers in the character and volume of the population it brought to California, the creation of its statehood and the foundation thus laid for the development of agriculture and rural life. Of the relations of agriculture and mining as the two greatest industries of the State, some consideration will be undertaken later in the chapter. At this time concern is rather with mining as an agency in the peopling of California and as an influence in determining the character of citizenship.

The first effect of the announcement of the gold discovery was the practical depopulation of the few old Spanish towns in the central part of the State and the several settlements and farms which the Americans had established during the previous decade. However, this unsettled only a few thousand in the aggregate for they comprised the population then within reach. The world-wide reports that followed the local exodus to the mines induced a rush to California which is spoken of as the swiftest and greatest movement of people known to history, although California had neither regular sailings on

the sea nor roadways on the land and was thousands of miles distant by either route from populous states or countries. It was, therefore, several months after Californians were digging gold before distant areas heard of it and not until December 1848 did the President of the United States make announcement to Congress and exhibit in the war office at Washington gold received from government representatives in the newly acquired country. Then followed the rush to California from all parts of the world, by sea and land, of adventurous persons whose bravery in perils, heroism in hardship and suffering, persistence in face of baffling obstacles, life losses by shipwreck, by disease and by murderous savages of the interior plains and humorous experiences under all the conditions of tragedy, are abundantly recorded in the writings of the time and reviewed by all historians of the westward course of development in the United States. It is, however, only features of this movement and the character of the participants therein, in relation to the present rural life in California, that are pertinent to this sketch.

The white population of California at the end of 1848 has been estimated at 14,000: 7500 native Californians, Mexicans and Spaniards and the remainder Americans with a few foreigners. California was admitted a State of the Union in September 1850 and the United States Census of July 1850 placed the population at 92,597. This included the access of the gold-seekers "of 1849 and the spring of '50" which was the definition constituting a "real first

comer" in the standards of the time. The census taken in July 1850 made no account of those who had come and gone before that date, of whom there were thousands. It is estimated that not less than fifty thousand came by sea and even more by land in the first rush.

Nevertheless, the gold-seekers were not wholly actuated by a mining motive. One historian writes:

"It is still customary to speak of the immigrants of 1849 and the '50s as gold-hunters and they were such to some extent: but they were something more and better. They were primarily home hunters, as is proven by the fact that some brought their families with them even in 1849 and a much larger number in later years. . . . Mining, if they resorted to it at all, was to be only an expedient. People were hungry for land to be tilled by their own hands. The greater number came to do each his part and in his own way, of the great work that has since been done."

They were disappointed at first by the aspect of the country, but were almost immediately surprised by its agricultural capability, and their impulse was to try every plant and animal that was held in high esteem in the states and countries whence they came. As they were from numerous countries, the development of California was thus endowed at the very outset with agricultural knowledge and materials of great diversity.

Although the first comers before the gold discovery were chiefly from the frontiers of pioneering in the

Mississippi Valley states, and the first to arrive at the gold diggings were also from these western areas, it was not long before throngs pushed overland from states further east, came by ships around Cape Horn or made their way across the Isthmus or through Mexico. Thus California's new population was largely from the oldest and most fully developed states of the Atlantic Coast and they undertook to transplant the ideals, laws and institutions of civilization which the oldest regions of the country were then cherishing and developing. As California enjoys the distinction of having been admitted at once to statehood without passing through territorial organization, so also the development of the new State was entered on by a population which lifted itself immediately above the slow courses of pioneering and rushed at once at the realization of an American commonwealth of advanced standards and attainments. It is recorded by all the historians that the legislative, educational and industrial undertakings of those who participated in the establishment of the State in 1850 were as high in moral and intellectual purpose, as resourceful in methods and as confident in expectation of results as the State has ever manifested in its later development, and the foundations of law, social life and educational effort were broadly and firmly laid at the very beginning. A corroboration is the quick mastery obtained over crime and disorder that arose in a mixed and adventurous population wholly freed from the restraints so strong in established communities.

California was as empty of law as it was of population when the Americans came. There were only a few old Mexican regulations framed for a pastoral people dwelling in a country where land was too abundant to be of much value, where credit was practically unknown and in which there were no judges, courts nor lawyers, except as local justices of the peace *(alcaldes)* dispensed justice in personal relations. It is conclusive testimony to the quality of the American pioneers and their insight as well as their devotion to the principles of morality and equity, that the rules and regulations which they adopted and enforced for self-government in their mining camps, and by which they established justice in a new country without laws and adjusted right and title to land and water in mining, were subsequently largely embodied in the statutes of the State and of the nation. Nor is it less demonstrative of the earnest desire of these pioneers for equal justice that they inscribed in the constitution of the new State the practice of their Spanish predecessors that a wife does not part with her right to possess and to bequeath her individual property and that she has equal title with her husband to whatever community property accumulates during a period of marriage. Although there are property rights of women still to be secured, this conception of their equality, which entered at the very beginning into the organic and statute law of California, doubtless exerted a strong influence toward the attainment of full citizenship and suffrage for women, by amendment of the consti-

tution of the State in 1911. It is also an interesting fact that from pioneer days to the present time women have personally undertaken the farming of their own property and have been a recognized force in agricultural organization, not only in its social aspects and purposes but in the technical and commercial phases.[1] Women have, in fact, been leaders in the establishment of several unique agricultural industries which have attained great success.

The rapid development of California during her first decade was not alone due to the ability of the people to conceive high ideals of statehood and citizenship but to the abundance of money that enabled them concretely to realize their conceptions and to found the institutions which they recognized as essential. The production of gold from 1850 to 1855 was, in round figures, four hundred millions of dollars, of which 1851 and 1852 produced seventy-five and eighty-one millions respectively. Such large and rapid production of gold is said to have met a world's need and later to have notably assisted in maintaining the national credit during the Civil War.

Continent-crossing railways have multiplied from one in 1869 to six in 1921. California possesses two cities which are in the list of the fourteen greatest in the United States. The volume and speed of increasing population are shown in the United States Census reports, as follows:

[1] According to the Census of 1920 California has 5,773 farming women, including 5,406 owners, 315 tenants and 52 managers.

CALIFORNIA POPULATION AND RANK AMONG STATES [1]

	Population	*Rank*
1850	92,597	29
1860	379,994	26
1870	560,247	24
1880	864,694	24
1890	1,213,398	22
1900	1,485,053	21
1910	2,377,549	12
1920	3,426,861	8

While during the first decade of California statehood, the per capita production of gold was the greatest in the world at that date, there was also attained agricultural production which rendered the State independent of imported foods. During the second decade, although the era of picking up gold in stream-beds and pulling it up with grass roots had practically closed and the flood of incoming settlers largely checked by the Civil War, a vast surplus of wheat was produced for export and subsequently California became for a time the greatest wheat-producing state in the Union. In the third decade flocks were increased to such an extent that California became the greatest wool-producing state. During the fourth decade fruit production entered on its course toward the leadership of all California industries by fuller application of the force of proprietary and coöperative colonization of fruit lands, by the dawn of coöperative enterprise in packing and distribution of fruits and fruit products, which in 1899

[1] The rural and urban populations of California counties and the number and valuation of farms in each, according to the Census of 1920, are given in Appendix A.

constituted California the greatest fruit-producing state in the Union—a standing which has been continued since that time with a constantly increasing margin of supremacy. At the close of the seventh decade, California, in addition to her advance with fruits of all kinds, has leadership in three of the twenty staple crops (barley, beans and peaches), on which the government relies in the determination of agricultural valuation of all the states, and in 1920 was ranked fourth in the Union in value of all crops produced.

It has already been claimed that in early days accession to California was largely a matter of courage and endurance. Afterwards, and even to the present time, another criterion of selection has prevailed, viz.: mastery of funds and business confidence and enterprise. Development has been ministered to by people from every civilized state and nation, and has escaped a low average intelligence and ability because remoteness and cost of travel have discouraged mass movement of inferior types. A few specific factors that underlie the advanced and most satisfactory type of country life characteristic of California may be cited:

First: Broad views of education. The present expansion and profitability of the leading lines of agriculture is largely due to those who came to California in mature life and brought capital and minds well trained in business and professions. Their example, and their precepts also, are a strong force for breadth in educational efforts for agriculture. California is keenly conscious that common schools which

do not employ rural phenomena and points of view in their daily work are culpably narrow and neglectful. Education in agriculture from youth to manhood is considered a fundamental need and teachers of all grades are alert to qualify themselves for the work. Such provision has definitely entered into the general educational system of the State, as will be outlined in Chapter XI.

Second: Social and financial recognition of agriculture. The recognition of agriculture as a pursuit which does not debar its votaries from the highest social standing has always prevailed in California. It is freely conceded, not only in theory but in regular practice, and agriculture is recognized generally as a desirable vocation. There is, in fact, some danger that recourse to agriculture may be becoming too popular, even fashionable, with the urban population because they are disposed to exaggerate the profits and minimize the knowledge, ceaseless effort and command of adequate capital on which success depends.

Financial recognition of agricultural security has been advancing during the last thirty years. It began in the acceptance of warehouse receipts for grain stored in country warehouses at that early date and since then loans on other gathered products or on growing crops have been freely available under ordinary financial conditions. The old disfavor of country real estate as compared with city property has largely passed away; in fact, much money has been loaned on too high valuations or prospects.

Rates of interest were formerly too high considering the security of legitimate country loans but considerable improvement has been secured by borrowers on farm property and business during the last decade, as will be noted in Chapter IX.

Third: Average excellence of country homes. With the understanding that light construction is advisable under existing climatic conditions, it can be claimed that California country homes are of very high average excellence. It is probably true that there is a greater per capita consumption of periodical literature in California country homes than in other rural communities. The per capita supply of running water, hot and cold, in farm houses and the use of it in all the devices of modern plumbing for cleanliness and sanitation are also very large. Electric light and power for domestic purposes are widely employed. It is reported that 91 per cent of all houses where current is available are using it and 79 per cent of all houses in the State are electrified.

Fourth: The benign influence of coöperation. Unquestionably the most powerful agency for advancement in the quality of rural life in California during the last two decades has been coöperation. While a degree of education is assumed, coöperation is itself a potent educational agency. It not only enables men to achieve, but it points the way continually to greater achievement. Strong coöperative effort has secured protection and promotion for nearly all the leading products of the State; it has obtained

nearly all the recent large provisions for agricultural education and research; it has secured fair treatment from interests serving agriculture which formerly dominated rather selfishly; it has enabled producers to demonstrate possession of force, business acumen, soundness and capacity, which have commanded the confidence and respect not only of rival business interests but of financial institutions. The rise and progress of coöperation in its relation to agriculture will be outlined in Chapter VII. The recognition and enforcement of such relation may well be counted, perhaps, the most widely significant factor for agricultural advancement which the Americanization of California has accomplished.

DEVELOPMENT BY COLONIES

The first irrigated colony of California was organized in 1857 on the true coöperative plan. Fifty members constituted the "Los Angeles Vineyard Society" which was organized in San Francisco and purchased 1265 acres of land about thirty miles southeast of Los Angeles near the Santa Ana River. The colony was named "Anaheim." The land cost $2 an acre and the water only the expense of diverting it from the river. The land was laid out in fifty twenty-acre farms, with roads on all sides, around a town site of building lots, and in 1859 the improved property was distributed to the fifty shareholders, each of whom obtained a twenty-acre farm partly planted with vines, a half-acre building lot in the town, a share

in a twelve-mile main ditch and laterals, and the like, for a total outlay of $1400. This was not only the first fruit-growing colony of California, but it freely gave more for the money than has ever been secured from colony promoters since that time. The last survivor of the original coöperators in the Anaheim colony died in 1921, and a few of the first subdivisions remain in the ownership of the families of the original settlers.

About fifteen years after the beginning at Anaheim, colony enterprises began to be projected on a large scale, and by that time they had become less coöperative and more proprietary and speculative in their character. Settlers were sold land but not always water with it, only a right to buy water, the ownership remaining for a time or permanently with the projectors who purchased or appropriated it and built the works to bring it to the land. In spite of financial sufferings, sometimes to the settlers and often to the water companies, the outcome of irrigated colony enterprises as a whole has been for the prosperity of those participating in them and notably for the development of the State. Almost all have grown into large centers of population, production and trade, famous throughout the country and beyond, for their attractiveness to tourists and investors and for the satisfaction that permanent residents find in them.

The irrigated citrus settlements at Riverside, Redlands, Pasadena, Pomona and other similar enterprises began before 1880. About the same time irri-

gated colonies were started in the Fresno district of the San Joaquin Valley and laid the permanent foundations for the raisin industry, which had previously been demonstrated to be feasible in other sections. Later colonies developed beyond present enumeration, in all parts of the San Joaquin Valley, founded on all kinds of farming but always on an irrigation basis. Beginning later still, but continuing to the present, are the irrigated colonies in the Sacramento Valley, delayed by the fact that larger rainfall renders irrigation less essential and sale of subdivisions to unorganized settlers was the common method of development.

In this outline of settlements, the term colony is very loosely and broadly used to signify small subdivisions of land which bring settlers into close neighborly association. Most of them had no other relationship at the outset, although they usually associated themselves in undertakings for mutual benefit soon after getting together geographically. While perhaps none has had the coöperative method so completely embodied as the original Anaheim colony (the actual cost of land, water and necessary improvements to unite them being divided equally among settlers without profit to promoters or organizers), nearly all groups of subdivisions have advanced in such ways that ultimately the owners of the land have become owners of the water and of the system by which it is secured and distributed, or are still on the way toward such attainment. This consideration touches closely on the law and philosophy of water

rights and ownership which are too elaborate and technical for pursuit in this connection.

The colony method of multiplying small farms in California began during the first decade of American occupation and has continued to grow in popularity and achievement until the present time and promises to be even greater in the future. At first a few acquaintances associated themselves together; afterwards groups from stated localities in the eastern states and in foreign countries were gathered by personal solicitation and transplanted, and later still individual families from everywhere were brought together by processes of general advertising and promotive propaganda and geographically associated after arrival in California. In most cases communities thus formed were the offspring of the marriage of land and water. Although colonies have been successfully established in regions of adequate rainfall without a basis of irrigation, they have been fewer and smaller in accomplishment than the irrigated colonies.

STATE LAND SETTLEMENT

Although large rural communities and populous towns of beauty, wealth and industrial importance have been developed from initial undertakings in land subdivision and colonization by private or corporate owners of land and water, many such enterprises were profitable neither to sellers nor buyers but involved loss and hardship to both. In some cases this was

the result of worthlessness, sometimes in the land, often in the promoters of the enterprises, who too often failed to warn the purchaser that it usually takes high-priced land a long time to pay for itself and the improvements needed. In a greater number of instances, disappointments and failures accrued from unpreparedness to meet the requirements. This included, on the part of promoters, lack of water, of adequate capital, of wisdom and foresight; while to the purchasers for home-making, all the effects of the unpreparedness of the promoters were added to their own deficiencies in knowledge, thrift and reasonable anticipation. The results were naturally large failures on the part of colony organizers and developers and small widely distributed failures among those who purchased from them, involving loss, suffering and forfeiture to such an extent that there came to be a saying that subdivisions yield profit and support only to the third or fourth purchaser in succession, the last having the advantage of the improvements forfeited by his predecessors.

This state of affairs in land subdivision and sale engendered the wide conviction that enterprises of this kind were too often a discredit to the State and an imposition on those who desired to make farm homes. In 1915 Elwood Mead was recalled to the University of California from very successful design and leadership of colonization in Victoria and New South Wales, to serve as head of the Division of Rural Institutions. As the result of his experiment in Australia and his study of government land set-

tlement in Europe, Mead was confident that methods of subdivision and farm home-making in California must be radically reformed. In 1915 the State created a Commission on Land Colonization and Rural Credit of which Mead was made chairman. On the report of this commission the legislature of 1917 passed a law, the first section of which makes this declaration:

"The legislature believes that land settlement is a problem of great importance to the welfare of all of the people of the State of California and for that reason, through this particular act, endeavors to improve the general economic and social conditions of agricultural settlers within the state and of the people of the state in general."

In accordance with its declaration of belief, the legislature of 1917 created a State Land Settlement Board, consisting of five members "with the object of promoting closer agricultural settlement, assisting deserving and qualified persons to secure small, improved farms, providing homes for farm laborers, increasing opportunities under the Federal Farm Loan Act and demonstrating the value of adequate capital and organized direction in subdividing and preparing agricultural land for settlement."

The law also provided that a demonstration of such proceeding should be made by the Board which was authorized to buy ten thousand acres of land and to use a revolving fund of State money to the amount of $250,000 to be returned in full within fifty years with interest at 4 per cent for whatever sums

were actually in use by the Board in its transactions during that period. In 1919 the legislature reflected the popular approval of the undertaking by making an additional appropriation of $1,000,000 and by authorizing a State election on a bond issue of $10,000,000, but the vote was not taken because of a technical error in the statute. The legislature in 1919 also amended the law of 1917, removing the restriction to ten thousand acres and authorized the Board to acquire all the lands, water rights, and the like, needed for its purposes.

The details of policies, methods and administration of land settlement as authorized by the State are available in special publications[1] and cannot be recited in this connection. Briefly it may be stated that the plan is to furnish good land for the purposes indicated; to deliver such land with water (as the purpose and condition may require) and otherwise ready for cropping; to build highways connecting all farms with local trade centers and general routes of transportation; to lend settlers funds (on long terms at low interest) for buildings, equipment and improvements which are approved by the Board; to promote coöperative organization of settlers for social, educational, producing and product-selling purposes, and to furnish information and advice concerning all farming operations that are justified by local conditions. The requirements of the Board

[1] "Helping Men Own Farms" by Elwood Mead, Professor of Rural Institutions, University of California and Chairman State Land Settlement Board (The Macmillan Company, New York, 1920). Reports and circulars Land Settlement Board, Berkeley, Calif.

are (in addition to general essentials of morality and satisfactory personal history) that the applicant shall have had training and experience in farm life and industry and satisfactory qualification for the line he intends to pursue; that he shall not own agricultural lands (including the sale made to him) exceeding $15,000 in value; that he shall enter on actual occupation within six months; that he shall pay down in cash 5 per cent of the value of the land and 40 per cent of the value of the approved improvement and equipment which he may desire and that he shall apply to the federal land bank for a loan on the land and improvements and pay this loan to the Board as an installment on his debt for the land; and that he shall be an American citizen or have declared his intention thereto. The Board may reject applications in its own discretion.

The practical operation of the State Land Settlement so far as it has proceeded in 1921 is exceedingly satisfactory. The Durham colony in the Sacramento Valley upon an acreage of 6200 acres has installed one hundred and twenty families, and the Delhi colony opened in the San Joaquin Valley in 1920, has one hundred and thirty installations on 8600 acres. The initial undertaking at Durham proceeded with land selection and preparation, including provision of irrigation, in 1917, and the first unit was open to settlers in May 1918. A review of the settlement at the end of two years showed that it was paying its way, that settlers' installments had been met as they came due, that a notable unearned

Plate IV. Soil surveys in California, 1921.

increment in land value had come to the settlers; that they had all paid their taxes, and their improvements, possession of high-class live-stock, development of social spirit, had added greatly to the resources and attractiveness of the county. It is an early demonstration that when the State buys, improves, irrigates and subdivides good land and coaches the settlers with farming wisdom and paternalizes them in desirable ways, it can make confident and satisfied farmers out of qualified young persons who might never otherwise get to the land which they desire to earn.

Mead's work in California is attracting attention throughout the country and beyond. It was planned along educational lines as a demonstration of how land settlement could be undertaken with satisfaction to the settlers and to the State. It will not be the achievements of the few hundreds of farmers who are thus placed in successful action that will measure the results of the idea and enterprise. Far more important and extended must be the example of the policies and methods that are shown to be sound and practicable, how the land must be prepared and the beginning farmer made ready for the land and how the two can be kept in mutual operation. Evidently all parties involved are eager for it. When the Board announced its desire to buy land for a colony in 1917, it had offers of eighty tracts varying in area from 4000 to 12,000 acres each, and when the land was ready for settlers, more than 3000 applications were recorded. Whatever may be the popular

conviction as to the length the State should go in actually placing qualified persons on good land, there remains the assurance that the State has shown the way, and if the Land Settlement Board should never go beyond the two colonies which it now has in operation, it has already rendered a public service of vast and lasting advantage.

By an act of the legislature of 1921 the State has identified itself more closely with the operation of land settlement by discontinuing the special commission which has conducted it since 1917 and merged the enterprise in a newly created Board of Public Works. The plan has worked so well that the State will not only continue its own operations but may also sponsor and supervise settlement by private owners, providing such enterprises are projected and carried out strictly in accordance with its own rules and requirements.

RELATIONS OF MINING AND AGRICULTURE

From several points of view, mining in California may be looked on as the father of farming. The Spanish farming that had been pursued for seventy-five years at the missions and haciendas, before the Americanization of California began in 1848, was utterly incapable of sustaining the population which the gold discovery, in the same year, induced. Food supplies of all kinds were brought by sea by all ships which could be chartered for San Francisco Bay, gold-seekers and provisions for their support arriving

together. Even the product of beef, which was the largest the new State afforded, quickly became inadequate and large herds of cattle were driven in from New Mexico and Texas to supply the imperative demand. Perhaps there never was a capable agricultural country with local markets so empty of supplies and ready to pay such fabulous prices for them as California in 1850 and a few following years. Had it not been for the great demand for large and immediate production of food, agriculture would probably have advanced slowly, during a gradual settlement by Americans, as an expansion and modification of Spanish methods and purposes.

The mining industry did more than merely generate farming as a business. It endowed the latter with much of its own spirit, its greatness of industrial conception and its insistent demand for speed. Almost from the very beginning there was a readiness to pursue new ideals in agricultural production or to pursue old ends in new ways.

There were, however, more tangible and concrete contributions from mining to farming at the very beginning. One of these was furnishing capital with which the earliest farming adventures were entered on before their outcome could be clearly foreseen. The prices of all food products were so high that temptation to have a try at farming was almost irresistible and fluctuation of prices resulting from plunges into over-production soon afterward demonstrated that farming was quite as much of a gamble as mining. Thus it came about that many who had

made a stake at mining became farmers and others who came to mine stayed to farm. Thus mining was closely associated with farming, so closely that many pioneers had a mine in a back-lot of their farms where they dug out and washed gravel when the land was too wet to plow or plant, or they picked gold out of outcropping rocks when the soil was too dry to work. This division of individual effort between the two industries has not yet been wholly abandoned. The amount of money available for the capitalization of side issues can be imagined from the statistics of the gold product of the early years.

Another concrete contribution of mining to farming was the joint use of the foundries and shops created to manufacture mining machinery. Probably no farming state ever had such capable metal-working outfits within its own borders to draw on for equipment at its very beginning. As mining requirements grew less, farming demands increased both in quantity and variety. Practically the same course was also taken by investments, made in early days for mining, in storing and conveying water long distances in the mountains and foothills. Many reservoirs and ditches would have been abandoned as mining was either worked out or was proscribed by law (because navigable streams were being ruined by the débris from gold washing) if a new and profitable market for the water had not arisen in the irrigation of foothill orchards and pasture fields. Thus investments for the sake of mining became development agencies for the promotion of farming. Speaking at the State

Fair of 1859, Colonel E. D. Baker, one of the noted orators of the period, said: "The time will yet come when the ditches which traverse the whole mineral regions of California will be more valuable for agriculture than they ever have been for gold finding."

Although the mining interests may be credited with engendering at least a part of whatever industrial buoyancy and adventure California had beyond the endowment of other new western states, her agriculture suffered at one time from a perversion of the spirit of adventure just as did legitimate mining itself. In the third decade (1870–1880), California reached a notable over-supply of grain and other staple products and exportation of them was wholly in the hands of speculators. The opportunity to get rich quick seemed to many farmers the outlet from their financial difficulties and many of them threw themselves into it. Many of the first generation of California farmers went out on this tide. They had neither resolution nor capital to handle their lands either in new lines of production or in subdivision and sale. Others supplied these essentials and California entered on a new era of agricultural development which brought the State to its current achievements. The sad lesson was well learned. During the last forty years farmers have not largely invested in mining, either in its producing or gambling phases, as the soil and its products have shown superior attractions. On the other hand, large fortunes made in mining have been securely and profitably placed in farming lands and enterprises in production.

Greater than any contribution which agriculture in California has ever received from mining and more profound in its influence on the development of satisfied citizenship and industrial permanence in the commonwealth was the quickly discerned opportunity in agriculture, which has already been suggested. It amounted to nothing less than a change in the point of view and complete transformation of purpose among the argonauts. These eager adventurers came with the determination "to make their pile and go back home." They nearly all hoped it would be very soon when such competence would be attained. They declared they had "no use for the country except to get the gold out of it." Of course such a purpose and ambition or the methods that many employed to achieve them would never have made a prosperous and permanent state nor have ministered to the attainment of high ideals of manhood and citizenship. It was the discernment of the opportunities in agriculture and the desirability of becoming a part of a durable industrial and home-making population in a country affording new advantages in profitable work and enterprise and exceptional delights in living, which so quickly transformed a dream of adventure into a resolution toward permanent development.

"Our climate and soil will not only produce all the cereals, grasses, vegetables of mammoth growth and superior quality, all the northern fruits to perfection but the most delicate fruits, trees and shrubs of the tropics. Our even, healthy and delicious climate is

unsurpassed even by the world-renowned Italian—a climate that at once gives life and strength to the newly arrived invalid and renovates broken-down constitutions from other climes. In short what other country presents so many inducements to the man of the northern states, who is six months chilled with frost and four months living in snow-banks; or the man of the south, who once a year flees from the pestilential heat; or the western man, whose first god is his rifle as a protector from the Indian? To establish the fact that this is the best country to live and die in, seventy-five in one hundred who leave this state return again, fully satisfied that California is the country!" [1]

It is interesting to note that this declaration was not made from any idea of the decline of mining, for none was anticipated. The gold product was still going at upwards of fifty millions a year. It was merely the awakening of the public mind to a greater industry of which California was capable and the direction of effort and investment toward its realization. Agriculture was not either a successor to nor a supplanter of mining, for the latter still continues as a great industry, and made an output for 1920 valued at nearly two hundred and fifty millions of dollars for all kinds of mineral substances.[2] However, agriculture supplemented mining and has attained an annual value of output two or three times

[1] Rept. of "Visiting Committee" to investigate Calif. farms: in Rept. of Calif. State Agr. Soc., 1857, p. 30.

[2] An official enumeration of the mining products is given in the Appendix D.

as great. It gave a new objective in the building of a permanent state to those who had come for personal enrichment alone. It opened a greater field for the high average intelligence, daring, initiative and resourcefulness. Mining lifted California out of the inertia and hopelessness of the preceding régime. Agriculture, by what it achieves and by what it inspires and provides for, still holds California aloft.

Of course the fact should not be concealed that California mining and farming have not always sidled against each other in mutuality and reciprocation. Sharp issues have arisen which aroused conflicts engendering much ill feeling. The most serious was the injury to navigable streams and the ruin of river bottom lands by deep deposits of débris from hydraulic mining which is now prohibited by law wherever such streams are within reach of mining wastes. Another problem, still pending solution, is the destruction of considerable areas of river bottom land by a system of dredge-mining which lifts good land from the surface to a depth of many feet, transforming a part of the landscape from a stretch of orchards and meadows into a desolate unproductive welter of cobble stones and coarse gravel. The dredge miners buy at high prices the land they desire and thus far have the undisturbed right to destroy it. As the gold product by dredging has averaged for a number of years upwards of seven million dollars annually and is greater than all other forms of placer mining combined, the permanent ruin of large areas

of deep rich land is involved and the State is impoverished to an extent which must be looked on as a multiple of any possible present profit. This outlook naturally alarms all those who are not personally advantaged by the operation. It is an interesting fact that on these lands which are now being destroyed, the farmers were the first miners, for they found that it was easy to have wells in all their pasture lots because the gold washed from the gravel they took out in well-digging would often pay the cost of getting the well.

DEVELOPMENT OF AGRICULTURAL PRODUCTION

From the point of view of demand and supply of food products, a unique situation arose immediately on the mining rush to California. A floating population of perhaps a hundred thousand arrived within a few months in a territory which had before supported perhaps ten thousand. This one hundred thousand concentrated themselves in a district in which hardly one thousand had hitherto resided and they were at an average distance of perhaps two hundred and fifty miles from the settlements with which they were connected only by bridle paths and cattle trails. The local population had largely joined in the gold rush, leaving the old men and the women to care for the ranchos as best they could.

The field opened to local production and the prices which promised unusual reward can best be appreciated by citation of the quantities and values of a

few articles of produce that were imported by sea in 1853, viz.:

Dried apples	12,000 bbls. at $12	$ 144,000
Barley	294,000 sacks at 2½ ¢ per lb.	735,000
Bread	60,000 kegs at $10.50	630,000
Butter	140,000 kegs at $20	2,800,000
Flour	298,000 bbls. at $10	2,980,000
Oats	150,000 bbls. at $4	600,000
		$7,889,000

Obviously these were only a few staples and no higher class foods and provisions are included. Although the rancheros gained much gold by selling their flocks and herds to furnish meat for the miners, they did not conceive the purpose of multiplying animals for that trade but were soon driving herds and flocks in from Arizona, New Mexico, Texas and from old Mexico to furnish a supply which they could probably have met by wisely farming the breeding stock they already possessed.

Quite in contrast with the foregoing was the American recognition of the opportunity for profitable agriculture and their zeal to realize it. The first fresh fruits for San Francisco and the mines came from trees and vines surviving the partial abandonment of the old mission orchards and restored to fruitfulness by Americans who leased or purchased them. This was only a side issue of the general effort. Almost immediately on their assurance that the soil was surprisingly fertile if farmed aright, the newcomers began to plant everything which they conceived to be acceptable in the local markets and they

increased values, already fabulous, by seizing seeds for planting that came in by ship for food. They planted such large areas of some vegetables that the very first crop produced an over-supply, and a part would not sell for enough to meet the cost of taking it from the ground. On the whole, however, food production was exceedingly profitable.

The achievements of the first few years in nearly all lines of production were very striking and interesting, but are beyond enumeration in this connection. Some may be recalled later in the discussion of special products, where they may seem particularly significant. A single contrast will suffice to show the general advancement. From 1849 to 1854 inclusive there were imported, chiefly from Atlantic states and Chile, flour and wheat to the value of five or six millions of dollars annually. In 1856 California produced wheat enough for her own consumption and some to spare, which sixteen of the oldest settled states on the Atlantic and Gulf coasts and the Mississippi River did not do.

What was done with wheat was also accomplished with many other products. The most significant thing was not the accomplishment itself but the spirit and purpose to build a great state which it engendered. At the State Fair of 1856 the orator made this declaration:

"An experience of eight years, during which we have dug and shipped so enormous an amount of gold, out of which we have saved so little, ought to convince us that we shall never get rich by this

process. In this respect we furnish the most striking illustration that history records, of how little the precious metals add to the wealth of people in the absence of agricultural and mechanical industry. In my opinion it is time we had begun to feed and clothe ourselves and thus keep our gold at home to enable us to build better houses, extend and establish our farms, erect churches and colleges, construct railroads and build clipper ships and ocean steamers. In these things do true national wealth and individual prosperity consist."

At the State Fair of 1857 rivalry with the world's greatest producing region of semi-tropical products was announced:

"Every agricultural product reaches its highest perfection in our valleys and hillsides and in a very few years they can, and undoubtedly will, produce vast quantities for exportation and turn to other countries the present Mediterranean fleet of six hundred and forty-three vessels which annually leave for our Atlantic ports loaded with figs, lemons, oranges, almonds and the products of the vine, currants and raisins, to the value of seven and a quarter millions of dollars. Italy and the countries bordering on the Mediterranean annually produce over two hundred millions of dollars' worth of wool and other products—one half of which are sent abroad. California has climate and soil very similar and with the perseverance and indomitable energy of her inhabitants and the twelve millions of acres of arable land, should also, in due time, freight to foreign

markets her six hundred and forty-three vessels."

Naturally as the Mediterranean products reached the outside world by water, the speaker was impressed with California's fitness for rivalry through her equal maritime situation. The building of an overland railway was quite as early descried as requisite to the agricultural development of the State. This picturesque declaration of it was made in 1856:

"We have one great, overshadowing want—a railway connecting us with the Atlantic seaboard. We have been too passive under this neglect. We have for eight years past quietly shipped our millions upon millions to Wall Street, from which golden streams were distributed throughout the land enriching every part of the confederacy, whilst in return for all this treasure we have received little else than our board and clothing with the indefinite promise of a railroad at some future day. It is time we had demanded as a right the fulfillment of that promise, and if we shall live to see the day when the iron horse, with his impetuous speed, shall come from the Atlantic to quench his fiery thirst in the cool waters of the Pacific, then will our fondest visions have been realized and clouds of doubt will no longer obscure the bright future of California."

It may assist the reader to secure a comprehensive view of the development of agricultural production in California and the leading special features thereof if a scenario is undertaken, thus:

1850–1860. Decade of wonders and dreams. Dem-

onstrations of productivity of the State in surprising volume and variety of staple crops and of un-American products, recognized. Local population fully supplied and importation of staples displaced by local products and exportation thereof begun. Conceptions of world entry of unique California products confidently cherished.

1860–1870. Decade of wheat. Beginning of exports of wheat by specially chartered ships to Europe, which grew into larger fleets, year after year, until the peak of the movement was reached in 1896, after having won title in 1878 as the "greatest wheat state in the Union," the title being, however, soon lost to Minnesota even while the California wheat product was still increasing.

1870–1880. Decade of wool. California attains place as largest wool-producing state, with twice as many sheep as any other, and secured her greatest wool product in 1876. Wool production gave way to the growing convictions of the better use of land for other products for which the first decade of an overland railway brought not only a shipping outlet but a multitude of new settlers eager to invest in more intensive agriculture. It was the dawn of new development which closed the pioneer period in rural life and industry.

1880–1890. Decade of fruit. Not of greatest achievement for after forty progressive years that is still in the future. It was, however, the decade of definite and adequate foundation; eager demand for land; successful colonization and subdivision; wide-

spread irrigation enterprise; the birth time of systematic organization for production, protection and world-wide marketing of California fruits and fruit products, by increasing overland railway transportation. It was the first decade of multiplied production and of actual first steps toward coöperation of producers to handle their own products although such enterprise had been foreshadowed almost from the beginning.

1890–1900. Decade of dairy awakening. State provision for establishment of purity of product and sanitation of surroundings. Government provision for standardization of products for long shipment. Wheat begins its decline and barley to advance to greater production than wheat ever attained. Coöperative fruit-marketing organizations struggle for permanent existence with many casualties. A decade of reaction from booming development in all farming lines and of confident reorganization on more reasonable plans and sounder foundations.

1900–1910. Decade of advancement of live-stock industries. Wider recognition of profit and promise in alfalfa. Realization of large investments in meat-packing enterprises and transition from pioneer methods and policies to systematic operations. General appreciation of pure-bred live-stock develops from individual beliefs and efforts of preceding decades. Conviction dawns that California will advance to very great development of stock breeding and feeding by utilization of superior adaptations long foreseen, and that fruit and general farming

will derive advantage and extension from such development.

1910–1920. Decade of notable achievements. Great volumes and values attained in nearly all classes of production; only sheep, horses, mules, rye and wheat acknowledge peaks of production passed in previous decades. Organization of nearly all groups of producers into notably successful marketing associations. The State provides for official promotion of coöperative organization of agricultural producers. The war gives special products increased demand and popularity. From an outgo of ten millions in gold for imported food supplies in 1849, California advances to a local production thereof commercially valued at seven hundred and fifty millions in 1919, three-fourths of which, perhaps, bring gold or its equivalents for the advancement of the State.

To enable the reader to cover the whole field of California agricultural products at a glance and at the same time recognize details enough to give the review satisfactory definiteness, the following tabulation has been undertaken. It has been arranged to serve also an historical purpose, for entry is made of each crop or product in the particular year in which it achieved its largest record of quantity and the value is given for that year. In most cases the value is also the greatest ever attained but that criterion is not chosen, because high market prices may indicate less rather than greater volume. Quantities produced are a truer measure of capacity. The figures cited are chiefly derived from the records of the United

States Department of Agriculture. As totals of annual meat products are not available for recent years and will not be until the census of 1920 is compiled, the numbers of animals are the only index available of the extent of that important and growing branch of California agriculture:

Product	*Year of Greatest Product*	*Quantity*	*Value*
Apples	1919	8,640,000 bushels	$12,528,000
Apricots	1919	175,000 tons	14,000,000
Berries	1918	33,243 "	6,847,500
Cherries	1920	17,500 "	3,500,000
Figs	1919	11,000 "	1,650,000
Grapes, table	1919	200,000 "	15,000,000
Grapes, wine	1919	400,000 "	20,000,000
Raisins, cured	1919	182,000 "	38,325,000
Lemons	1921	5,300,000 "	13,250,000
Olives	1919	8,800 "	1,408,000
Oranges	1921	22,500,000 boxes	49,500,000
Peaches	1919	440,000 tons	26,400,000
Pears	1919	115,000 "	8,280,000
Plums	1919	42,000 "	2,520,000
Prunes	1919	135,000 "	32,400,000
Almonds	1919	7,250 "	3,190,000
Walnuts	1919	28,100 "	15,455,000
Nursery trees, etc.	1919	4,080 acres	2,920,458
Greenhouse products	1919	5,003,298 sq. ft.	2,099,308
Beans	1918	8,584,000 bushels	46,353,000
Barley	1910	46,500,000 "	25,575,000
Corn	1919	4,768,000 "	8,535,000
Oats	1912	7,800,000 "	4,290,000
Rice	1920	9,720,000 "	24,831,000
Rye	1907	1,251,000 "	1,063,000
Sorghums	1918	4,896,000 "	7,889,000
Wheat	1896	45,097,000 "	37,430,672

Product	*Year of Greatest Product*	*Quantity*	*Value*
Garden seeds ..	1919	20,621,610 lbs.	$24,902,792
Hay	1914	5,265,000 tons	43,173,000
Hops	1920	21,000,000 lbs.	7,350,000
Cotton (lint) ..	1920	73,150,000 "	13,167,000
Cotton (seed)..	1920	83,500 tons	1,419,000
Potatoes	1917	15,225,000 bushels	22,838,000
Onions	1920	3,713,500 "	2,785,000
Beets (sugar) ..	1916	1,477,426 tons	9,311,000
Sweet potatoes.	1918	1,190,000 bushels	1,785,000
Cantaloups	1920	14,000 carloads	6,000,000
Vegetables	1921	26,923 "	13,900,000
Dairy products	1919-20	(Appendix H)	99,004,358
Eggs	1919	64,123,885 dozens	31,420,704
Poultry	1919	12,929,044 "	8,921,040
Honey	1920	9,500,000 lbs.	1,140,000
Wool	1876	56,550,970 "	8,482,545
Slaughtering and meat packing	1920	.....	84,000,000
Forest products.	1920	.....	60,000,000
Horses	1893	518,824	28,010,045
Mules	1909	83,000	8,881,000
Cows, dairy....	1918	597,000	43,282,000
Cattle, other...	1918	1,701,000	71,612,000
Sheep	1880	7,646,800	12,287,816
Swine	1919	909,272	13,850,907

No formal total is appended to the foregoing because the compilation does not represent the products of any particular year. It may, however, gratify certain curiosity to know that the values aggregate over seven hundred and eighty million dollars, omitting of course the valuation of animals because they

represent no product but stock employed in production, of which the items of wool, dairy and slaughtering products are stated above.

It may also be noted that the figures include only products which reach magnitude enough to count as commercial commodities; also that the quantities reported are only those which actually enter into the larger avenues of commerce and do not include local consumption on farms or in rural villages.

Rural manufactures in California.

The standing of California as a manufacturing state which, according to the United States Census of 1914, was ninth in the Union, rests on an output of manufactured commodities of an agricultural character, fabricated in rural rather than urban communities. This standing has been attained recently, for the increase during the decade ending in 1914 was 176.9 per cent in value of all manufactured products and during the same period California advanced from sixteenth to ninth place among the states. The shifting of preponderance of manufactures from urban to rural environment is also of recent occurrence and the result has been the quick transformation of several small towns into cities of considerable size and great promise. The newer large towns have grown, not by the usual process of ministration to their rural environment, but through the incursion of organized rural producers to build up and equip their own establishments and employ laborers to give their own productions commercial forms and to manage

the sale and transportation thereof. In this way the countryside is assuming an initiative and proprietary interest in city building and manifesting its self-confidence and resourcefulness.

All manufacturing, however, in which California has engaged has shown some picturesque features. Almost immediately after the gold rush of 1849–1850, foundries and machine-shops were equipped in San Francisco to supply miners' machinery. Inventors were active and new and more capacious gold-extracting outfits were designed and constructed than were previously known. When mining declined in California, such machinery was still in demand for shipment to newer mines of the Pacific Slope and abroad. As styles of mining changed and new methods were employed, new machinery was produced to serve them, but, although this line of manufacturing was of considerable importance decades ago, it was of too specialized a character to become a great industry. One item out of the mining requirements that has survived and become distinctively great is the manufacture of pumps, which has increased because of multiplied uses for pumps of great power and capacity. Their services in large undertakings in drainage and irrigation indicates that these devices are now vastly more important to agriculture than they ever were to mining.

Another picturesque line of California manufacture is ship-building. Many ships have been built for freight and fishery service in near-by seas and for ocean-transit as freighters and liners; a few war-

ships of good repute have been launched from shipyards in San Francisco Bay; during the World War these yards won some distinction for speed in construction, but greatness in this manufacture has not yet been attained.

Of machinery for agricultural uses, the anticipations of earlier days have never been realized. Although California inventors and manufacturers have recently achieved notably in design and construction of tractors, not only revolutionizing tillage to a considerable extent but also showing European armies a new way to make war; and although many tools and implements for special uses are largely made in California, nevertheless the appliances for common agricultural uses are furnished by manufacturers in other states. The most distinctively Californian machine is the "combined harvester," which cuts, threshes, cleans and sacks (or pours into a bin-wagon) as it traverses the field. However, the decrease of grain-growing has set bounds on its service and distinction.

California manufacturing was handicapped by the absence of a coal supply until the abundance of fuel-oil and of hydro-electric power was demonstrated. Formerly there was a discouraging difference in the supply of factory labor and the rate of wages but these factors of general discouragement in manufacturing are disappearing. Prophets in industrial lines are predicting that the advantages of mild climate and its incidental gains both to employers and workmen will tend to advance general manufac-

turing in accordance with the advance in population and trade which is being realized. At present, however, her open door in manufacturing attainment is in the increase of distinctively rural industries.

The totals of values produced by manufacturing in California, according to the United States Census, for the years indicated, are as follows:

	1914	*1919*
Value of products	$712,800,764	$1,981,204,781
Value, less cost of raw materials	265,326,233	762,346,183

Selecting from the schedules of 1914 manufactures of distinctively rural character, the rural contribution to the development of California manufacturing becomes apparent, viz.:

Canning and preserving	$ 61,162,849
Timber and lumber	52,860,272
Slaughtering and meat-packing	50,011,820
Flour-mill products	24,078,735
Butter, cheese, condensed milk	30,466,428
Sugar-beets	15,528,666
Vinous liquors	11,299,858
Leather, tanned and finished	10,020,739
Food preparations	8,010,713
Fertilizers	2,330,761
Agricultural implements	1,962,235
Total	$267,733,076

Thus it appears that 37½ per cent of the total value of manufactured commodities of California is rural. The total of $72,800,764 includes the products of seventy-one specified lines of manufacture and

includes also $133,021,601 as the value of the products of "all other industries" which are not specified. Those specified include everything from a newspaper to a bottle of medicine and those not specified may be taken to include everything else made by hand or machine for public sale. In such a broad and inclusive total, the percentage of agricultural manufactures is remarkable. It is also notable that of the four highest values assigned to specified industries three are those named first in the tabulation above. The second of these four is petroleum products and they might properly be counted also a rural industry as all the petroleum refineries are in rural districts and such a preponderance of gasoline is released on rural highways and in generating power for agricultural purposes.

The greatest of all the manufactures of California is canning and preserving. This consists almost wholly of the canning of fruits and vegetables and the drying of fruits, with a small fraction of the value consisting of dried vegetables. Next in rank is petroleum products. The third is forest products and the fourth is slaughtering and meat-packing. The scope of these and the others in the agricultural schedule is sufficiently indicated by their titles.

The progress and attainment of California in slaughtering and meat-packing are shown by the United States Census Bureau as follows:

	1914	*1909*	*1904*	*1899*
Number of establishments	108	94	76	64
Value of products	$50,011,820	$34,280,000	$22,013,000	$15,817.000

The figures include, of course, not cattle only, but also sheep and swine. In view of the estimate of a product-value of $84,000,000 for 1919, "slaughtering and meat-packing" will advance to a higher place among "manufacturing industries" when the details of the census of 1920 become available. The same is true of all other agricultural manufactures.

CHAPTER V

AGRICULTURAL INDUSTRIES, PLANTS AND CROPS OF CALIFORNIA

In variety of crops grown, California leads in this country, due largely to her great area, varied climatic conditions, and range of elevation. In estimating the quantities and values of certain staple crops in the different states for the year 1920, the United States Department of Agriculture ranks California as the fourth state on the basis of production, reaching a "farm value" of $587,600,-591, as shown in detail in Appendix G. The farm value is of course less than the value crops bear when they reach wholesale markets and the latter is generally cited in popular valuations of production.

In 1921 California was advanced by the same authority to second place among the United States on the aggregate value of leading crops produced—because while the value of the crops of rival states declined from 60 per cent to 66 per cent, California crops declined but 41 per cent, owing to their unique character.

HAY AND FORAGE

The first decade of grazing of cattle and sheep by Americans was carried to over-stocking the land and "areas which carried thousands of animals

before, yielded scant sustenance to hundreds." Pasture improvement became the general demand. The necessity was conceived to be for perennial forage plants which would hold life in the root to displace the seed grasses, as the abundant annual plants were commonly called. Even after the idea of summer verdure on dry lands was abandoned, the hope remained of securing plants which, though sere above, could be started by the fall rains from the roots and not be dependent on growth from seed.

All these nutritious forage plants which finished their life courses in a single year, and there was a multitude of them representing many botanical families, were held at first to be native, although some of the most conspicuous and best of them were not indigenous but introduced, either with intent or by accident, by the Spaniards. Among these were wild oats *(Avena fatua),* bur clover *(Medicago denticulata),* alfilerillas *(Erodium cicutarium* and *moschatum)* and others of less moment and value. Some of these have advanced from California into the interior grazing states and have made a good record.

Effort and enterprise to secure perennials began with the pioneers who sent for seed of plants which figured in the permanent pastures in all parts of the world whence they had come. Subsequently, the Agricultural Experiment Station pursued the search broadly and systematically from the very beginning of its activities in 1875. Actually hundreds of perennial grasses and forage plants have been introduced during the last seventy years.

Naturally, as the chief difficulty to be overcome was the long soil drought of the dry season, much importance was attached at first to securing plants from arid and semi-arid regions. If the early Californians had known more about the forage resources of such regions and the ways in which grazing animals are maintained in them, they would have expected and expended less in this line of effort for practically nothing has ever been gained by introduction of forage plants which grew only in arid regions. Quite contrary to expectation, however, a few plants grown for centuries in humid regions and most hardy against soil saturation or even submergence possess a resistance which also serves them well in surviving the opposite kind of adversity in a certain degree of drought. There was disappointment that such grasses did not make a good turf but under moderate drought, even through a long rainless season on a soil naturally retentive, they kept life in the root. They assumed a bunchy habit of growth, and became coarser in texture as the result of their struggle with trying conditions. Though the ground-cover of bunch-grasses lacks the beauty, succulence and, in some respects, the value of the dense turf of the humid climates, its superiority to bare or weed-laden land is so marked that complaint of tussocky fields is silenced. So long as the bunch maintains its central inclosed life and verdure and will start freely into growth whenever intermittent moisture penetrates to its roots, the arid land stockman feels that he has perennial pasture, and has escaped the danger of

its running out, which always attends a dependence on annuals. It must be frankly admitted, however, that though good grasses which will withstand protracted drought in some situations have been found, they will not survive the summer in all locations. There are large areas of dry hills with shallow soils which rapidly lose their moisture, either by drainage or evaporation or both; and there are arid plains with loose soils which cannot retain moisture near enough to the surface to serve the purposes of shallow-rooting plants. In such trying situations even the hardiest perennial grasses thus far secured will not live through the dry season and do not give assurance of summer growth on dry hill and plain area without irrigation.

On the other hand, there are large areas of valley and uplands in the northwest coast region and in the mountain valleys in the northern part of the State (see frontispiece and Chapter I) where rainfall is abundant and the dry season relatively short; also in the lowlands along the rivers of the interior valleys, where the soil-moisture is maintained by summer overflow or by seepage, perennial grasses in considerable variety have established themselves. The grasses which years of trial have shown to be best for moderately dry lands in such situations are English and Italian rye-grasses *(Lolium perenne),* orchard-grass *(Dactylis glomerata),* red-top (Agrostis), and meadow soft grass locally called mesquite *(Notholcus lanatus),* tall oat-grass *(Arrhenatherum elatius).*

Mention of early introductions should include also

red clover *(Trifolium pratense),* white clover *(T. repens)* and alsike *(T. hybridum),* because of their value to the upper coast valleys and in interior lowlands, where the water is constantly too near the surface or often rises to submergence, both conditions hostile to alfalfa. Red clover is also notably successful on irrigated land in the foothills. Timothy *(Phleum pratense)* is an introduction of note because of its growth on the upper coast and moister mountain valleys of the extreme north of the State, even though it resolutely refuses to succeed elsewhere.

All the plants named thus far were introduced by private enterprise. Out of more than one hundred fifty introduced by the California Experiment Station since 1875, only four have shown themselves entitled to further consideration, viz., Smilo grass or many-flowered millet-grass *(Oryzopsis miliacea),* Schrader's brome *(Bromus unioloides),* awnless brome *(Bromus inermis),* and Harding grass *(Phalaris stenoptera).* Some of these have established themselves and are yielding value in wild pasturage, but none has solved the old problem of growth during relatively low winter temperatures and soil-saturation of the rainy season and either summer growth or, at least, survival of summer heat and drought on valley plains and foothill slopes. Therefore, securing an all-around dependable grass for the improvement of unirrigated pasturage is still a problem. The reasonable policy of the olden time to refrain from overstocking, to give the annual plants a chance to make seed before the rainy season closes and to return the

stock later, to graze the "dry feed," and distribute the seed of the mature plants, remains the most promising prescription for wild pasture maintenance.

During the last few years, several coarse summer-growing plants have been introduced and have shown promise of giving large weights of forage on naturally moist or irrigated lands, but they are either dead or dormant during the rainy season and, therefore, do not meet the prevalent requirements for success in this connection. This is also true of Bermuda-grass *(Cynodon dactylon)* which has invaded cultivated land where its presence is not desired while it has satisfied a few with its river and levee bank-holding, and its tolerance of a certain amount of alkali in the soil.

Some gold-seeker coming around the Horn and tarrying in Chile or some Chilean sending plants and seeds for sale in San Francisco (for such traffic is on record) introduced to California seed of a plant called "Chilean clover" in 1851 or earlier. In that year forty acres were sown by W. E. Cameron on the bank of the Yuba River near Marysville. About forty acres were sown each year afterwards on the same ranch, until in 1858 there were 270 acres well set with the plant. The alfalfa was pastured from February 1 to December 1, 1857, for hire at the rate of $3 per capita a month. The books showed that 2270 head were pastured for ten months or an average of 227 a month or over eight head to the acre, cash receipts being $25 an acre each month. The alfalfa in three fields had been fed down twice and on June

15, 1858, when it was officially visited by a committee of the State Agricultural Society, was three feet high and in bloom. The alfalfa was not irrigated; the previous year a freshet had washed the bank, showing the roots twenty feet below the surface. "While all other grasses and clovers under similar circumstances are perfectly dry and yellow, the alfalfa exhibits most luxurious green," is the report of the committee. Soon after its introduction it was given its Spanish name "alfalfa," and after a longer interval it was recognized to be the old-world plant of historic renown, known popularly in Europe as "lucerne" and to the botanists as *Medicago sativa.*

All lands do not have water at twelve to twenty feet; some have water only at hundreds of feet; some do not have soil open to the water at any depth but are shut off from it by impenetrable hardpans or layers of alkali; some lands have water which will not remain at a proper depth but will rise too near the soil surface or above it. Therefore, it was soon learned that alfalfa could not be the universal summer-verdure plant by rainfall on all lands because natural conditions sometimes gave it too high a water-table which caused its fleshy roots to decay and sometimes sank so low that moisture fell below even its surprisingly great powers of penetration.

Alfalfa is profitable only when its demands are met by adequate irrigation. It will accept soil of great variation in quality and depth if irrigation is wisely administered so that it is never either desiccated or drowned. Thus alfalfa, which the pioneers hoped

would deliver them from irrigation, which they saw at first no way to apply to the vast interior plains, has become the greatest irrigated plant of the State and beyond. It is interesting that although lucerne was introduced at an early date to the Atlantic states both north and south, it never widely demonstrated superiority to other clovers nor did it advance far westward. On the other hand, the same plant under its Spanish name alfalfa, moved eastward from California until it again appeared full of honors on the Atlantic seaboard, where it had been neglected for generations. The eastward movement is interesting. The Mormons of Salt Lake were pioneers in irrigation by Americans on the Pacific Slope, but they had no alfalfa until they saw the California demonstration and profited by it. Alfalfa followed irrigation water in Colorado, Idaho, Montana, Wyoming, Nevada, Arizona and New Mexico. Then came the movement eastward from the Rocky Mountains, Kansas and Nebraska first, and the whole sweep of the Mississippi Valley; then to the Atlantic Slope from New England to Georgia.

No single kind of plant (either herb, vine, or tree) is producing so great value in California as the alfalfa. No other comes so quickly to the homemakers' help on irrigated land or on suitable soil under rainfall, if properly protected from its enemies. No plant, save a vine or tree, endures so long in profitable service, or is so good to fit land for every other crop. Alfalfa is largely the basis of the following marketed products of the State for 1919:

Dairy	$74,515,381
Poultry	2,586,440
Eggs	18,120,080
Honey	950,000

It may seem strange at first to credit eggs and honey to alfalfa. The egg product in the alfalfa-growing districts is increasing rapidly, and even in the coast regions, where alfalfa is little grown, alfalfa hay and meal from the interior enter largely into poultry rations. As for honey, which was formerly made on wild bee pasturage, the chief product comes now from the alfalfa fields of the irrigated valleys. If it is objected that the dairy product should not be wholly credited to alfalfa, let it be noticed that no credit is given to the plant for its vast meat production and its contribution to the motive power in farm work stock. In fact, there are only enumerated what might be called largely by-products of alfalfa, but the case may be safely committed on the evidence given, in expectation of a verdict that alfalfa is worth more than a hundred million dollars annually to California.

Naturally the absence of the meadow grasses of humid countries which excited the apprehension of the pioneers was accompanied by a quandary as to what they should do for hay. They learned that wild-oat hay, of which there was more than abundance, could be cut whenever there was a good annual rainfall. The pioneers soon found that wild oats were just as hard to eradicate as eastern meadow grasses were difficult to get in. Cronise in his

"Natural Wealth of California" (1868) gives the following picture:

"When California became first known to Americans the face of the country was nearly everywhere covered with wild oats. Though parched, in the long summer, the grain held firmly in its capsule, giving good pasture. The wild oat has bearded projections with bended joints like the legs of a grasshopper. The first rains limber out the joints which, being again dried by the sun, shrink, causing the berry to jump about, giving it wide distribution over the land—and falling into cracks in the soil is preserved in these natural receptacles from birds, squirrels and other animals."

If hay could be made of wild oats which have particular ability to hold on from year to year without perennial roots, the question arose as to why barley and wheat could not be sown to cut for hay when continued haying of wild oats took away the seed and reduced the yield too low. Therefore, the problem of how to get hay in California remained settled until the desirability of alfalfa was fully demonstrated and it became the chief hay of the State.

Of the relative desirability of hay from grains cut green and from timothy and other meadow grasses, the only enduring opposition to the former was put up by the quartermasters of the United States Army, and this existed until very recently. When the continued occupation of the Philippines made it necessary to ship hay across the Pacific, it took some effort by local congressmen to get Pacific Coast con-

Plate V. A rice field in the Sacramento Valley.

tractors a chance to file bids and longer still to admit the grains cut green to the place occupied by timothy on the army schedules, but finally oat and even barley hay became admissible to the government mule menu. This fact is mentioned to emphasize the contrast between the conservatism of the army and the ready acceptance of grain hay by the pioneers who saw what the Mexicans did with horses. The more specific demonstration came later when the race horse magnates put a test on the efficiency of grain hay and stopped at no expenditure to secure the advantage of it. Joseph Cairn Simpson, who was probably the greatest equine philosopher of the last century, was firmly convinced that the supremacy of California horses, so clearly demonstrated a few decades ago, was due in good part to the climate and the feed, and he used to point to the practice of expert horsemen as supporting his contention. Simpson gave these facts:

"A test between Timothy hay imported from Oregon and wheat hay of California resulted in a decided preference for the latter. That estimate has been endorsed by many trainers from the east. Hickok, Marvin, Goldsmith and Salisbury, after one trip east with trotters, when eastern hay had to be used, became so well satisfied of the superiority of California hay that in subsequent eastern trips they took a season's supply with them. There were differences of opinion as to which kind was best: wheat, oats, wheat and oats, and wild oats each had its advocates. The crowning testimony of its excellence was when

Edward Corrigan, known at the time all over the United States as one of the most successful managers and trainers of race horses (which achieved many notable victories on every prominent race course from San Francisco to New York and from Chicago to New Orleans) shipped a detachment of his horses from California to England. Accompanying the horses went several carloads of California hay—enough to last his large stable for a year. This was because his horses did not do as well in distant parts as they did when trained in California, and this he could only ascribe to the superiority of the hay, as all the other conditions in distant parts were favorable."

Although grain hay was at first challenged, its victory was easy compared with the struggle alfalfa hay had to make for its deserts. The present popularity and wide use of the latter is in sharp contrast to its disfavor thirty or forty years ago, when sharp discrimination was made against butter manufactured from alfalfa-fed cows by city receivers who charged that its ill flavor made it impossible to sell it at anything like the price of coast butter and intimated that the cream must be "doped" in some way. The dairymen proved that they were feeding nothing but alfalfa and alfalfa hay and the trouble was corrected by changes in feeding materials and methods and in handling the milk and cream. During the decade following 1880, there was great difficulty over bad butter in the then new alfalfa district around Fresno. "Country butter" was declared too bad for

good axle-grease and "city butter," sent through San Francisco from the coast dairy districts, was considered indispensable to good housekeeping. Here again alfalfa and alfalfa hay came under indictment which endured for a time, until the large well-equipped creameries were opened in the alfalfa districts and began their conflict with the coast establishments for standing both in quantity and quality of product—and thus the prejudice against interior valley butter faded away. Since then the greatest butter production in the State has developed in the interior alfalfa regions and the greater part of the city milk supply also comes from alfalfa feeding, the hay being freely used in the old coast dairy regions where the plant is not largely grown.

Alfalfa hay for horses then came under indictment and city teamsters would not use it. Not only did it make the horses washy and prone to undue perspiration, but the public objected to having the pavements defiled with their excreta. Although alfalfa hay can be utilized in a proper way even for horses at hard hauling in the city streets, its unwise use has created a lasting prejudice against it, which it is hard for horse feeders in the alfalfa districts to consider reasonable as they rely on it largely for their country work horses. However, as city motors are now so largely fed on gasoline, the city hay supply is a diminishing quantity, both in use and in public interest. On the whole, alfalfa hay may be said to have made good for all purposes, to a degree far beyond early expectations.

The extent to which dependence is placed in California on grains cut green and on alfalfa for the local and export hay trade is shown by the following classification of hays for the two latest years in which such segregation is available:

HAY BY VARIETIES, 1916-1917

	1916 (*tons*)	1917 (*tons*)
Timothy	44,000	101,000
Timothy and clover mixed	44,000	121,000
Clover alone	87,000	75,000
Alfalfa	1,838,000	2,237,000
Millet and sorghums	.....	5,000
Grains cut green for hay	2,056,000	1,714,000
Other tame hay	306,000	307,000
Wild, salt, and prairie hay	240,000	259,000
Total all hay	4,615,000	4,819,000

One cannot be quite sure of the accuracy of this classification, because the schedule is the same as used in all parts of the country and those making estimates may have had to throw figures somewhat to get them in. The product of "timothy and clover" and of "other tame grasses" seems too large and those suggesting "coarse forage" are too small to include fresh-fed and siloed corn and sorghum, bean straw, and the like. The chief interesting item in the table is the relative standing of hay from alfalfa and from grains cut green and their total compared with the whole product, of which it is, roughly, four-fifths. Even the spread of irrigation has given little more of humid region grasses except in suburban lawns. Irrigation has merely magnified alfalfa, which

is now in a winning race against grains cut green, in which alfalfa has taken the lead during the last decade. It will require the careful enumeration of the census of 1920 to determine the matter definitely. It may of course be urged that the cry of the country for "wheat to win the war" may have caused some grain to stand to maturity which would otherwise have been cut green for hay; but, on the other hand, much alfalfa was plowed up in 1917 to plant beans of which California quadrupled her normal product, also to "win the war." Since then, however, the old land has returned to alfalfa and a vast area of new land has been added to its acreage, which has helped to gain the total valuation of the hay product of California, which reached $102,320,000 in 1920, although the tonnage, owing to war distractions and to seasonal irregularity, was less than in 1914.

GRAIN CROPS

During a century California has twice passed from a considerable surplus in wheat production to a lack of it for the uses of her own population, not by flood nor drought, nor by any other natural phenomenon, but by her own choice. In 1818 the missions produced 82,500 bushels of wheat, and in 1840 the rancheros were exporting to Mexico as much as 12,000 bushels; in 1850 the American gold-seekers were crying for bread, and wheat and flour were brought in ships from all the quarters of the globe. In 1860 California produced wheat beyond her own needs and

began her career as a world supply. Before 1905, the State began to eat more wheat than she produced and for a decade or more ranked as a consuming country. California does not stand as low in general cereal production as these facts might indicate, because she is now the largest barley-producing state in the Union and has attained, in volume but not in value, a higher producing and exporting mark in barley than ever attained in wheat.

Wheat-growing by Americans came about in this way. During the first decade of greatest gold output, there was wide trial of agricultural production, chiefly for home use and to displace imports. This was successfully done with many products that did not require much skilled labor, but the crops which could be most easily, quickly and cheaply produced were demonstrated to be cereal grains. Wool, dairy products, fruit, and the like, were shown to be superlatively suited to the natural conditions but they all required more men, money and time than to grow grains. For these reasons, California fell into wheat at first just as do all other new countries and found out later that her wheat was in particular request because of its whiteness and softness and its blending well with the dark harder varieties which Mediterranean and Atlantic ports of America were sending to Great Britain and the north of Europe. The war of the early sixties assured good prices and California entered the list of wheat supply countries under most favorable conditions.

This achievement followed an agricultural and not

a commercial initiative, which is rather unusual. At the opening of the first permanent pavilion of the State Agricultural Society in Sacramento, in 1860, it was announced that "samples of California-grown wheat sent to the chief agricultural societies of both hemispheres elicit the most unqualified testimony to its great superiority—which testimony is sufficiently corroborated by the price it brings in foreign markets whither the farmers have, from the last harvest, shipped already a very large amount to various parts of the world."

At the State Fair of 1860, the late John Bidwell said: "From 1848 to 1853 we were dependent upon importation from abroad for almost everything—including the staff of life. In 1853 we imported 498,740 barrels of flour. We are now able to export half a million ourselves. In 1853 we imported 80,186 bags of wheat—now the scales have turned and we are able to export. Our success in raising to the greatest perfection this the most valuable staple of the world involves the momentous question of our capacity to augment the production until we can justly claim, that ours is the granary of the Pacific hemisphere."

General Bidwell lived long enough to see California become the leading wheat state in the Union, over Minnesota, her rival of that time, and to see her produce in 1878 and 1879, two wheat crops with a farm value for each of about $40,000,000, more than twice the value of her gold output for each of those years.

The production of wheat in California in United States Census years has been as follows:

Year	*Bushels*	*Farm Value*
1850	17,328	.....
1852	271,763	.....
1860	5,928,470	.....
1870	16,676,702	$15,592,000
1880	29,017,707	39,524,496
1890	40,869,337	22,131,778
1900	36,534,407	16,555,304
1910	9,900,000	9,306,000
1913	4,200,000	3,990,000
1917	7,425,000	14,850,000
1919[1]	16,335,000	33,323,000

California's present capacity for wheat is shown by the quick return made to large production when both price and patriotism urged it in 1918. This was done without taking land from other crops, for all were largely increased by the same motives. No matter how great the population of California may become or intensive special industries, with fruits, vegetables and live-stock, there will always be land for wheat. Coast valleys and uplands, interior valleys and foothills, mountain valleys, lands reclaimed by drainage, lands protected from drought by irrigation or by rainfall conserved by tillage—everywhere in fact, up to a certain elevation, wheat can be successfully raised, if the right variety is grown in the proper way.

There is, therefore, much satisfaction in the demonstration that California can return to large wheat production without displacing other products and that

[1] 1920 was a dry year: acreage and product were reduced nearly one-third.

having reduced wheat-growing until one-half the local consumption had to be supplied from outside, the State can not only return to eating her own bread, but can produce also for export, preferably not wheat but flour, for the milling of which she is well equipped and the exportation of which was large and active even when the wheat had to be brought from other states for the grinding.

When wheat-growing in California fell to its lowest output, production was only about one-half of the local consumption. World experience indicates that no highly developed commonwealth where natural conditions favor the growth of wheat departs so far from a home supply. The ratio of imported to home-grown wheat in European countries is, in normal times, as follows: Great Britain, three-fourths imported; Germany, one-third; France, one-ninth; Italy, one-fourth; Spain, one-fifth imported.

Great Britain is in a group by herself because of large population of trading, manufacturing and leisure classes and enforced idleness of so much land. The other countries are better instances of small farms and intensive agriculture and they are largely producing their own wheat, as the fractions show. In their cases, the grain is produced chiefly as a part of the output of small and diversified farming. Of the several countries, France most resembles California in area and farm products. To support her population, which is fifteen times larger, France only needs to import one-ninth of her bread requirements, although giving much land to high-class special prod-

ucts. France is a demonstration of the fact that a fertile country with a climate favoring it can be most highly developed in the line of special products and still grow her own bread.

From an agricultural point of view, wheat is an indispensable factor in rotations for the maintenance of fertility in the soil. A high-priced cereal is the collector of the value which the other factors of the rotation store up. There are two high-priced cereals, wheat and rice, and both will serve as rotation-collectors, but wheat is vastly more available because of the extra water and soil handling which rice requires. Therefore, wheat is indispensable in improved farming of the future.

California should produce her own flour and enough for export. The milling process saves to the State the most valuable part of the grain, namely, the bran and other feeding stuffs required for dairy and other branches of the live-stock industry which indirectly enrich the soil and increase all products, with their by-products of manure. From this point of view, it might answer to import wheat and export flour, but California's milling industry will be most permanent and prosperous if it can command home-grown wheat. Great mills have a natural tendency to draw near to plenty of wheat.

In the change of objectives from production of export wheat suitable for blending by foreign millers to the local production of flour both for home use and export, it became necessary to demonstrate the possibility of growing in California wheats richer

in gluten to displace or reduce the need of importing such varieties to mix with the soft white kinds characteristic of the State. This was undertaken zealously with the result that several wheat varieties not formerly grown are now preferred.

It is desirable for California to continue wheat production because the wheat plant makes its chief growth during the winter or rainy season and turns at once into vegetation much moisture which would otherwise be lost in run-off or evaporation. Because the winter is a growing season, it is possible to secure maximum results from a minimum of precipitation. Therefore, the arts of better tillage, which have come to be called dry-farming, will do more in California than in any cold winter climate. In districts where the rainfall is scant even for dry-farming, wheat is also desirable because it is irrigated in the winter when water is most abundant in streams and least needed for fruit and forage crops. Wheat-growing in California is undergoing modification in cultural policies and methods which are beyond the scope of this writing, but assurance may be taken that they are contributing notably to the security and profitability of production.

It has been intimated that wheat-growing during its four decades of great exportable surplusage brought to California as much value as the gold output aggregated, from the discovery to the present day. Naturally so potent an agency, influencing life, labor, trade, invention, manufacturing, transportation, and the like, has not only played a very

important part in the development of the State, but has shaped it to its own needs and uses. No industry has ever peopled the harbor of San Francisco with ships as did the wheat business and no transportation gambler has ever made and lost so much money in any craft as in ships for wheat. Similarly, no farm product ever gathered land into such ducal areas or moved over it such capacious machinery of production or broke up so many men by its lure into speculative production or trade as has wheat. It hastily subdued a vast area of wild lands which were afterwards largely turned to more productive uses—to fruit planting and alfalfa-growing, the latter the basis for large dairy production and for the chief part of the progress made in improved live-stock enterprises, for the most notable achievements with better horses, cattle, sheep and swine have been secured on lands first farmed for export wheat. Wheat-growing also threw much land into good hands and the wheat trade furnished wealth for city building. Its effect on the development of good citizenship was also notable. Although it wrecked some families by the spirit of gambling and allied dissipation which it engendered, it stimulated a broader view of farming in others and many of the best of the second generation farmers, mentally well equipped and adequately capitalized, are the sons of the old wheat-growers of four or five decades ago.

Although California wheat-growers never attained fully capable and continuous organization, they have from time to time undertaken coöperative enterprise

with more or less success. In the first decade of large exports (1860 to 1870), they undertook to ship wheat for growers' account but they lacked control, capital and experience, and commercial competitors triumphed and never afterward yielded control. They did, however, achieve much for fairer financing and storage in the following decade when, largely through the Grange, they secured from the legislature a law providing for negotiable warehouse receipts for grain in storage in the country and they built many warehouses at interior shipping points which relieved them from immediate sale or shipment to metropolitan storage at high cost. When wheat was greatest the growers had, however, the spirit of coöperative organization but were handicapped in realization of permanent organization by the fact that in the public mind as well as in their own apprehensions, wheat-growing was regarded as a passing phase of production and not as an enduring industry. If, however, the current revival of interest in wheat should endure, there is every reason to believe that growers will control the product by assumption of coöperative relations among themselves as so many other groups of producers have done during the last decade, as will be shown in detail in Chapter VII.

Barley and wheat have had a close run for supremacy in California. On the whole, barley has led in aggregate volume of production for the last seventy years and wheat in aggregate value. Wheat sprang sooner into production beyond local needs, but

barley endured longer in such surplusage; in fact, when wheat declined below local needs and wheat ships practically disappeared from our harbors, barley advanced in production. From a local point of view, though wheat can claim the greater aggregate of value for all the years together, barley came in 1917, owing to volume of product and war prices combined, to reach a single year's value of product which exceeded the value of any single year's wheat. These elements in barley production justify the following statistical review, which can be compared with the similar record for wheat given on page 128:

	Barley	*Farm Value*
1850	9,712	.....
1852	2,973,734	.....
1860	4,415,426	.....
1870	8,783,490	$ 7,230,440
1880	12,463,561	8,979,349
1890	17,548,386	11,327,441
1900	25,149,325	6,388,153
1910	46,441,954	25,575,000
1915	39,440,000	24,453,000
1916	33,320,000	31,654,000
1917	39,150,000	46,980,000
1918	34,320,000	39,468,000
1919[1]	30,000,000	42,306,000

California figured only once as the leading wheat state of the Union, while she took the leadership in barley before 1860 and maintained it for half a century. In 1909 the leadership went to Minnesota and in 1915 North Dakota advanced above Minnesota, making California third in the barley list; but 1916 restored the leadership to California and

[1] Scant rainfall in 1920 reduced the crop nearly 7 per cent, and low prices reduced the total value one-third.

it has been retained since that date by a product of about one-fifth of all the barley grown in the United States. This supremacy becomes intelligible when it is understood that in California barley stands not only for potable virtues, which are now at least temporarily obscured except from the point of view of exports, but stands also largely for oats and corn, as will be cited presently.

Barley was the chief bread grain of mankind in most ancient times. It is interesting, however, to remember that though barley did consent to go 12,000 feet high on the Himalayas, and north to Scotland on the map of Europe, it always manifested preference for semi-tropical salubrity and was the chief bread grain around the Mediterranean until the ancient Romans brought wheat from Egypt and took to feeding the barley to their horses as they are doing in Italy and Spain to the present day. The Spaniards brought barley with them—to Lower California in 1697 and to our California in 1769. Barley reached the Atlantic Coast about a century earlier, but fell into disfavor because it only yielded about twenty bushels to the acre and only then on land rich, early, warm, and mellow; while in California it yielded incredibly, even under the rude husbandry of the padres. At the East farmers grew oats more extensively, in California the movement was reversed, for barley was easier because of favoring soil and climatic conditions.

At the first fair ever held in California, which was in San Francisco in 1851, a sample of barley

was shown from San Jose Valley of which it was said: "This sample represents a crop of 965 bushels from less than five acres." As this would be 200 bushels to the acre, we do not pass on its credibility. At the same fair another sample was shown "representing a crop of 53,000 pounds from 12 acres, grown by Madame Scoofy of Sonora." As this would be about ninety bushels to the acre, it is reasonable, for such a crop was frequently reported at that date and since then also.

At the same fair there were mentioned stools of wheat and barley "with 150 and 200 mammoth stalks from one root—the product of single seeds," which is also credible. The free-stooling of barley during the long winter growing season is matched by the succession of volunteering. In 1856 a committee of judges for the State fair made this memorandum: "Near Santa Clara on the road to Alviso we saw a field of fifty acres of volunteer barley. This is the fifth crop from a single sowing and the yield this year has averaged 43 bushels to the acre. It has received no special care." It is difficult now to appreciate the sensations of pioneer farmers who came from parts of the country where barley was abandoned because it required the best land and best care to get even 20 bushels to the acre. Here was a man reaping annually more than twice that much barley from seed sowed five years before and the field had never been given anything but a little harrowing since it was sown. California quickly became the chief producer of the grain in the Union, the product in

1857 being 5,980,485 bushels, while the whole United States in 1850 produced only 5,167,000 bushels.

Early Californians, both Spanish and American, took to barley instead of oats because the former was easier to grow in the more arid parts of the State, where the early agriculture was undertaken. This was owing both to acceptance of aridity and to the greater resistance of barley to rust. However, this was not the full explanation. By virtue of its kernel contents and its adhering chaff, barley is really the only rival of oats for stock feeding, both in nutritiveness and digestibility. Although in this conclusion Californians merely add their experience to that of the ancient Mediterranean peoples, they had a long struggle to convince others of the stock-feeding value of barley. It took a full half century, for instance, to convince the quidnuncs of the United States Army that barley was a wholesome cereal food for a government mule and if it had not been for the accident of feeding this animal in the Philippines with supplies from the Pacific Coast, where barley was abundant and oats were shy, it is probable that to this day barley would be banished from the official mule menu. The vindication of barley must now be considered indisputable, for both the victorious grand champions from the University of California Farm at the Chicago International Show in 1917 had barley as their chief grain feed.

Excellent barley is grown in the Rocky Mountain states, and to the northeastward, in North Dakota, Minnesota, Wisconsin and in Canada. In this region

barley succeeds, not because it likes hardship but because it is naturally very rapid in its course and can, therefore, sprout in the gentle springtime and sprint to a harvest before the autumn rains and fogs dim its brightness. Under such conditions barley is sown in northern climates from April 15 to May 25, about the time of its ripening in California. Growing in the California valleys from fall and early winter sowing, it advances more slowly during the rainy season, stools more amply and under favorable conditions makes its notable acre yields in this State.

The knowledge that barley has been grown in California since 1769 and that the variety most abundant since the American occupation is different from those largely grown elsewhere, has led some eastern writers to surmise that California had a native barley from which the locally cultivated variety had been developed. Two conclusive facts oppose this view: California has no indigenous barley or Hordeum species and no aboriginal population sufficiently energetic and intelligent to accomplish such development. Another assumption is that the common California barley is a legacy from mission agriculture and is, therefore, a descendant of a Spanish or Mexican variety which the padres introduced about one hundred and fifty years ago. This is a more reasonable belief, but it has not been demonstrated. There is no specific description of the barley grown at the missions preceding the coming of the early Americans. The question of whence came the six-rowed California barley is probably unanswerable. As soon

as the argonauts came in quantity, barley ran out of supply and importations were made from everywhere. There were 294,000 sacks of barley imported at San Francisco in 1853, which gave quick impulse to local production. It came from the four quarters of the globe and they all had six-rowed varieties grown chiefly for grinding. Some of these perhaps brought the six-rowed which became the common barley of California.

For many years California brewers endeavored to popularize some of the two-rowed kinds which were relied on by European maltsters, but the result was a winning fight for the six-rowed. The grower's idea that it is better to have six rows of grain on the head than two is reasonable not only on the ground that conditions of soil and climate favor a six-rowed variety and give greater weight of produce, but this greater vigor in the plant itself enables it to develop a six-rowed head producing a kernel which carries amplitude of starch, gives a strong sprout in malting and a low albumenoid content which best serve a brewer's purposes. The outcome of the whole matter is that although many varieties from all parts of the world have been tried and some have achieved local popularity, nothing has been found fit to displace the "common California barley" which has been chiefly grown from the beginning, although recently the University of California Experiment Station has demonstrated adaptation to special conditions in several varieties which are becoming popular.

It is an interesting fact that the pioneer barley-

growers of California had rather an ambitious dream of what they could do with the barley which sprang to a surplus production almost as soon as they touched it. In 1866 exports were made from this surplus, chiefly to Australia, of 741,815 bushels which suggested this dream, recorded in that year:

"What shall we do with our immense barley crops? We are growing hops of the very best quality and within two years the supply will exceed the local demand. We are annually importing millions of gallons of malt liquors for which we are exporting thousands of gold. Overburdened with barley and hops we should not go abroad for ales and porters, but should supply our own demand. This being accomplished we could save England the trouble and expense of doubling Cape Horn or the Cape of Good Hope to supply the immense quantities used by her colonies in the Indies and make money by the operation. The State offers a liberal premium for the first ale exported and proved to stand sea voyages and changes of climate."

The State by legislative act did offer $2200 as premiums for the first three considerable shipments of sea-going beer, but there is no record of payment thereof to a local brewer. However, California has contributed largely to the beer of the world, for exports of barley in 1915 reached a total of 26,754,522 bushels or two-thirds of the total barley product of the State in that year, and this was for malting at foreign points.

The outlook for barley-growing in California is

clouded by doubt. Will Europe lose its thirst for malt liquors and will the United States find more than enough barley in the northwestern states, as prohibition advances, and California be excluded by distance from American consuming centers? How far can local feed uses of barley be increased beyond the present one-third of the product which is now consumed in that way? Such questions are unanswerable. It is fair, however, to conclude that whatever dramatic situations may arise, barley, because of its winter growth which corn refuses, its short season and drought resistance with which wheat cannot compete, and because of its wider range of adaptations and greater resistance to rust than oats, will remain the most popular grain among California growers to the limit of its profitability.

Corn came from Mexico with the padres in 1769. They soon found that wheat, barley and oats were hardy against frosts, would make their chief growth during the rainy season and were easier to produce than corn which had to be kept out of frost by spring planting, and therefore, was pushed into the dry season to make its growth, which it resented by curling its young leaves while the winter-growing cereals were spreading flat blades to early maturity. The padres soon learned, of course, that on the lower moister lands, like those southward from the San Gabriel Mission (which was their greatest granary), corn could be brought through without irrigation, but not without more work than winter-growing cereals required. Therefore, the padres did not count

much on corn, and probably imparted this view to their early American visitors, for they also largely avoided corn. The first accounts of farming, after the gold rush, say little of corn, and the very first shows of produce were rich in tall and productive barley, wheat, and oats, but not in corn. Nevertheless corn was grown, for it is reported that in 1856, "many corn crops at El Monte, Los Angeles County, average 80 bushels to the acre and as high as 120 bushels to the acre has been raised." In that year the product of the State was estimated at 165,464 bushels, while wheat was 2,937,236 bushels, barley 3,229,230 bushels, and oats 364,420.

Soon afterward on the basis of good yields in widely separated places, there arose quite an interest in corn and large expectations were indulged in from 1857 for a few years and "yields of 80 to 120 bushels of shelled corn per acre from plants which attained a height of fourteen to twenty feet and carried ears nine feet from the ground" were reported in the records of the time. Thus, California can claim a share in the "tall corn" sensations of the same period which the Middle West enjoyed. However, even as early as 1858 the limitations in corn were quite clearly discerned, for in that year it was written: "There is not a doubt but that there are many fine corn-growing districts within the limits of California that are as yet unknown, so far as practical experiment has demonstrated their appropriateness to the culture of the product."

That suitability for corn depends on local condi-

tions and not on geography is shown by the very interesting fact that for nearly half a century the two leading corn counties in California were over five hundred miles apart. Los Angeles County has stood first in corn for more than sixty years, excepting two or three dry seasons. Sonoma was nearly always second until 1899, when she stood first, because Los Angeles was dry. Since 1900 Los Angeles has held leadership, several other counties have advanced to rivalry for next in rank, and Sonoma has done less with corn. Every California county grows some corn except Alpine and Plumas, which are too high, and San Francisco.

There are also some cultural requirements for success with corn which are more necessary than in states with summer rains, and these lead to choice of other crops. The maize plant is, however, greater in value in California than its grain product would indicate. The growth for the silo has increased probably a thousand fold in the last decade, but even for silage maize finds itself rivaled by sorghums and alfalfa, for the latter can either get along better without irrigation or make more satisfactory use of it than corn.

In census years California has produced corn as follows:

Year	*Bushels*
1860	510,708
1870	1,221,222
1880	1,993,325
1890	2,381,270

Year	*Bushels*
1900	1,477,093
1910	1,878,000
1915	2,624,000
1920	3,150,000

The relative insignificance of these figures is very plain by proper comparisons. The California corn crop of 1919 was only about one two-hundredth that of Iowa, while that of Iowa is but little more than one-seventh of the whole country. Roughly speaking, it would take about fifteen hundred states with California's liking for the crop to make the corn product of the United States.

In contrast with the lack of great achievement of corn is the rapid advance of rice, the production of which in 1919 constituted California second only to Louisiana in the volume of product and first of all the states in the average acre value of the crop. It was natural that the first Americans looking on the vast area of low rush-grown lands along the courses and in the deltas of the two greatest rivers of the State should have dedicated them to the production of unlimited rice. Especially did their prophecies pertain to the deltas where the land was always subject to overflow. There were sharp exhortations to rice-growing both to use lands, then thought to be almost worthless otherwise, and to displace the forty million pounds of rice annually imported, partly to feed the sixty thousand Chinese who were then in the State. This was the current dream for two decades centering in 1865 and, though nu-

merous small experiments with growing rice in the river deltas were made, no commercial quantity was ever gathered.

On the other hand, utterly forsaking this dream and the kind and situation of land for which it was projected, rice-growing, which did not give California entrance to the list of rice-growing states in the United States Census of 1910, began about that time, chiefly in the Sacramento Valley, and within a decade reached such production that the State became second for rice in the whole country, as aforesaid. It is dramatic also that, refusing the rich open soils of the deltas upon which other products properly handled rival the production of all other lands of the State, rice accepted hard rebellious lands on which other grains had become unprofitable because of the exhaustion of organic matter from the soil and often because of the increase of alkali therein. Such lands were usually far away from the rivers but when water was brought to them by irrigation canals or locally supplied by pumping from shallow wells, they held it up to the rice roots as coarse open soils could not do. The water, with adequate summer heat for large growth and safety for the maturity of the plant in a frostless autumn, produced surprising development. With the arrest of the water supply at the proper time, the land quickly dried out by evaporation in the dry autumn air and brought itself into an ideal condition for harvesting, with such a thick stand and full maturity of the plants that the average acre yield, as reported by

the United States Department of Agriculture, was for the year 1919, fifty-five and one-half bushels in California as compared with an average acre yield of thirty-seven and three-quarters bushels for all the rice-growing states of the country. Thus, the demonstration of the suitability for rice of large areas of land which had become of very low productive value for other purposes, coupled with the high price of rice engendered by the war, induced large investments for water supply and land leveling, brought the rent value of suitable lands to figures beyond all anticipations, and induced also large investments for rice milling and storage and organization of producers for handling of their products. All these things constituted a development which, both for speed and volume of investment and enterprise, no other specialty of California production ever realized within a single decade. Following are the records of the advancement of rice-growing in California compiled from the reports of the United States Department of Agriculture:

Year	*Production* *Bushels*	*Farm Value*
1910	3,000	$ 2,000
1911	6,000	4,000
1912	70,000	64,000
1913	293,000	293,000
1914	800,000	800,000
1915	2,268,000	2,041,000
1916	3,263,000	2,545,000
1917	5,600,000	9,800,000
1918	7,011,000	13,321,000
1919	9,300,000	24,831,000
1920	9,720,000	11,761,000

Comment seems baffled by a product which increased ten thousand fold in a decade. It is too sudden and too great to be either fully understood or appreciated. Perhaps the most significant fact about it is that rice added itself to the productions of California without notable disturbance of any other product, partly due to its using so much land which other crops were retiring from. If rice-growing continues to be profitable, the grain will assume mutually advantageous relations to other field crops because of the rotation with them which conditions promise to make imperative. Holding water upon the ground all summer for the sake of the rice induces growth also of other aquatic grasses and weeds which are at enmity with the rice and the easiest way to destroy them is to turn the land back to dry-farming for a year or two, in the course of which such aquatic intruders will disappear in the drought, or be sheep-grazed with the stubble, following the early harvest of winter-growing field crops. There are many other cultural problems connected with the new industry under climatic conditions somewhat different from those in other rice-growing states, which are beyond the scope of this writing. There are also problems touching the types of rural life which it will engender or promote, the solution of which cannot now be foreseen. It is clear enough, however, that such problems are impending. In 1920 there came autumn rains which checked harvesting, a fall in price which caused losses and the question arose as to whether, because of its spectacular advancement and

potentialities of extension or in spite of them, rice-growing may not be advancing toward a tragedy for itself or for other interests, agricultural, municipal and commercial, from which it may detract river water supplies which are indispensable to them. On the other hand, rice-growing may hasten great movements for river improvement and flood water storage which are essential to the greatest development of California both in production and navigation.

California is only one of seven states to secure place in the list of large growers of the sorghum group noted by the United States Department of Agriculture, and stands fifth. Pioneer Californians had an ambition to produce sugar, induced by the sight of true sugar-cane growing in the vicinity of Los Angeles. There was in 1885 a large introduction by the United States Patent Office of sorghum seed from China under the name "Chinese sugar-cane." Wide distribution was made in California. Its desirability as a forage plant was early discerned. In 1857, in the midst of the sweetest anticipations, in his State Fair address, Henry Eno of Campo Seco, Calaveras County, voiced this foresight:

"If Chinese sugar cane cannot be successfully cultivated for the making of sugar and molasses it is believed it will prove of immense value for forage. At least two crops can be raised in a year. I have known it this year, planted May 10, to have reached a height of 10½ feet by August. It was then cut down and a second growth started which was six feet high in September. It was irrigated."

A year later Elam Brown of Lafayette, Contra Costa County, declared that he had "found no other known plant at present grown in California that can equal Chinese cane. Whether profitable as a plant to be converted into syrup or not, its value as food for stock will secure it a permanent place in our list of valuable farm products."

It is also rather clear that other sorghums also reached California about the same time, "Egyptian corn" or "dhoura" being one of them, for in 1858 Stephen Cooper wrote from his farm near Colusa: "I grow Chinese sugar cane and Egyptian millet. They are much alike, but I prefer the latter both for grain and fodder." Some years later, on the publication of a full description of the plant, a San Diego County farmer wrote that he had been growing it in a small way since 1863, and considered "one acre of Egyptian worth 25 acres of barley because one can irrigate that much from a well and keep two or three horses and several milch cows every year independent of drouth." In this way sorghum really came to its chief use in California interior valleys which a re-introduction of both brown and white dhoura in 1874 direct from Egypt largely extended. Isaac A. Grout, in January, 1878, wrote: "I was first to introduce Egyptian corn to the Central California Colony, but farmers outside planted it on small scale with great success. I consider it the best crop for the valley as it requires little water."

It was probably at this pioneer colony of the Fresno district that grain and forage sorghums first demon-

strated adaptation to the needs of small farmers in interior valleys, which is conspicuous to this day. It was on the demonstration by the colonists that large production was later undertaken and found profitable. However, in California the planting of sorghums has usually been for temporary needs, the land soon going into alfalfa or fruit-growing. For this reason, the crop in this State has not reached the large figures of Texas, Oklahoma, Kansas and New Mexico which, with California, produced in 1919 nineteen-twentieths of all the grain sorghum credited to the seven states listed as commercial producers. These states produce, in fact, nearly the whole sorghum grain and forage production of this country, largely because in the southern extensions of the Indian corn-belt into regions where heat is high and the air scant of moisture, sorghum is more dependable and productive than maize. This is the chief ground of the popularity of sorghums in California. Since the uses of sorghum grain as a substitute for corn and barley in large scale feeding of swine and poultry have been amply demonstrated and its availability recognized as a summer catch-crop to follow winter-grown grain, if a moderate irrigation supply is available, and as sorghum rivals corn as a silo crop, its production was largely extended by the exhortation to grow all possible stock feed to "help win the war." The sorghum grain product of 1918 in California was estimated to be worth $7,889,000 (and in 1920 four and a half million bushels worth $4,250,000), while the capacity of the State for its

production is vastly greater, if profit be assured.

Perhaps the most interesting fact about the minor grains of California is that they are so small in production and value. Oats, which are of good standing in most other states and countries, are of only about as much value as grain sorghums which are themselves too small for enumeration in states where oats are great. This strange reversal of attainments is due to the fact that oats for grain are largely restricted to the coast counties and to the high mountain valleys of the interior and are practically excluded from the great areas where wheat and barley are grown. Sorghum grains are excluded from both the coast and the mountain valleys and are grown in the wheat and barley region of the great valleys, but in the summer instead of the winter. This gives sorghums command of a much larger productive area in the use of which in the dry season, however, they are considerably dependent on irrigation. Oats are also reduced in importance by the fact that even in regions well suited to them, they are likely to be displaced by barley which serves the same stock-feeding purposes and is easier to grow and surer to come to profitable production. If, however, one considers the use of oats not for the grain but for the hay product, it has higher standing and much greater value than the usual consideration of value would accord to them. On the whole, the reason why oats are so small in California is because barley is so great.

Of much less importance and value than oats is

rye. In fact, the government in its enumeration of staple crops excludes California from even casual mention in the rye category. Rye is a good winter grower and is raised for winter pasturage and cutting green or for plowing under as green-manure, all of which services it renders better than other grains in rather trying places. Rye is also grown in a small way for grain on lands which have become weary for both wheat and barley and occasionally a cargo of rye is shipped to Europe, as the local demand for rye flour is limited.

Buckwheat is even nearer the vanishing point than rye, in part due to its demand for frost freedom and requirement of rich mellow ground which can usually be employed to better advantage by other plants. The demand for buckwheat is almost negligible and buckwheat cakes are displaced by wheat cakes which are considered less heating to the blood. Buckwheat is grown to some extent as a maintenance ration for bees and as a summer-grown green-manure plant to supplement clovers and other legumes which are largely winter-grown in California valleys.

SEED-GROWING AND TRUCK CROPS

In the gold rush of 1849, many argonauts brought the very best seeds from their home regions in the older states for trial in the new country and secured later acquisitions by mail. Pioneers from all foreign countries also introduced seeds of the best home plants. As early as 1852 there were collected in California, in this way, a great variety of seed-

ling plants. The first commercial seed-grower on a large scale was A. P. Smith, near Sacramento. He began as a market-gardener in 1848 for Sutter's Fort and later expanded his operations to meet the miners' and pioneer planters' demand for trees and garden seeds. In December, 1858, this was written of him: "For the past few years he has continually raised tons of the finest seeds, which have been sold in every part of the State, in Oregon and Washington and the Sandwich islands and the annually increasing demand for his seeds is a flattering comment upon their value."

In June, 1860, this additional statement was made: "For several years, better seeds of all the vegetables that flourish in this latitude have been produced than have been or can be imported; this fact is now among the indisputable ones."

Greater than A. P. Smith, the pioneer grower, in lines of publicity achievement, was D. L. Perkins, who began growing seeds in 1856 on land now included in the city of Alameda. In 1870 his business had so increased that he himself wrote of it:

"It has been impossible for me to fill orders for seeds during the last two years. The time was when they would not buy of me, but that prejudice has worn off and they find that the seeds grown in California are better than foreign seeds. Probably there is no State in the Union so well adapted in its soil and climate as California for the raising of seeds; they seem to hold their vitality longer than those grown anywhere else."

Perkins' chief characteristic was his grasp of the advantage of long-distance publicity. At the Paris World's Fair of 1867 he exhibited his seeds, won a silver medal over eighty-four competitors and presented the collection to the Imperial Garden of Acclimatization of France. In 1868 he presented collections of one hundred and fifty kinds of California-grown seeds to each of four European and Asiatic potentates.

From the efforts of such pioneers, seed-growing made a good start. From 1870 onward, both growing and trade distribution were advanced and many seed farms were established, chiefly from Santa Clara southward in the coast valleys. In the eighties the attention of eastern seedsmen was arrested not only by the offerings of California commercial growers but by their own experience. When they offered prizes for the best products from seeds they sold, most of them were captured by Californians and they were thus compelled to conclude that California was the best place to let contracts to secure well-developed and strong seeds for their trade. Thus by the efforts of local commercial growers and distributors and by direct contracts with eastern distributors, seed-growing in California came, as the decades passed, to be a great business, until in 1910, by the valuations of the United States Census, the production of vegetable and flower seeds constituted 42 per cent of the total value of the seed product of the United States in those lines.

In recent years, owing to the interference with

foreign production by the war and because of high prices and patriotic propaganda, other states grew more garden seeds and California's share in the total production declined to about 20 per cent, but the range of kinds of seeds produced and their values show the variety and greatness of the industry:

CALIFORNIA'S PRODUCTION OF GARDEN SEEDS IN 1919

Crop	*Production Pounds*	*Valuation of Crop*
Beans—dwarf snap	1,006,000	$ 271,620
Beans—garden pole	2,974,000	1,115,250
Beet—garden	1,568,000	2,132,480
Beet—mangel	502,650	389,553
Beet—sugar	826,800	661,440
Cabbage	3,500	22,855
Carrot	2,135,700	2,669,625
Celery	62,650	318,262
Cucumber	70,500	133,950
Kale	4,800	9,792
Lettuce	570,750	1,272,772
Muskmelon	24,600	33,210
Watermelon	34,000	4,930
Onion seed	2,256,100	7,625,618
Parsley	52,560	65,700
Parsnip	225,000	337,500
Peas—garden	4,983,500	1,893,730
Pepper	5,000	28,250
Pumpkins	54,200	70,460
Radish	2,068,000	3,722,400
Salsify	82,000	225,500
Spinach	329,600	411,500
Squash—summer	98,400	123,000
Squash—winter	256,500	359,100
Sweet corn	145,200	58,080
Tomato	149,000	685,400
Turnip—English	124,900	149,880
Turnip—Swede	7,700	10,934
	20,621,610	$24,802,791

Some of the above quantities constitute practically the whole product of the United States and others are large fractions of it. California produces 86 per cent of the garden beet; 85 of the mangel beet; 99 of carrot; 100 of celery; 100 of endive and lettuce; 96 of onion; 100 of parsley; 98 of parsnip; 48 of radish; 100 of salsify; also the larger part of the flower seed grown in the United States. In addition, there is a considerable production of seed-potatoes (for which the State has enacted a system of certification), grains and forage plants, mainly alfalfa, which is chiefly undertaken in the interior valleys and foothills, but data concerning the cheaper field seeds are less definitely determined.[1] It is probably true that the total seed production of California has a value of about twenty-five million dollars annually as it passes from first hands. In 1920 California employed 41,562 acres of land in seed-growing, a little less than in 1919 when the acreage was 43,040. These figures rank California as the leading state in production of vegetable seeds.

Truck-farming is an important industry in California and has attained very unique and profitable development. A large export product is sent by both rail and sea to distant markets, the total annual exports of "green vegetables" aggregating over forty thousand carloads when growing and marketing conditions are favorable. It is a striking fact that storage of fresh vegetables is not necessary in

[1] The legislature of 1921 enacted a pure seed law which requires the labeling of field seeds in containers of five pounds or more to show purity and germination percentages.

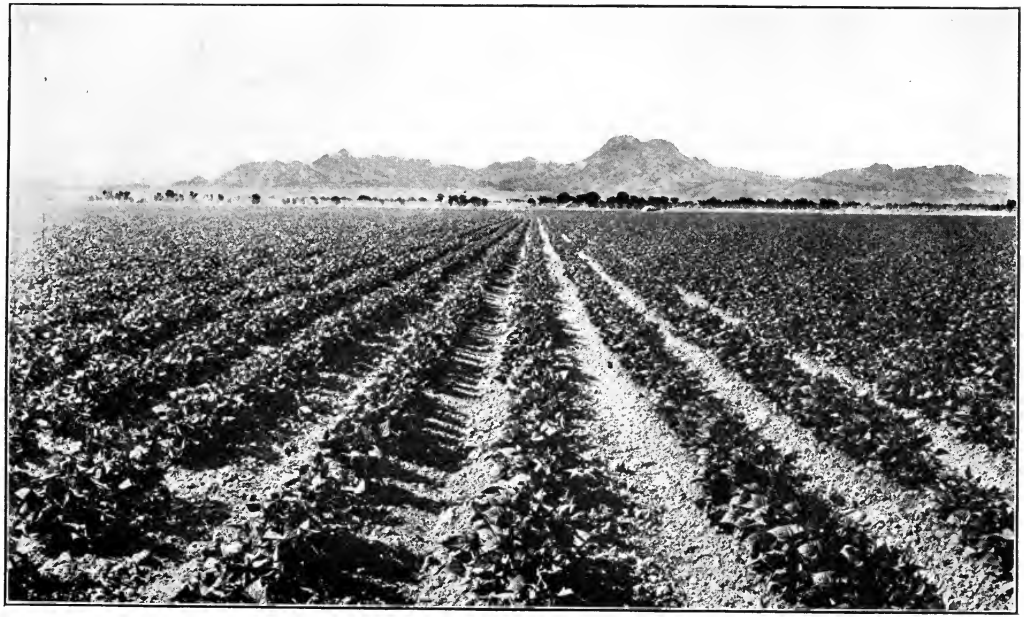

Plate VI. Bean field in the heart of the Sacramento Valley.

California. The mild winter does not freeze hardy vegetables; consequently they are allowed to grow until the shipping season arrives, as in the case of celery, cabbage, parsnips, salsify, and the like, or are gathered, sacked and placed under some cheap shelter from the rains, as in the case of potatoes, beets, and carrots. No storage pits nor cellars are thought of. In fact, the most direct and cheapest method of loading cars is employed in many instances, for railway spurs are carried into the center of the celery, cauliflower and cabbage fields, the crates filled and the cars loaded from the ground on which the crops were grown. This not only reduces the cost of handling and eliminates the expense of storage, but it enables the grower to supply the winter and spring markets on the Atlantic side, in the Middle West and the great interior plateau, as well as the North Pacific coast territory of the United States and Canada, with vegetables fresh from the soil.

California has in different parts of the State large areas of land excellently adapted to the various export vegetables which are proving profitable. The soils are various, and yet all in the truck-farming class, viz., deep sandy and medium loams of the plains, warm, easily worked and rich; alluvial soils of both ancient and recent origin, holding moisture well and full of plant-food; peat and sediment soils, reclaimed in vast areas by dikes, as in Holland (except that the excluded water is chiefly fresh), exceedingly productive and particularly adapted to the great crops of celery and asparagus.

The growing of vegetables for shipment fresh does not constitute the only opportunity in vegetable-growing. The output of canned asparagus, peas, beans and tomatoes is large and canners are always on the outlook to contract for their supplies. Beyond this, also, there still remains market-gardening to supply cities and towns and the popular resorts of tourists. The work is often very satisfactory and profitable. Production is, however, in the hands of orientals to an extent that must be counted as undesirable from an American point of view.

The principles underlying success in vegetable-growing are universal, but the methods in California are quite different from those applied elsewhere. Here the garden runs practically all the year in the open air. All during the winter, except in the mountains, successions of hardy vegetables are grown. Green peas, small onions, young beets, carrots, potatoes, and the like, can be ready at New Year's and continue for nine months, if desired. Asparagus begins in February and runs until May or June. Globe artichokes cover about the same season. Tender vegetables, sweet potatoes, tomatoes, beans, corn, cucumbers, squashes and melons are safe in the open air from April until October and in some places considerably longer. Lettuce, radishes and other relishes can be had all the year, and the same is true of garnishing plants.

The extent and variety of the commercial truck-farm crops are indicated by the following compilation, covering the products of 1920:

	Fresh Vegetables (*carloads*)	*Canned Vegetables* (*cases*[1])
Artichokes	60	.....
Asparagus	490	1,024,813
Beans, string	.....	99,269
Cabbage	1,223	.....
Cantaloupes	12,849	.....
Cauliflowers	2,167	.....
Celery	1,440	.....
Peas	.....	366,679
Lettuce	5,764	.....
Spinach	.....	685,328
Tomatoes	1,500	1,858,822
Tomato products	.....	833,019
Other vegetables	5,657	382,116
Watermelons	3,061	.....

Potatoes, sweet potatoes and onions add figures to the shipment of fresh vegetables when prices in distant markets and freight rates favor such movement. In 1919, 6,286 carloads of potatoes and 5,236 carloads of onions were shipped out of the State by rail but no such movement was possible in 1920. There is also considerable shipment of vegetables by sea to foreign ports and for ship-stores, neither of which is included in the tabulation, which indicates only the uses made of a portion of the total production estimated in Chapter IV. Total valuation of truck-crops grown in California sometimes rises above forty million dollars.

Bean-growing is the most important vegetable industry of California. There are no native beans in the agricultural sense, nor does California share in the aboriginal endowment of beans, which, through the recent popularity of the tepary and other ab-

[1] A case contains six one-gallon tins or the equivalent.

original sorts, handed down from prehistoric people, have made Arizona famous. Beans came with the Spaniards, or Mexicans, who are never very widely separated from frijoles, and were therefore brought to San Diego by the padres in 1768. According to the records, there were grown at all the missions during their active period, which ended in 1833, a total of 71,115 bushels of beans, of which 19,380 bushels were raised on land which is now central in San Francisco.

Beans came to California with gold-seekers, as did other garden seeds, but made a slow start, for what reason is not now known. At the first display of productions held in San Francisco in 1851, there were exhibits of many grains and vegetables of surprising size and productivity, but in the details given there is no record of beans, though nearly all other garden growths are specifically mentioned, described and glorified. Even in the list of plants of which J. M. Horner grew crops in 1851 valued at $200,000, and for which he was awarded a silver goblet as a prize, no beans are included.

At the State Fair of 1857 there was only one exhibit of beans, which led the judges to scold and prophesy in this way:

"One sample of beans only was exhibited. When this product shall be properly understood and the quantity known that has been and is continually imported, a wise attention will be given to a crop that will always pay, if planted upon the right kind of soil. California pays annually for many thousand

bags of beans imported from foreign ports and thus a competition is brought to bear with a home product that a little knowledge would enable it to defy and even become a rival in the very ports which now send beans to us."

Apparently Californians took to growing beans because they could not quiet their commercial conscïence over the sin of parting with so much of the rapidly decreasing gold product in paying for what they could produce themselves. The turn came rapidly and much satisfaction is expressed in contemporary records over the fact, in connection with the product of 1859, that the average of 20.56 bushels to the acre was set down in the United States census of 1860 as higher than attained in any other state, Connecticut following with 20 bushels and South Carolina next with 18 bushels. In 1860 also beans disappeared from the lists of products too largely imported and exports began. The records show the value of bean exports from San Francisco as follows: 1861, $10,214; 1862, $40,507; 1863, $11,608. The ability of the State to roll up a bean surplus was demonstrated, but the high hopes of profit were soon dissipated, for the crop of 1866 was worth only $1.50 a bushel, which, at the average yield stated, would give only $35 to the acre gross. Therefore, it is not to be wondered at that the acreage was reduced to one-half of that grown a decade before. Nevertheless, a local bean interest had been awakened and the record says in 1867:

"Every known variety of bean has been tried and

all have given good yields when properly planted. The varieties of beans are so numerous that almost any one of the large produce stores in San Francisco has for sale more kinds of beans than can be found in most of the cities of the United States. Considerable quantities of beans are exported, but the greater demand is from the mining districts."

California's greatest single achievement with beans was the large field growth of the lima. It was not only a fortunate demonstration of exceptional natural adaptation in some parts to this fastidious variety which was content to run at will over the dry soil surface without poles or strings, but it was also a most fortunate commercial hit and lifted California bean exports to great opportunity and distinctive character. The earliest official record of this variety declares that John Cook of Santa Clara was awarded a prize at the State Fair of 1856 for the best lima beans. In early times, however, limas were grown for green vegetables chiefly and the development of the dry product, which was first achieved in Santa Barbara County in 1867, was a real discovery of great importance, for it led to the selection of new local varieties and to so great a product that for the last thirty years the lima bean has regularly constituted about one-half of California's total annual output of beans. It has also been the chief incentive to the development of unique cultural methods and machinery for planting, cultivating and harvesting which have been of great importance and influence in bean-growing in other parts of the world.

For a generation previous to the war, bean-growing developed normally, production increasing as wider success was attained in marketing until beans moved by trainload and even Boston became a dependency of the California bean fields. For many years the product was chiefly from the central and southern coast counties (Region 2 and 3, as defined in Chapter I), the lima beans having always been exclusively from the latter, while other beans came to be also largely grown in Region 4 chiefly in the central areas of the confluence of the Sacramento and San Joaquin rivers. Thus bean-growing was extending naturally, adding new varieties and methods and invading new districts as adaptations were disclosed and profitability demonstrated. Then came the war, the exhortation to grow beans without limit, the advancement of California to the position of first bean state of the Union, all of which is most compactly told in a figurative way, as follows:

GREATEST BEAN STATES: VALUE OF PRODUCT TO GROWERS:

	1909	*1918*	*1919*
California	$6,295,457	$47,952,000	$19,418,000
Michigan	9,716,315	24,435,000	16,026,000
New York	3,689,064	11,122,000	7,105,000

California threw land recklessly into beans in 1918 and her chief gain from it was a demonstration of producing capacity. It was impossible to get from the product the valuation which current prices imputed to it because of distance from the great war consumption in Europe and lack of shipping to reach

it; substitution of cheap Mongolian beans which were bought for the Allies and for the United States Army instead of the American beans which growers were exhorted patriotically to supply. The result was that Californians fared worse even than eastern bean-growers in selling their product and while the valuation given above was proclaimed, the beans largely remained in warehouses a prey to interest, storage cost and weevils. Lima beans suffered less than others but the whole product fell away from the peak of production in 1919 and still lower in 1920 when the value of the crop fell to $9,405,000—a slight increase above the normal established during the few years preceding the World War.

The California bean industry has achieved much for its own protection and advancement by coöperative organization of growers, as will be noted in a later chapter.

FRUITS AND NUTS

The chief contribution of the Spanish missions to fruit production was perhaps the demonstration of opportunity in the adaptation of the State to grow all the fruits famous in the most ancient sacred writings. When one remembers that the California pioneers chiefly came from the states and countries in which, seventy years ago, the summer was a quick flash of strawberries and the winter a long barrage of dried apple pie, it is not strange that their imaginations were fired with discernment of opportunity when they beheld the olive of Mt. Ararat and Mt.

Olivet, the grapes, pomegranates and figs of Eschol and the oranges of the Hesperides being freely used as the commonest missionary munitions to win California's first war against barbarism.

Another incentive was production for home supply to exclude importations and to save the gold shipped to various parts of the world to pay for food products. More specific reference to the efforts in fruit production are interesting in this connection. The ambition to produce a home supply of fruits arises in all new countries. Most notable about California's effort was the speed with which it was achieved. As early as 1858 the danger of producing fresh fruit beyond the requirement of local markets was proclaimed and it was realized a few years later. In the early sixties planting was almost stopped, and, in spite of this, the product was too large for profit. Cheap fruit suggested canning and preserving, and as early as 1868, canned fruit and vegetables rendered the State independent of the eastern states and Europe, and shipments worth $650,000 were made to the other parts of the coast and to the Orient. Dried fruits of fine appearance were also being produced, but eastern dried apples were hard to displace, a million pounds a year being brought to California from 1863 to 1865. In 1866 it was recorded that "large quantities of apples, pears, plums, peaches and nectarines were dried for home consumption." In that year also the California product of dried prunes was estimated as about thirty-five tons weight and of raisins about forty tons, which was about the begin-

ning of commercial production of these fruits. Still the importation of dried fruits from the eastern states and from abroad was valued at $1,745,000 annually. In 1866 also there came to San Francisco from the vicinity of Los Angeles 250,000 oranges, while at the same time about 3,000,000 oranges were received from Mexico, Central America and the Pacific Islands. In those days oranges were counted and wholesaled by the thousand fruits and not by boxes or carloads.

It is notable that exhortation and effort for a home supply were always accompanied by anticipations of mastery of the American supply and reduction of importations of semi-tropical fruits to the United States, which is indicated in Chapter IV. The movement of the fruit-growers toward realization of an overland railway is also noted in that connection. There are, however, specific historical steps in the attainment which are interesting. From many similar contemporaneous declarations, the following are taken as indicating quite definite conceptions of California's capacity and opportunity. E. L. Beard, in his address as president of the State Fair held in San Jose in 1856, said: "Within four years I ventured to predict our markets will be abundantly supplied with all the choice varieties of northern fruits as the most favored sections of the Atlantic States, and after a few years we shall actually produce more olives, figs, raisins, oranges, lemons, prunes, dates and nuts than the present imports

of these articles into the United States, amounting to a value of over three million dollars per annum."

In 1863 a writer in the *Mercantile Gazette* of San Francisco made this conditional prophecy: "The man who shall bring into proper notice and cultivation in California the fig, the raisin and the prune will do the State greater service than if he should pay her public debt. There is no country in the world better adapted in every way to their successful cultivation than California. The United States is now importing these fruits at a cost of $2,318,978. In a few years, by proper exertion, our orchardists and vine growers may supply the demand of the whole country."

It was only five years later that H. D. Dunn wrote: "From present appearances it seems probable that California will be enabled to supply the entire Union with raisins before the close of the present century."

In 1869, when California was still counting and pricing oranges and lemons by the thousand fruits, it was written: "Citrus fruits, it is believed, can be grown here for the Eastern States with good success and profit. It would probably take California fifty years to supply the demand of the United States if her growers were to enter into the business with energy."

These were all true prophecies. Measuring them by the values of American imports of half a century ago, they have been far more than realized. In fact,

California production has more than kept pace with the increase of the population of the country and rendered the importation of several kinds of fruit almost nominal, besides participating in the American export trade. However, this was not simple nor easy to achieve. They began to push fruits and fruit products eastward by rail in 1870. Their progress was slow and the obstacles baffling. Mankind had never been called on before to lift ripe fruit more than a mile high twice while it was being trundled two or three thousand miles forward in ordinary freight cars over poorly ballasted tracks. Again, the first overland shippers were required to pay in advance for freight as much or more than has since been sometimes considered a fair average selling value at an eastern point for a carload of fruit. The situation was full of pomological and commercial problems. In short, growers who began distant marketing of their product had to learn what fruit to grow, how to grow, pack and load it for long transit and how to sell it to get their freight money back. The orchards and vineyards were attacked by many pests and diseases from which the planters of the first two decades had declared the State forever free.[1]

Under the incentive of distant trade, California fruit-growers have naturally become important factors in transportation. They have been influential

[1] Distribution of pests has been checked for many years by enforcement of rigid quarantine laws and in 1921 a statute was enacted requiring that all local and distant nurserymen shall be licensed before they can sell trees and plants in California.

in multiplying overland railways and the regulation of them by government authority. Just as their predecessors of the first generation promoted a highway across the continent, so did the fruit-growers and shippers of the second generation help to secure the second great novelty in American transportation, the Panama Canal. For a quarter of a century before the building of it, the California fruit-growers were among its most persistent promoters and it has manifested the advantage which they expected, although the measure of that advantage will be for coming generations to realize.

California fruit production was really an act in industrial creation. The more distant objective of export was clearly in mind even while home supply was deficient. The conception of entering national and world trade in fruits before home supply was attained was unique, daring and original. The common way, of course, is to project distant movement because local markets show surpluses which traders can gather and transport, building commerce first on short hauls, then on longer and longer still, until world currents are entered. California conceptions rose above any such evolutionary process and were really creative.

Success in the upbuilding of California fruit industries is the product of organization, both for its own specific purposes and for correlative attainments. So far as these related to the development of the state by colonization, they have been considered in Chapter IV. The relations of organization to com-

mercial promotion of fruit-growing will be discussed in Chapter VII, because the results were the outcome of a general ambition of farmers to do their own business and the success of fruit-growers acted as an incentive to groups of other farmers toward that achievement. There were, however, forms of organization strictly internal in their activities and exclusive in their service to fruit-growing which exerted very marked influence. During the first three decades they consisted of fruit-growers, local societies and clubs which were ephemeral but rendered important service, especially in the line of disseminating cultural information. They were also instrumental in the attainment of more systematic undertakings on rather broader lines, of which several will be sketched.

Very specific in their work and very influential were the "Citrus Fairs" beginning at Riverside in 1879 which unified people in sympathy and purpose and taught the motley collection of reformed sheep farmers, teachers, lawyers, doctors and tired business men, who largely comprised the early citrus colonists, the difference between an orange and a gourd and that girth and weight were not the chiefly valuable characters of a lemon. These citrus fairs were intensely educational. It is impossible for anyone who did not participate in them to realize how intense they were. No one knew which was the best orange and the best lemon to plant except an exhibitor and, if he had buds or young trees to sell, he had no doubts about it. When the question of the

very best was being incubated by the judges, exhibitors were too nervous to sleep and the whole community was expectant. The question of the best orange was decided by side-tracking all seedlings and proclaiming the sovereignty of the Riverside navel, which subsequently took a broader name. The decision on lemons was not so easy. They were all considered sour enough but the question was which one would not go bitter. Therefore, lemonades were made of all separately to see how they would taste the morning after, all samples being securely locked up so that no exhibitor might be tempted to come in the night and give doses of quinine to all his rivals. These early citrus fairs were well-springs of enthusiasm and of optimism but they also taught close discrimination and loyalty to correct standards of judgment.

Similar in influence to the early citrus fairs in southern California were the "Fruit-Growers' Conventions" which dealt chiefly with deciduous fruits, the first of which was held in 1881 and the fifty-third in 1920. These popular assemblies have convened once or twice a year in all parts of the State. They have been unique in their character and most effective in their work and many of the great successes of special fruit-growers' organizations in regulating production, protection, transportation and distribution have followed from the initiative at these great conventions. No other agency or institution compares with them in work done for the promotion of the fruit industry and the prosperity of producers.

They were from the first a novel kind of organization and in method and purpose quite unlike the horticultural societies of other states and countries. They set up no qualifications nor requirements of membership; they had no constitution nor by-laws. Their rallying cry was: "Let's get together and do something," and the growers did get together and did things continuously for forty years.

It was in the same decade that promotion and protection of fruit industries was permanently grafted upon the State Government of California. Commissions on viticulture were created in 1880, and in 1881 repressive and quarantine regulations against fruit pests and diseases began by State authority. Practically every session of the legislature since that date has amended and added to the laws providing for State and county protection of fruit industries and appropriated funds for the extension of such work. In this original line of legislation, California has provided models of purpose and enactment to all other states which have moved in the same direction since that time and has also influenced the policies and provisions of the national government.

In the same decade also the foundations of distinctly horticultural literature were laid by free and dignified publication by the State of the transactions of fruit-growers' conventions and of State Boards of Horticulture, Viticulture and Forestry; by the enlargement and improvement of horticultural

journals and by the publication of special monographs and books on local horticultural subjects.[1]

In the development of fruit industries, California has had notable help from other states through the placing of fruit products under the protective tariff. This offsets remoteness, higher cost of transportation and higher wages than ever paid in the Mediterranean countries which were her chief competitors. The handicap which impended through the free trade legislation of 1913 was averted by the world war and the revenue needs of the country after the war may render indulgence in free trade policies impracticable for a long time.

In acknowledging California's great debt to national help in population, capitalization and legislation, it is not amiss to remember that she has achieved results which have had distinct bearing on the fruit development of the whole country, a few of which may be cited.

First, the relation of tillage to thrift and productiveness of fruit-trees and vines. California demonstrated that clean garden-like culture of large fruit areas is superior to cow-pasture conditions; and first applied on a large scale the principle that adequate

[1] The scientific and technical literature of California fruit-growing is considerable, not only in the publications of the State Boards mentioned but in those of the U. S. Dept. Agr. and of the Calif. Agr. Exp. Sta. There are also comprehensive treatises: viz., "California Fruits and How to Grow Them" by E. J. Wickson; "Citrus Fruits" by J. E. Coit; "Standard Cyclopedia of Horticulture," by L. H. Bailey, has descriptions of California methods in the treatments of all leading fruits and ornamental plants, as well as descriptive and botanical characterization of forest trees, etc.; "Manual of Tropical and Subtropical Fruits" by Wilson Popenoe.

tillage is effective for moisture conservation, both in operations by rainfall and by irrigation, as will be outlined in Chapter VIII. To these early conceptions, the State has recently added the widest demonstration that cover-cropping with tillage includes restoration of soil fertility in the act of securing the highest duty of water.

Second, the relation of form to efficiency of plant performance. Methods and styles of tree and vine pruning have been devised and older systems from other parts of the world modified with such success that "California style" is recognized horticulturally and accepted as a model for imitation in more recently developed fruit regions in all parts of the world. "California style" in pruning is, however, progressive and is undergoing modification as the result of improvements demonstrated by research and large operations in practice.

Third, the relation of plant protection to success in commercial production. California has devised original methods and demonstrated the value of new materials in insect warfare which other fruit-growing countries have accepted as important improvements. In addition to her initiative in legislation to control and exclude pests, she first applied high-pressure spraying and invented devices to secure it; first publicly announced through an experiment station bulletin investigations which made legal control of insecticide manufacture and sale imperative, although a few other states preceded in actual enactments; first demonstrated the efficiency of lime sul-

fide in killing armored scales on dormant deciduous trees, which is now universally employed for that purpose; discovered the availability of hydrocyanic gas for insect killing on tented evergreen trees and saved her citrus industry by systematic and timely invention which rendered the use of this treatment practicable and profitable; first made great and striking demonstration of success in bringing from abroad the natural enemy of an injurious insect which arrested the latter's progress and made world search for beneficial insects and introduction of them a sustained State policy. In a very different phase of fruit protection, California was first to demonstrate the feasibility of frost prevention by direct heating of the atmosphere.

Fourth, the relation of new varieties to commercial fruit production. New varieties of fruits have been originated, which, in the case of peaches, plums, almonds and walnuts, constitute the larger part of the commercial product; the immense citrus fruit production has been built up with varieties of especial suitability which were not commercially important elsewhere. All these fruits of California birth and adoption have now a place in the world pomologies and are becoming important abroad in all regions which have natural conditions resembling our own. In addition to his notable contributions to this attainment, the unique conceptions and original methods of Luther Burbank have given California popular repute for leadership in plant-breeding and have stimulated public interest in plant improvement.

However, in fruit-growing California does not need new varieties so much as better ones of types already demonstrated to be supremely serviceable and acceptable. In this direction, the demonstration of rigid test and acute selections as a basis of propagation made in California seems destined to become a moving horticultural force throughout the world.

Fifth, the relation of enterprises and methods to fruit preservation. California is the leading state in the Union in the output of canned and dried fruits, and her styles of these products and methods of producing them are models in other parts of the world which have conditions favoring their use. The pioneer policy of producing fruits directly for preservation as a primary product and not looking on preservative processes as merely means for saving fruits from waste, was new to America though it was a prevailing practice in some parts of Europe. On it rests largely the development of great canning and drying industries. The California drying tray is an original invention of about fifty years ago, which by its cleanliness, ease of handling and economy of space, immediately relieved producers from most of the cost and dirt of the drying floors used from time immemorial throughout the Mediterranean region. The use of sulfur for preserving natural color in sun-dried fruit is an ennobling of the older art of using sulfur as a bleaching agent.

The California fruit box, so-called, but which was probably first used in shipping Oregon apples to San

Francisco, threatens to displace the old bushel basket and barrel, as fruit carriers everywhere.

California raisin machinery has invaded historic Malaga. Packing-houses for all kinds of fruit embody original work in plan, policy and appliances, and the remarkable results attained in careful handling of fruit in the orchard, on the road, in the packing-house and in the cars, and in realizing the advantage of pre-cooling.

California grows many fruits of the temperate and semi-tropical classes. The list is growing and some are coming into prominence and acreage which are not yet enumerated by the official statisticians, while many others receive attention only from enthusiastic amateurs. It is not the design of this writing even to approach the categories of kinds and cultures but merely to cite facts enough about particular fruits to indicate to the general reader the materials and conditions that enter into the pursuit of the greatest agricultural industry of California and thus underlie the greatest fraction of the rural life and industry of the State.

The fruits that are commercially great in California, and their relative importance, are concretely shown by the State Board of Equalization, on the first of March 1920, in the table on page 178.[1]

As it is the function of the State Board of Equalization to deal with taxation and as their enumerators are the county assessors, securing their data

[1] The amount and value of the 1920 product of these plantations, also the movement beyond State lines and the quantities of preserved fruit products are given in Appendices G and H.

Numbers of Trees	*Bearing*	*Non-bearing*
Apple	2,276,406	1,149,300
Apricot	3,336,646	548,054
Cherry	750,794	301,917
Fig	543,940	386,024
Peach	10,708,395	980,403
Pear	2,168,198	1,098,668
Plum	1,133,145	261,553
Prune	11,829,832	3,329,634
Lemon	2,212,883	531,253
Olive	1,150,059	353,199
Orange	9,878,635	1,490,826
Pomelo	143,423	149,802
Almond	2,711,550	1,872,387
Walnut	1,173,123	381,068
Acres of Small-Fruits		
Grapes, table	64,823	15,938
" raisin	138,922	19,814
" wine	126,357	10,697
Strawberries	5,997	
Other berries	4,890	

largely from persons about to be taxed, it is unlikely that the foregoing statement is exaggerated. The total number of fruit-trees growing in 1920 is, by the foregoing enumeration, 62,951,117 and, estimating the planting of tree-fruits at an average of eighty to an acre, and including the acreage of small-fruits, the total is 1,162,884 acres, which comprise 1.1 per cent of the total land surface of California and 5.8 per cent of the arable land of the State, as cited in Chapter I.

The geographical distribution of fruit production in California is indicated in the discussion of the characters and products of the regions of the State in Chapter I. Leading facts about other phases of

production which may lead toward a general understanding of the producing situation of each fruit will be briefly indicated.

The apple industry of California has two distinct branches: one is the growing of early varieties for sale in the northern parts of the Pacific Coast and the interior mountain states before the earliest apples can be ripened in those parts. The localities where early varieties are chiefly grown for such shipment are in the Sacramento Valley and the foothills surrounding it. The forcing heat of the spring and early summer brings early varieties quickly to notable size, crispness and flavor. This heat, however, continued into the summer and autumn, makes the same districts quite ill-suited for the growth of winter apples which are prematurely ripened and lack quality and keeping power. The second branch of the apple industry then, the production of winter apples, is undertaken in parts of the State quite different in climate from that of the early apple regions. The requirements of a winter apple are fully met by two main divisions of the State, viz., the smaller valleys close to the coast; in fact, in some cases, the coast flats, where the exposure is directly toward the cooling breezes of the ocean which produce a cool summer, a long slow-growing season which develops the greatest beauty and highest quality in a winter apple. Similar results are also produced by the climate at an elevation of 2500 to 5000 feet on the interior plateaux and in the mountain valleys. The coast district has developed a greater commercial apple

industry than the mountains because transportation facilities for shipment are vastly better, but as the State advances the mountain districts will be employed in this production much more largely.

Apricot trees stand in the open air without protection of any kind and bear large luscious fruit. Excepting a few localities in other parts of the Pacific Slope, California has a monopoly of commercial apricot-growing. However, the apricot does not find all parts of the State suited to it. The whole northwest quarter north of San Francisco Bay and west of the high ridges of the Coast Range does not grow apricots commercially, nor does this fruit anywhere ascend above an elevation of 1500 feet on the foothills. It is particularly a fruit of the protected coast valleys south and east of the Bay of San Francisco to the southern end of the State; also of the great interior valleys and lower foothills, avoiding, however, the low places in these valleys where spring frosts may injure the crop, though the tree is not harmed. A point of advantage with the apricot, as with the pear and peach and to a less extent with the nectarine and plum, is that it has three great lines of demand: First, as fresh fruit, second, canned, third, as dried fruit. Some counties producing apricots largely are 500 miles apart and their success shows how widely suitable locations are distributed over the State.

The cherry is one of the lesser orchard fruits of California because the regions which favor it are fewer and its commercial field is less, but in size and

quality of the fruit and prolific bearing of the tree, the cherry is a great fruit in locations which meet its requirements. The cherry requires a modification of summer heat and of the dryness of summer air and for these reasons does not thrive on the interior plains, even when irrigation is employed to regulate soil-moisture. In the central coast valleys and in those tributary to the great Sacramento Valley and on the river lands, where depth of soil prevails and modification of air dryness is secured by abundance of adjacent water, the cherry grows magnificently. Elevation also secures conditions suitable to the cherry in some cases, notably in southern California, where the product of trees in mountain valleys at an elevation of 2000 feet or more is satisfactory and profitable although the trees on mesas below, where citrus fruits thrive, are disappointing. The cherries grown are of the sweet varieties. Sour cherries grow and bear well but are not commercially desirable.

The peach ranks second among deciduous fruits and has a very wide range in California. It goes beyond the apricot in the coast valleys north of San Francisco; it grows beside the apricot wherever the latter thrives in the interior, rises a thousand feet above it on the foothills and goes lower on the plains into the frosted areas with safety because of its later blooming. The peach has a ripening season with different varieties and locations from May to December, although, of course, the mid-season varieties constitute the great commercial crop. The varieties most

largely used are of California origin. The peach is chiefly grown in the great interior valleys, the San Joaquin and the Sacramento and the foothills, though coast valleys participate in production.

The nectarine is a smooth-skinned peach, but it bears no comparison in product nor popularity. California produces an excellent nectarine, and better demand for the fruit may at some time justify increased producing effort.

The pear resembles the peach in its wide range over coast valley, interior valley and foothill situations, but it extends beyond the peach, for it goes to an altitude of 5000 feet and descends to the lowest places in the valleys, for neither frost nor occasional standing water can avail against it. It escapes frost by its slow start in the spring and it endures water and even a degree of alkali in the soil by the hardy character of its root. In ripening also it is not injured by a degree and duration of heat which ruins the quality of a winter apple. Until about two decades ago, the pear was free from the blight in California and there seemed no limit to the possibilities in pear-growing. Since then the disease has wrought havoc and many growers have abandoned it, but those who wage successful warfare are greatly profited. The varieties grown are comparatively few and the Bartlett is chief, because there are fully two months between the first to mature in early districts and the last in late regions, and during all this time supplies are ready for shipping and canning of this one exceedingly ac-

ceptable variety which permits no intruders while it is in season. Later pears are little grown although a few shippers are doing well with winter varieties.

The choicest varieties of the European plum are hardy in California. Growers do not need to circumvent the curculio and the black-knot for these have never appeared in the State. The French prunes were introduced at an early day and the product has won its way by displacing European prunes in American markets, has outgrown the requirements of the United States and is being largely sold in Europe, even in France itself. California has invented new methods of handling prunes by machinery and other labor-saving recourses and has endeavored by human devices to contribute to economy of production to which nature contributes free sunshine and dry air. Probably nowhere can so rich and delicious a fruit food as the California prune be so cheaply produced and it is warranted to expect that the world will need all that can be grown if organization for distribution and trade is continued. The largest prune-producing valley is Santa Clara (which has nearly two-thirds of all the prune trees in the State); other coast valleys and the great interior valley participating in the production of the other third of the crop.

Of plums, aside from varieties that are dried without removal of the pit (and therefore called prunes), the production is largely restricted to the Japanese and a few European varieties which are particularly

adapted to fresh fruit shipments and canning. These fruits are largely grown in the districts where early ripening can be counted on. The size and beauty of the canning plums are striking and the product reaches a good volume.

California produces practically the whole of the almond crop of the United States. The almond demands much intelligent judgment on the part of the grower. It is a very restless tree during the winter because the temperature in the valleys is always near the point which induces blooming and rather a light frost may injure blossoms and young nuts. It is very important to select locations where there is a minimum danger of frost. These are on the bench lands around small valleys, while the bottom lands in the same valleys might be quite frosty. Frosts are also less frequent on the plains of the interior valleys where there is a free circulation of air to equalize temperatures, while on the river bottom lands the trees may be unproductive. The almond does not thrive at elevations in the foothills and seems to be a bench and valley fruit, but even within these limits locations must be chosen with close attention to local topography. The wide distribution of the product shows that local conditions rather than wide geographical generalizations should be studied.

The chestnut product is small and consists almost entirely of the Italian variety grown in the interior valley and foothills.

On light loams all through the lower lands the peanut thrives well and makes a large product of

exceptionally large, bright and well filled nuts. In southern California the chief product is on the lower lands of the coast region, while in the central and northern parts, peanuts are mostly grown on the alluvial loams of the river bottoms of the Sacramento and San Joaquin Valley, although the crop is sometimes made between fruit-trees on the light upland loams. Although sometimes quite profitable to those who have mastered the details, the crop has been recently unprofitable because of reduction of duties on importations and only a small fraction of the peanuts used in California are grown here.

The pecan grows and bears well in the lower lands of the interior valleys. It does not thrive near the coast where the seasons are not well defined nor in the drier regions of the interior. On deep lands, however, where moisture is ample and the approach of autumn is marked by rather sharp frosts, the pecan stops its growth and matures its nuts satisfactorily. The product has not yet risen to commercial importance.

The English walnut is the most important nut grown in California, judged by the volume and value of the product, by the breadth of its adaptability to local conditions and the greatness of its outlook. The present product is almost entirely grown in three southern coast counties. In recent years there has been a large planting in the central part of the State and the product of the future will be drawn from a wider territory. The walnut tree is content with the coast, interior valley and foothill climates, pro-

viding it has sufficient depth of soil to sustain it and to furnish the constant, but not excessive, water supply that it needs. Where the rainfall is large and the soil deep enough to retain moisture and yet open enough to prevent standing water, walnuts yield satisfactory results without irrigation. In places with light rainfall or where the soil is too shallow or non-retentive to hold moisture for the long growing season, irrigation is requisite.

The grape grows in all parts of California from near sea level to an elevation of 5,000 feet or more. It is contented with nearly all fertile soils from the deep valley loams, where the great fat firm-fleshed grapes are grown for raisin and table purposes, to the shallower soils of the high foothills and mountain slopes, where the grapes are less in quantity but of superior aromatic qualities. This wide adaptation gives an immense area suited for grape culture. The chief reason for the achievement and promise of the grape in California is in the fact that the European species (*Vitis vinifera*) thrives, and thus the grower has command of all that the Europeans have accomplished in centuries in the development of varieties for special purposes. The European varieties are the only ones from which raisins can be made; they also furnish the world's wine and brandy and they give size, beauty and shipping quality to table grapes beyond all comparison with American varieties. Table grapes are grown for local use everywhere and for shipping chiefly in the interior valley. The raisin interest is almost wholly concentrated in the

center of the San Joaquin Valley, although there is a raisin product of some moment in the Sacramento Valley and in southern California. The wine and brandy interests were widely distributed through the length and breadth of the State when prohibition prevailed as a national policy. It was apprehended that wine grapes could no longer be profitably grown, but prohibition multiplied the price for both fresh and dried grapes and induced a considerable increase of acreage of all varieties in 1920 and 1921, on the chance that grape-juice in various conditions might be in greater demand than ever before.

Fruits of the semi-tropical class which have reached considerable commercial importance are indicated in the tabulation on page 178. Others are succeeding with amateurs, and some of them advancing to commercial recognition. The date fruits freely in the Sacramento and San Joaquin valleys and in central parts of the State and an increasing commercial product is made in the irrigated areas of the Colorado River district in southern California—all comprised in Region 4. The banana is fruited for home use in many thermal situations. The pineapple is grown in a small way in frostless places near the coast in southern California. The cherimoyer is found in the markets of Los Angeles, while the avocado is becoming very popular in the south, and is also being planted in several other parts of the State. The guava and loquat are freely produced for local use and sale. The persimmon and pomegranate grow in nearly all fruit districts. Many

other semi-tropical fruits may be found in the districts which grow citrus fruits.

Old fig trees of the Mission variety attain the dimensions and aspects of oaks and bear so much fruit that it becomes of some importance in swine feeding. The fig is hardy in all central and southern coast and interior situations (Regions 2, 3 and 4), except in a few places where the temperature falls ten or twelve degrees below freezing. This naturally suggested the fig as a great commercial fruit but production has been restricted by the fact that fresh figs are just beginning in long shipment and because until recently California dried figs have not compared well with the product of Smyrna. This condition has, however, been completely changed by the experience of the last decade. The fig industry comes on a new basis through the successful introduction of the pollination insect essential to the success of the Smyrna fig which is now being produced in considerable quantities and the percentage of current increase in fig acreage is greater than that of any other fruit except the grape.

The olive has been successfully grown in California for more than a century, but its handling since the American occupation has been attended by many vicissitudes. Recently, however, the pure food laws have prevented the use of the word olive in connection with substitute oils for salad purposes. Canning and bottling hermetically, with adequate sterilization, have made it possible to produce pickled ripe olives of suitable varieties with good keeping

qualities, and California is now producing largely and profitably good olives and olive products. Practically all the counties of the State except those on the high mountains and on the upper northwest coast, have olive trees in bearing, the interior valleys and foothills of the Sierra Nevada leading in the production.

Imported lemons have met sharp competition in the markets of the United States by the California product. Though lemon-growing is possible in most sections where oranges are produced, the lemon does best in nearly frostless places, being more tender than the orange. For this reason the chief product is in the southern coast counties (Region 3). The lemon is more exacting in production than the orange, which is marketable fresh from the trees, while the lemon requires curing and a good part of the crop has to be held from winter maturity to be sold in the following midsummer, when the chief demand for lemons occurs.

California has accomplished more with the orange than with any other single fruit, not only largely supplying the United States but successfully selling the fruit in northern Europe. As explained in detail in Chapter I, the orange thrives in suitable situations through a north and south distance of over 600 miles and the topography of the State is such that similar winter and summer temperatures occur all through this distance. By choice of early and late varieties and by using the variation in the season of maturity in different regions, California can

furnish fresh oranges in large quantities all through the calendar year and can make the United States practically independent of importations. Another advantage peculiar to the State is that the orange grown in a dry summer is more dense in texture and has much better keeping and shipping quality than one raised in a humid summer. The fruit is also more sprightly and refreshing, and though there is some controversy over the alleged superior sweetness of the Gulf fruit, the popularity of the California orange and prices which it commands are evidence of its wide popularity.

The pomelo or grapefruit is also grown in California, but has not met the extent of demand that was anticipated.

In California the term small-fruits signifies only berries and currants, as the cherry is always classed with other great orchard fruits and the grape stands alone as the foundation of a great fruit industry, as has been indicated. Aside from supplies for home use and local markets, there is a large field for small-fruit growing for shipment. Berries are largely used by the canners. Small-fruits are also shipped to markets from one to two thousand miles distant in the interior states and territories to the north and east. The earlier ripening of these fruits gives shippers an opportunity to place the product in this vast region, where there are home-grown supplies later in the year. The growing of small-fruits is scattered over the State and the special regions are widely distant from each other.

Plate VII. A celery field on reclaimed land in the San Joaquin Valley.

On the whole, it is true that the immense fruit products of California are being easily disposed of at fairly remunerative rates, and the business enjoys a good outlook. There is, of course, fluctuation from year to year in the values of different fruits and in the market conditions which they meet at distant points. Such off-years strike the fruits somewhat irregularly and are discouraging first to one special grower and then to another, because localities are largely given to specializing, according to favoring culture conditions or otherwise. Nevertheless the fruit-growing districts of California have the busiest towns, the handsomest rural improvements, the largest assessment rolls, and are most attractive to homeseekers.

THE QUEST OF SUGAR

The different plants held to be available for sugar supply are true sugar-cane, saccharine sorghums, melons, beets and grapes. In the first decade of American occupation about five million dollars a year were paid for imported sugar either refined or raw, the latter being refined in the first sugar refinery built on the coast which began operation in San Francisco in 1855. The knowledge that about one-tenth of all the gold annually produced at that time was being expended for sugar from foreign sources naturally aroused enterprise to keep the gold and produce the sugar if possible and it was thought at first that this would not be difficult. When the American came there was true tropical cane grow-

ing in Los Angeles, as there has been ever since. It probably came from tropical parts of Mexico or Central America, whence many plants were brought in early days. The demand for sweet cane for chewing out the sweetness was apparently considerable among the argonauts. In 1855 a crop from five acres at Los Angeles sold for $1000. It was all sold for chewing. It was said that "it makes good molasses, but does not granulate readily." At El Monte, there was in 1856 "an acre of cane granulating well and making an excellent quality of white sugar," but nothing is said about the process which made it white, and one is left to infer that some small scale refining was practiced. True sugar-cane has been growing in small quantities in many parts of the State since that time, but has never reached commercial standing except as it may be salable from the fruit-stands for chewing. The plant grows perennially but it does not reach a high sugar percentage near the coast for lack of heat and it refuses free growth in the dry heat of the interior. As late as 1893 an appropriation was made by Congress to provide for a test of true sugar-cane on the reclaimed low lands of the delta of the San Joaquin River, in the hope that moist heat would be found to suit the cane better, but no satisfactory sugar-content was secured. Such demonstrations only confirmed the conclusions of the pioneers as shown by the fact that they allowed to go unclaimed the large premiums which the State offered in 1863 for California-grown sugar from the sugar-cane.

While the true sugar-cane was still considered a possible recourse, a saccharine sorghum commanded much interest from the impression that it was capable of producing crystallizable sugar—which the name given to it, "Chinese sugar-cane," encouraged. As early as 1859 there were "several kinds of cane crushers on sale in San Francisco." The State legislature in 1863 offered large bounties for sorghum sugar as well as for sugar from cane but none of these bounties was ever claimed and the law was repealed in 1871. Before that, however (1867), it was written: "Chinese sugar cane or sorghum has been cultivated to a comparatively large extent in previous years. So far as known no sugar of consequence has been made and as a general rule, the quality of the syrup offered has been quite inferior and slow of sale at unremunerative prices."

There was a revival of interest in sorghum molasses about ten years later when Peter Collier's quest of sorghum and corn-stalk sugar was causing large expenditures in the Middle West for laboratories and factories to secure sugar for 1 cent a pound. Improved varieties were introduced and some sorghum molasses was made with little profit, and there has been a scattered small production ever since. The call for sweetening during the war and the high price of sugar since, revived sorghum sirup making and one factory made ten thousand gallons in 1920, but no great production has been undertaken.

While hope of home-grown sugar still lingered with the canes, the sugar-beet began to command

wide attention on the basis of its achievements on the continent of Europe and many highly anticipatory declarations were made in California publications of the time. One writer exalted the opportunity by calling attention in 1865 to the fact that "beets grow all the year in California and a single beet has been known to attain in one season, near Sacramento, the remarkable weight of one hundred pounds." However, this misconception of size of the beet as an exponent of availability for sugar-making does not fairly represent the local knowledge of the time. There were many illuminating discussions and official publication of translations of European treatises covering the growth and contents of the beet, also methods and machinery for sugar manufacture. It is interesting that at the same time the idea prevailed that sugar could be made profitably from watermelons and this conviction actuated the first enterprise. Before building was undertaken, however, the melon was scouted by the chemists and the company decided on a beet-sugar factory instead. This was the Sacramento Valley Beet Sugar Company organized in March 1868 but, as it was delayed in construction, the California Beet Sugar Company organized in 1869 and its factory, in operation at Alvarado the following year, manufactured in November 1870 the first beet-sugar in California, and has besides the distinction of being the first beet-sugar factory in the United States. In its original and subsequently enlarged form it has, with the exception of a single year, been in continuous operation

for half a century, the pioneer of an industry which had ninety factories in operation in this country in 1919.

Beet-sugar production in California underwent many vicissitudes. At first it encountered stiff opposition from the capitalists who had funds invested in the refineries for imported cane-sugar because the beet-sugar factories brought no raw sugar to them but turned out sugar white in the first instance and, therefore, came into direct competition both with refiners and with traders in cane-sugar. The latter not only did their best in price cutting to make beet-sugar investments unprofitable but proclaimed no future for it that further undertakings with the beet might be discouraged. Those who desired to promote beet-growing from an agricultural point of view had no recourse against such opposition as beet-sugar production is impracticable in farm factories and large establishments requiring great investments are essential.

Several poorly equipped factories operated for a few years but were abandoned, so that in 1880 the pioneer factory at Alvarado alone survived. This factory struggled along until 1887-1888 when it was sold and rebuilt and in that year no beet-sugar was made in the United States. At that time also a reversion set in among those interested in cane-sugar refining and they became convinced that beet-sugar was better for their investments and they proclaimed the beet as the hope of the United States as a source of home-grown sugar. Capital became available for

new factories not only in California but in other states. For a number of years California led the country in beet-sugar manufacture but more recently other states have shared this distinction. Interesting facts about the numbers of factories in operation in California and their output and prices paid a ton for beets are compiled from the records of the United States Department of Agriculture as follows:

BEET-SUGAR PRODUCTION IN CALIFORNIA

Year	*Number of Factories*	*Tons of Beets Used*	*Price to Growers*	*Tons of Sugar Produced*
1913	12	1,138,003	$ 6.10	171,208
1914	10	1,082,000	5.68	169,004
1915	11	1,249,111	5.86	195,343
1916	11	1,439,000	6.44	243,800
1917	14	1,321,716	8.16	209,325
1918	13	845,728	9.25	122,795
1919	11	815,896	13.36	131,172
1920	..	1,037,000	....	163,700

The fourteen factories included above are widely scattered over the State. Three are in central coast counties (Region 2 of Chapter I); seven are in southern coast counties (Region 3); and four are in interior valley counties (Region 4). In some cases beets are carried over a hundred miles by rail to the factories.

At the time of California's greatest output of beet-sugar (1916), her rank was second in the United States, Colorado leading by about eighteen thousand tons. Since that time production has decreased. Confidence in the industry was unsettled by removal

of the protective tariff against imported sugar and although the anticipated results of that action were arrested by the outbreak of the World War, the diversion of beet-growers' activities to the production of beans and other war-winning crops reduced the beet acreage. Besides, the uncertainties in the sugar market in 1918 and 1919 were urged by the managers of the factories as a disability on their part fully to meet the demand of the growers for increased valuation of beets. It is probable that the production of 1921 will indicate that all doubts have been dispelled, at least temporarily, and that the beet-sugar output will be the greatest in American history.

It is interesting that in earlier years whenever more wine or raisins were made than could be sold profitably, there was always discussion of the possibility of using grapes for sirup. Although all features of its old environment have changed, the question still persists and in 1920 more casual discussion, careful research and investment of capital were given to the effort to produce profitable sirup from the grape than ever before. In spite of insufficiency of fresh grapes of all kinds to meet the demand, in spite of the prohibition amendment which has apparently doubled the value of California vineyards instead of reducing or destroying it, the production of grape sirup was one of the most active lines of promotion and investment of the year 1920. This activity apparently rests on the two assumptions that higher value for all forms of sweetening will endure for some time; that the high values of grapes, grape-

juice and raisins will continue indefinitely, because of their substitutive uses, and therefore there will be much inferior fruit from the expansion of production of types of grapes peculiar to California, from which it will be profitable to manufacture a by-product of grape sirup, even if the old forms of sirup should return to normal values. Demonstrations of the soundness of these assumptions can only be reached in due course of economic, manufacturing and commercial experience.

SPECIAL CROPS

In 1919 California was not only the first state of the Union in hop-growing but produced about two-thirds of all the hops raised in this country. Hop-growing began in 1855 with roots brought from Vermont and planted in Alameda County by Wilson and Daniel Flint, of whom the latter continued a hop-grower for about half a century in the vicinity of Sacramento. The crop has been almost exclusively grown on riverside loams, although some upland loams have also been successfully used. The producing region has always remained in the central part of the State, both in the interior valleys (Region 4, Chapter I) and in the coast valleys north and south of San Francisco (Region 2). The first crop in 1856 showed that the prevailing characteristics of California hops would be large size and large acre yield due to the favorable growing conditions; bright color, because the dry air prevented discolorations from

fungi; richness in lupulin as the flowers are unwashed by summer rains. Foreign brewers soon found that using these hops in their usual quantities made their beer too bitter, and they came to be mixed with local products, thus securing a market for them in many European countries at a price which more than compensated for cost of long transportation.

Hop-growing in California, as in all producing regions, has undergone great vicissitudes. As hops are inedible to either men or live-stock and only potable to the former, the world's consumption is limited; over-supply occasions worthlessness with consequent reduction of acreage; under-supply yields great profit to those who are ready to meet it and induces unwarranted expansion of acreage, because the ordinary man always plants when price is high and the trend surely downward instead of planting when price is low, acreage reduction sure, and prices bound upward for that reason. The growers who have made money in hops are those who steadily stayed in the business and not those who have jumped in and out of it. During the last half century, hops have sold three or four times at one-half to ten times the cost of production; that is from 5 cents to $1 a pound. Although there has been from year to year much planting and plowing out of hop roots, the decade record shows regular advancement, as shown in table on page 200.

The increased price of the 1919 crop, for which an average farm value of 77 cents a pound was recorded, coupled with the increased production

Year	Acreage	Pounds of Hops
1860		60
1870		625,064
1880	1,119	1,444,077
1890	3,974	6,547,338
1900	6,890	10,124,660
1910	8,391	11,994,953
1919	11,000	17,875,000
1920	12,000	20,000,000

seemed to indicate that there would be a greater demand for hops. In this latter respect, however, the hop did not share the experience of the grape, for hops were only valued at 35 cents a pound, less than half the price of the previous year.

Although notable achievement in cotton-growing in California was reached very recently and rapidly, it was preceded by more than half a century of experimentation. The entry of achievement was not, however, an outgrowth of such apprenticeship, because large commercial production was ultimately attained in a district of the State not covered by the first forty years of trial culture, in fact, in a region which during that period was considered of no discernible agricultural value whatever, because it had no rainfall of practicable significance and was not then looked on as capable of irrigation. The district of first successful demonstration was in the extreme southern extension of Region 4, as described in Chapter I, and as this includes the great central twin valley of the interior, where early cotton-growing reached its greatest production, it not only demonstrates the immense area of the State available for

cotton-growing but renders all early efforts to establish it interesting.

In 1856 the California State Agricultural Society offered a premium of $75 for the best acre of cotton, evidently to determine whether the many growers of a few plants previous to that time could be raised to an acre standard. This test did not produce results, for, although continued for several years, no awards were recorded. In 1862 in the hope of escaping the effects of the war on the supply from the southern states, state prizes were offered of $3000 for the first hundred bales of cotton, to be followed by awards of $2000, $1000 and $500 for the same amount in the three succeeding years. These prizes were subsequently declared awardable in fractions for small amounts of cotton. In 1865 an award of $3000 was made to Matthew Keller for cotton grown in Los Angeles County. At that time there were about 700 acres of cotton in Los Angeles County and in southern San Joaquin Valley. In 1871 Colonel J. M. Strong, after small tests for several years, planted a hundred acres in Merced County. The following year Merced County had seven hundred acres and Kern County one hundred and forty acres and in that year cotton gins were set up in both counties. In 1873 Merced County possessed from fifteen hundred to two thousand acres and the Buckley brothers made a shipment of ten tons to Liverpool, the first commercial export of cotton from California. In the few following years cotton was continuously grown in Merced, Kings and Kern counties, and the success of the

plant on land somewhat alkaline was demonstrated. On the data collected from such earlier undertakings and from his own researches into the character of the soils and climatic conditions and from observation of many experimental patches then to be seen (for cotton had never ceased to be a favorite plant with experimenters), the late E. W. Hilgard included California among the "cotton states" which he minutely described in his monograph on cotton-growing in the United States, a part of the United States census of 1880. It was nearly a third of a century later before cotton production became established in the Imperial Valley and subsequently extended by the stimulus of war needs to other interior districts of the State.

During this hiatus, however, experiments and exhortations were not wholly absent. The chief difficulty seemed to be to secure a labor supply to pick cotton at a cost which would leave a profit to the grower. The basis of picking with Chinese labor, on which growers were building previous to 1879, disappeared with the adoption of the exclusion act. Kern County growers, some years later, tried the experiment of introducing a train load of southern negroes but they ran away soon after arrival, seeking town jobs. It was subsequently pointed out that the experiment had failed because the negroes had been gathered from southern towns and not brought from plantations.

During this time also there was a continuance of exhortation because the California Cotton Mills

desired a home-grown supply to displace costly importations from Texas and pursued systematic propaganda to secure it. However, this availed little until cotton-growing took its new start in the Imperial Valley, in the extreme southeast corner of the State, where after a few years of small experiments and large planning, production assumed a commercial character in 1909. Since then cotton-growing has been commercially pursued in adjacent parts of California and Arizona and more recently in the San Joaquin Valley. The rapid increase in production and the satisfactory results obtained are shown by the following tabular compilation from the reports of the United States Department of Agriculture:

Year	*Acreage*	*Yield of Lint 500 lb. Bales*	*Average Price a Lb.*
1910	8,000	6,000	10.8
1911	12,000	10,000	7.5
1912	9,000	8,000	12.5
1913	14,000	23,000	13.0
1914	47,000	50,000	7.0
1915	39,000	29,000	11.2
1916	52,000	44,000	20.0
1917	126,000	58,000	28.0
1918	173,000	67,000	30.0
1919	167,000	102,000	43.0
1920	275,000	143,016	18.

The high average price is due to the fact that so much long-staple cotton is grown and the large acre value is also due to this in connection with the large weight obtained. In average price and acre value, California leads all the states except

Arizona where long-staple cotton is grown exclusively, beginning in 1917 and increasing rapidly.

The production of cotton in California includes many economic and cultural problems and policies and the rapid advance recently made is largely attributable to coöperation among growers in financing and constructing gins and oil-mills and in protecting their industry from all oppressive encroachments. The labor question which harassed the pioneers has not been eliminated but is being progressively reduced by dependence on white labor, an advantage being found in the fact that the dry frostless autumn allows the work to be done after most harvesting of other crops is finished.

In the search for vegetable fiber, ramie production has been promoted as a great new field for enterprise and investment. In 1870 John S. Finch exhibited ramie stalks and fiber at the State Fair and a special gold medal was recommended for his display. The plant was introduced and grown by him at Haywards, Alameda County. About that time a great prize was offered by the government of or for India for a machine which would successfully displace hand labor in extraction and processing of ramie fiber for manufacturing. In 1874 Finch and others associated with him constructed an elaborate combination of rollers and dipping tanks through which the ramie stalks were passed in series by a succession of belts and carriers. This machine was started for India to be entered in the competition and to give an exhibition in the Hawaiian Islands en route. It

arrived in the Islands in due course but never was carried nearer to the competition nor the prize and the idea of growing ramie in California was for the time abandoned. In 1880 other inventors of ramie machines and processes appeared and in 1890 still others. The latter group gathered influence enough to secure the passage of a state law in 1891 creating a "department of ramie culture" which undertook official promotion of a machine for fiber extraction and of ramie culture to provide the raw material. The result was a boom for venders of ramie plants and the filling of much ground here and there with roots from which the growth was worthless because no device nor process came through profitably. In later years other promoters have operated with other machines and ramie plantations, but no industry has been established nor notable product marketed to this day. The growth of the ramie plant in California is excellent and immense areas are suited to it, but sound inducements toward its production have not yet appeared.

Rising to public notice with about the same frequency and at about the same dates were agitations for local production of flax fiber by manufacturers' agents, and their appeals for help to establish a new industry induced the importations of a collection of European fiber flaxes. These grew well but there was no industrial outcome, as no one wished to buy the fiber and the seed crop was not so good for oil-making as the variety currently grown for that purpose. This undertaking was followed by a related

one to raise the oil flax known as "California" for both seed and fiber, but this gave birth to no industry, although flax-seed growing for oil-making has continued in varying amounts from year to year.

Esparto grasses were introduced into California about 1880 in answer to exhortation from a California lady who had observed weaving industries in Italy and claimed that California women should furnish mats, Italian style, for olive pressing. The plants were widely distributed and grew well, but the women were not more disposed to weave baskets than they were to spin flax and it was found that olive presses could work better with American inclosing fabrics than with esparto mats. The same history belongs to New Zealand flax (Phormium) for, although this plant serves an excellent ornamental purpose in many parks and private gardens, no fiber has ever been commercially produced from it. The same is true of sisal, the Yucatan product of Agave species. California "century plants" have attracted much attention by blooming at about one-eighth of the age their common name indicates and recourse to sisal production has been from time to time agitated but nothing has been realized, although from early days, cordage factories have operated with imported raw materials. Hemp has gone a little farther than cordage plants because, after scattered experiments in earlier years in various localities, there was commercial production on the lowlands of the Feather and Sacramento rivers but all such undertakings were abandoned about 1905, after shipment of the product to Europe.

Experiments in hemp-growing were, however, resumed in 1922 on the basis of new inventions for fiber-extraction—in spite of the earlier conclusion that better use could be made of the land by growing products edible to man or to live-stock. Urged by the large importation of jute cloth and grain sacks from India for sixty years before elevators and bulk-handling of grain was entered on, the jute plant was introduced about 1890 but no one succeeded in getting a good growth in the plant which seemed to demand more strictly tropical conditions.

CHAPTER VI

ANIMAL INDUSTRIES OF CALIFORNIA

In view of the fact that California's reputation for agricultural production rests chiefly on eminence in horticultural lines, it is interesting to note that in aggregate value of domestic animals the State stands fourteenth among the forty-eight of the Union. The progress by decades, as compiled from the reports of the United States Department of Agriculture, is as follows:

VALUE OF ALL FARM ANIMALS IN CALIFORNIA

1920	$234,000,000
1910	127,599,938
1900	67,303,325
1890	65,575,427
1880	41,498,417
1870	40,306,300
1860	35,585,017
1850	3,351,058

It is notable that the great increases came during the first and the last two full decades. The great drive on fruit, which has resulted in an annual production with selling value of two hundred and fifty millions, did not cause a backward movement in animal husbandry, so the current great drive on

animals need not be expected to depress the fruit industry, for the relations of the two are reciprocally beneficial in many ways. Especially in the line of producing animal manures which are coming into increasing appreciation for use on fruit lands, the live-stock industry may be considered as fundamental and indispensable.

In connection with the total value of $234,000,000 of farm animals, the total annual value of marketed products is also interesting and it may be compiled from the data in Chapter IV in this way:

VALUES OF CALIFORNIA ANIMAL PRODUCTS

Slaughtering and meat-packing (1919)	$84,000,000
Dairy manufacture and milk sale (1919)	74,515,381
Wool (1917)	12,180,000

Therefore, without counting the value of the manurial by-product and the locally consumed products on farms and in villages, there appears to be an annual gross product value of $170,695,381 from an investment of $234,000,000 in value of farm animals. Of course the product value covers use of land and cost of labor and supplies, as well as a fair return on the investment, which is all that is expected of a prosperous industry.

A categorical statement of the natural conditions affecting the live-stock industry in California with indication of their relation to policies and methods may be undertaken in this way:

1. The absence of snow and ground freezing, except on mountain valleys or plateaux, renders light

and cheap shelter sufficient. It is, in fact, frequently dispensed with altogether, but that is neither merciful nor profitable, in view of the little it costs to furnish it.

2. The mild climate gives a long grazing season and the dry summer furnishes dry feed, which is really good nutritious hay, cured as it stands. One who has land enough, including low and high, and pastures each in its best condition for green or dry feed, can carry all except dairy stock and hogs, without growing feeding crops and siloing. However, he alone reaps the full benefit of the climate who provides alfalfa or other clovers, silage, grain and roots, to save his pastures from being gnawed and tramped when too wet and his stock from all set-backs by even short spells of hunger. A certain amount of farming should always be associated with wild pasturing. This is often dispensed with, but it is not profitable in the highest degree.

3. The climate not only gives a long growing season to pasturage plants but multiplies the number of species which sustain the pasture. Speaking broadly, California pastures and fields include all the grazing and forage plants which can be grown in Europe from the reclaimed lands of Holland to the Alpine valleys of Switzerland. The hays, unwashed by rains and favored by dry air, have an average of concentrated richness and wholesomeness unknown to cured forage in humid countries (Chapter V).

4. The mild climate, free from set-backs due to

extreme cold, coupled with the provision of reasonable winter feeding, gives all well-cared-for animals surprisingly quick growth and early maturity. In old days strangers always over-guessed the age of sheep by their teeth, being helped to the error by their size. In a way this is true of all animals and it means great gain when weight is most cheaply attained; early sale of increase and quick turn of money; early maternity and, with some animals, more gestations in a year, because temperature, and, with proper arrangements, feed are always favorable for parturition and lactation.

5. California soils by variety in character, self drainage and retentiveness, richness and productiveness, match the capabilities of favoring climate in promoting wild growth and give the enterprising grower wide field for choosing feeding plants according to his conditions and requirements.

6. Irrigation, whether from ranch brooks or wells or from a regular system, establishes mastery over variations in time and amount of rainfall or makes a grower practically independent of rainfall in regions that were formerly called deserts and are now among the leading stock-growing districts.

To be a successful stockman, one should have land, capital, knowledge of the business, faith and positive liking for it. There is no sadder farm picture than a stockman scant of land. There can be no exact prescription of amounts of land, for animals require different areas, and lands vary in food productiveness and in acre valuation. To secure enough land, it

is still possible in California to go far enough away to find rich flats and warm slopes and running brooks and shady trees. The stockman should help occupy the State by going beyond the thickly settled areas; this can now be done with less social sacrifice than ever before, because a cheap automobile kills distance. The man who has too little land for stock is closely matched by the one who has too little money. Animal production is beyond all other farming, perhaps, in its demand for adequate investment. It is quicker than some others in return, if all goes well, but there must not only be investment but working capital from the start.

The introduction of improved live-stock was one of the first enterprises of American settlers. They devoted much effort and money to the undertaking, which was full of difficulties and risks. Results in transforming the common stock of the country, as well as in producing pure-bred individuals of notable excellence, were speedily attained. The conditions favoring the growth of domestic animals, which have been noted above, seemed to be accentuated in the development of pure-breds and the wide public recognition of their desirability among the pioneers encouraged effort and investment. These fundamental conditions have continued and have been supplemented not only by a wider recognition of the desirability of pure-breds but by the enactment of laws discouraging ownership of scrub sires in various ways. A concrete indication of the prevalence of pure-bred effort at the present day is found in the

United States Census of 1920 which is summarized in this way:

Kind of Stock	*Number of Breeding Farms*	*Number of Animals*
Horses	588	1,615
Cattle	5,179	32,388
Sheep	371	28,831
Swine	4,886	35,741

All the breeds popular in the United States are included in this summary; all the marks of distinction provided by the breeders' associations have found some qualified claimants and a number of distinguished records have been made. California breeders are shipping their pure-bred products to other states and to other countries bordering on the Pacific Ocean in which they hope to realize large trade and influence in the future.

CATTLE AND DAIRYING

Cattle ranging was the chief industry of the Spanish and Mexican pioneers of California. The expedition from Lower California which reached San Diego in 1769 was in a way tripartite in that it had a spiritual head, a governmental head and an agricultural head. Whatever honor pertains to the agricultural phases of the effort to civilize California should be awarded to Captain Rivera who was the herdsman of Junipero Serra and Portola and successfully did the practical things essential to the success of the spiritual and political features

of the expedition. Captain Rivera seems also to have been the first to enter the new country, for he started northward from Lower California in March 1769 with his cowboys and 200 head of cattle, sheep and goats, arriving in San Diego in May.

Probably neither Rivera nor any of his cowboys of 1769 had even the faintest dream of the outcome of the enterprise which was in part entrusted to him. Even the lush meadows and hillsides of San Diego in May probably did not suggest the full capacity for the animal industry of the new country to which he had driven his flocks and herds. Even if he had seen but a little way into the future, he would have beheld his 200 animals of 1769 multiplied to 424,000 horned cattle, 62,500 horses, mules and asses, 321,500 sheep, goats and swine, as shown by the mission inventories at the time of the dispossession of the padres in 1834.

If Captain Rivera never saw the great multiplication of the live-stock he introduced, he was also spared the sight of the most wanton but still unavoidable waste which attended the use made of them. For nearly half a century the natural increase of the little bunch he had convoyed to such rich pasturage and favoring salubrity was slain for hides, pelts and tallow to be traded with visiting ships. He also lost the farther sight which would have revealed his effort as a providential provision for the development of California as it has since been achieved. The services of the padres in the preparation for American occupation is inestimable. Suppose they

had not brought their live-stock and multiplied it as indicated, and if the rancheros away from the missions had not had the materials for their own extension, it is impossible to measure how the enterprise of the gold-seeking Americans of 1849 might have been slowed down. It is very sure that the people who made California a State in 1850 could never have accomplished it on a menu of acorn-cakes and clam-chowder on which the barbaric aborigines subsisted. It required plenty of roasted and boiled beef to start California on her career and the padres made such munitions available.

The Americans had no idea of continuing California as a hide and tallow state, nor of prolonging the rude pastoral husbandry which satisfied the ambitions of their predecessors. Although historically there were foundations laid for animal industries by the Spanish occupants, the superstructures rest only remotely on those foundations, for they have now deeply passed from view beneath the achievements of the Americans who developed in central California herds and flocks on the basis first of the British and later of the Hollandish breeds. So strong was the feeling in support of improved stock in the early fifties that to charge a man with owning and breeding Mexican cattle was something of a social reflection and reproach while honor came to those who gave effort and money to importing good stock by driving the animals across the plains from the Middle West or bringing them by ship from ports on either side of the Atlantic. The terms

American and Spanish cattle were generally used. Pedigreed animals, horses, cattle, sheep and swine, were fairly rushed into the State by the pioneers. At the first formal cattle show in 1856 in San José, the president, E. L. Beard, said: "We raise a very large amount of stock and no state has greater natural advantages for the cheap and easy production of stock. I see also, in the fact that large sums are beginning to be expended by some of our most enterprising citizens for the introduction of the improved breeds, a token that we shall shortly take that precedence to which our soil and climate entitle us."

It only took about a decade to fill the State with grades and thus establish a new common stock on which later achievements in improvement have been based. Writing in 1868, T. F. Cronise said: "The wild cattle of the Mexicans are poor, long-horned and lank, but they cross well with imported stock, carrying the fine points of the latter and the endurance of the former. Great attention has been paid to crossing and very soon the pure native stock will be extinct, for it is unprofitable."

Pure-bred Shorthorns were first to be officially recognized. They comprised all the exhibits of pedigreed stock at the cattle show of 1856 and of following years until Devons, Jerseys and Ayrshires were recorded in 1863 and Holsteins were added in 1872. Herefords were acknowledged in 1878; Guernseys in 1882; Angus in 1884; Galloways in 1886. Shorthorns have never lost their advantage of priority. For several decades the common stock was predomi-

nantly Shorthorn grades both in beef and dairy districts, then the Jersey began to shape the cattle in dairy service. Later the Hereford has reached marked influence in range cattle and Holstein-Friesian in dairy herds, until white faces became abundant on the range and black and white spots even more prevalent in the dairy pastures. In the line of pure-breeding, however, all popular breeds are represented by herds of good quality and large expenditures have been made to secure the popular strains of all the breeds. California-bred individuals have shared in the high prices which their kinds have attained in other parts of the country and have figured as champions in the great stock shows.

During the decade 1910 to 1920, the pure-bred interests of California have advanced notably and the enthusiasm over efforts to breed only the best has echoed the zeal manifested by the early pioneers when they started out to displace the Mexican cattle, as has already been noted. These pure-bred herds have supplied many selections for shipment to the Orient and to other countries bordering on the Pacific Ocean. It is an ambition of the present generation of breeders to embody the highest attainments of Americans in pure-bred stock and to meet the demand for the products of such breeding not only from all the interior states of the Pacific Slope but from all the shores of the Pacific Ocean, where interest in better live-stock is rapidly expanding.

Californians have always looked forward to contributions to trade in distant parts. It is inter-

esting to note that as early as 1856 when Governor Bigler announced that the State stood eighth in the census of farm animals, this declaration was also publicly made by an enthusiast in the same year:

"Why should we import cattle from Texas or Missouri? Is it not almost incredible that in a country like this, where cattle roaming over our mountains and valleys, live and grow fat upon the food which nature produces spontaneously, we should nevertheless import them from countries two thousand miles distant and that too at an enormous cost? In the natural course of trade precisely the reverse should be the case and it will be the case before many years shall elapse. In my opinion the time is not very remote when California beef will be found in the New York market."

It should be remembered that this prophecy was made before the great range industry of the plateau states was conceived; before there was any packing industry in the Middle West to consume the animals from the summits and west slopes of the Rocky Mountains and before there were railways to move them eastward. Under the circumstances, therefore, it was not unreasonable to conceive that the California coast with its wonderful natural pastures close to the ocean should send beef to the Atlantic cities by ship, as there seemed no other region so richly endowed for production and so eligibly situated for transportation.

Of course the development of the region between the Sierra Nevada and the Rocky Mountains put an

end to such dreams. Nevertheless, California figured indirectly in providing for the great meat supply of the East and for the vast export trade therefrom to foreign countries, and not only supplied range cattle to stock the plains but the early contributions from the Southwest toward such common foundation stock reached their destination by way of California. J. B. Grinnell of Iowa, who made a personal examination of the range industry in 1881, tells of these contacts: "I met J. H. Hoppin who went from New York to California, and who about 1870 drove herds of cattle from the Indian Territory and Texas to California and Nevada and thence eastward to Wyoming and Montana. . . . J. Q. Shirley drove cattle from Missouri to California in 1853; then in 1869 brought cattle from California to Montana in a drive of seventeen hundred head."

In this roundabout way the pioneers' dream of sending beef to the New York market actually came to realization. The movement of California cattle to Oregon and Nevada and the contribution of both states to the meat supply of the former were of course greater and have continuously prevailed, and California cattlemen owning ranges in Oregon and Nevada have always been numerous.

The cattle which California furnished to the great interior range states were not the old Mexican stock. Of the early importations of pure-bred stock which have been mentioned, it was written in 1859: "There is probably no State in the Union where more pains are taken or where money is more freely lavished

upon the purchase of animals of high blood than in California."

The result of this effort and expenditure was the transformation of the common stock. Although the drives from the Southwest to the great plains were chiefly cattle of Mexican type, those gathered in California for this movement were very different, for they had more or less crossing with the pure-bred and had assumed a distinctive character known as American.

In this contribution of graded stock to the ranges of the interior, California helped to demonstrate a matter which was greatly in doubt several decades ago, although now unquestioned, and that is the ability of improved stock to endure the hardships of the range. In 1859 a Butte County cattleman wrote: "I have since 1852 been engaged in stock breeding in northern California. Shorthorn grades I have invariably found to keep in good condition upon a smaller amount of feed than any of the native or common run of stock. Last winter I had a band of Shorthorn grades, common American and a cross between them and the native stock. Of the latter kinds I lost 18 per cent by starvation; of the grades not one. Because of half-starved condition many common cows dropped small deformed calves which died when dropped. My neighbor lost 50 per cent of his calves this spring from that cause. I have not yet lost a calf from a grade cow."

The editor who published the foregoing added this: "If a cross of improved breeds produced a hardier

animal, we can see nothing to be gained in a continuance of native blood in ill-formed carcasses. If they do not possess even the quality of hardiness or powers of subsistence on scanty forage, we can conceive of no reason for perpetuating them."

They were not perpetuated. They were eaten when meat was high: they were killed for hides and tallow when meat could not be sold and when pasturage was scant, as in 1864, when it was estimated that a million head had perished. Out of the depression in the early sixties which little survived unless it was top-crossed enough to be Americanized, there came the common stock from which drives were made to the new range states of the interior when their development began, as has been outlined. During all the decades since that time the use of well-bred sires has increased until the legislature of 1921 passed a law that on the open range no bull should be allowed to live unless "bred in a herd of the recognized beef breeds, the ancestral sires of which must have been registered bulls of the same breed for at least four generations and the dams cows of the same breed and of good quality."

Only during about two decades of her history has California had a sufficient fresh meat supply of her own growing and even in that period her supply of cured meats was chiefly by importation. The decades of sufficiency lay between the in-driving of herds for the feeding of the mining rush of the first decade and the invasion of the valley ranges by irrigated horticulture, beginning in the third

decade and continuing to the present day, and by irrigated dairying on an alfalfa basis which began soon after and has also continued to the present with rapidly increasing production. The first limitation of valley cattle ranging came with the spread of wheat-growing and the no-fence laws which were passed in that period requiring a cattleman to drive his herds across the valleys between parallel lines of vaqueros to keep them off the plowed ground or the growing grain. This was a costly hardship but it was only a foretaste of the exclusion which came with the subdivision of valley areas into farms and the planting of fruits to be grown both by rainfall and by irrigation as the local meteorology determined. This practically put an end to cheap or free ranging in the valleys and in much of the foothill country and forced the cattlemen to become land owners or lessees for the winter carrying of their stock and to follow long drives to the mountain and high plateau lands and forests for summer grazing. Then came the closing of mountain pastures by forest reservations and by prohibition of including public lands in range fencing. This was undoubtedly a matter of abstract justice but at the same time it rendered many enterprises for the turning of such pasturage into beef and mutton impracticable, caused such lands to be idle instead of productive and increased the hardships of the range industry. Fortunately a part of this handicap was soon lifted by a better policy of rendering public lands useful to stockmen, as noted in Chapter III.

Plate VIII. Rural homes in the citrus district of southern California.

Thus cattle-growing became notably a hard business in marked contrast to the ease of its beginning. This condition, in connection with the low price of wool, almost extinguished the sheep industry in 1880, and had it not been for the money in beef which came with increasing local population and the readiness of wholesale butchers to invest capital in land and to grow their own cattle for slaughtering, there was at the time a good chance that California would close her career as a pastoral country except in districts devoted to dairying. One butchering firm bought land until it held title to lands equal to the area of Rhode Island and owned a hundred thousand head of cattle which could be driven to San Francisco over a distance of about three hundred miles, passing each night on a ranch of its own. Others owned land and cattle in less amount and the beef supply of California cities continued to be a big business in an American instead of in the Spanish way.

It is interesting to note that the maintenance of the cattle industry in California has always been chiefly an urban contribution to rural development. The first state fair was held in San Francisco in 1853, but it was wholly an exhibition of plants and their products, and was popularly criticized as incomplete. The second state fair was also in San Francisco in 1854, and it was rounded out by a branch consisting of a cattle show which was of course richer in popular Spanish equine exploits than in improved stock, but involved a conception and impulse toward the latter. The state fair of 1855 was in Sacramento

with a cattle show at a local race-track; that of 1856 was in San Jose and was prominently designated as "not only a fair but a cattle show," and deserved the title, as has already been cited; that of 1857 was of the same complete character and was held in Stockton; and the same is true of a display in Marysville soon afterward. Thus the five great cities of the fifties joined in declaring their conception of the desirability of the proper development of American live-stock industries in California and their confidence in the attainment of it. The contribution of these pioneer towns was not merely the arrangement of a popular assembly to promote sport and extend trade, which is always an urban motive in getting the country to the town. It was more than that, for the exhibits, in the live-stock lines especially, were largely imports made by city persons and the offspring thereof bred on their own country property. It was largely due to the free money of successful city dwellers, therefore, that California made such a quick start toward an abundance of pure-blood stock, and the early obliteration of the Mexican types and the multiplication of grades which manifested the prepotency of their pure-bred sires as has been already claimed.

While fruit production has never needed promotive effort, animal husbandry has always been in need of it, either in production, packing or commercial handling, and has never had it in the effective ways which the fruit industries enjoyed. The result is that about seventy years after American farming began in California, the fruit industries by their own

attractiveness and by the cultural and commercial ability of those whom they attracted, attained products which though a glut on the local markets of 1858, were scarce in the markets of the world in 1919, although the value of a quarter of a billion dollars' worth were produced and exported. Another result is that the animal industries, which never have been adequately promoted, have not reached production equal to local consumption, and have never made anything more than spasmodic exportation at odd times of the year. Such exports have been wholly insignificant when compared with the volumes that still steadily reach California markets from distant producing regions. For these reasons, California lands suitable to the production of meat are still largely idle or are not used with the up-to-date policies that should prevail. Evidently the phase which needs promotion, because it requires rather more courage and a higher degree of personal attention and mastery of practical and scientific details, is the installation of live-stock production on large tracts that may be turned from idleness and desolation to activity and industry. It is an economic sin to let large tracts of land lie waste, not bearing their proper share of public expense.

There has been notable progress in realizing more adequate development of the California cattle industry since 1900. First came the more serious intent of the packers from the Middle West to undertake local production. Two decades ago the visiting packers from the Middle West really came for recreation and

were wont to take a hand in a real estate game with a packer's dream of stockyards, abattoirs and packing-houses. A few of such schemes materialized sufficiently to leave a few ruins of foundation walls on the rural landscape, but there was never much money either gained or lost by such enterprises. More recently free investment and real development was undertaken in a business-like way and San Francisco and Los Angeles began to have something different from the wholesale butchers of pioneer days and from the old style of buying meat animals and retailing of meat products. The great packers of the country have apparently arrived at a more adequate conception of the geographical and commercial relations of California to the meat production of this coast and the meat trade of the new world of the Pacific. They proposed to enroll the coast production of animals, and the product trade from the terminals and ports of California, in their enlarged scheme of economic world conquest through international trade. In this way California now has share in the national interest of stock-growing and product packing and a share also in the great national problems of how to make the packers best serve the public interest now pending solution.

In a general way, the promise in beef production in California must be considered good. Although shipments are made to great packing points, it is currently stated that about half the animals slaughtered are brought from beyond state lines. There is plenty of land available for stock ranging that

is not suited to other lines of production and there is capability and space in the valleys for the growth of grains and forage for finishing stock for the market. Proper alignment and association of these two branches of cattle production should result in a much larger output. The use of mountain summer pastures, in the national forest areas and in private ownership, must be connected with areas in the foothills or valleys for care and feeding so that what is gained in the summer shall not be lost during the winter following and to the end that the calf percentage shall not fall too low. There are also problems of fair financing of the cattle business, of transportation, of legislation to encourage the stockman and protect him from wild beasts, from pests and diseases and from thieves, all of which prey on his industry. None of these things has been adequately provided hitherto but seems now likely to be attained through the wide association of cattlemen for the promotion and protection of their industry.

A summary of the beef industry of California as of January, 1922, is prepared by the State Department of Agriculture, as follows: The number of stock cattle grazing annually is 1,250,000, and the number taken from the ranges annually for immediate slaughter is: 327,330 steers, 242,168 cows, 21,673 calves and 7,717 bulls and stags. The value of range herds can reasonably be placed at $51,000,000; of lands for grazing $250,000,000; amount of capital invested is approximately $400,000,000.

Before the American occupation, although cattle

were abundant and labor was to be had for the commanding, there was practically no dairying. Milk was rare, but the poorest ranchero had plenty of beef in his pot. The mission padres had an abundance of olive oil to take the place of butter and they drank wine instead of milk and other drinks to which milk is accessory. However, it is not true that they had absolutely no dairying, for one early visitor testifies that the pre-Americans did have milk, but it was drawn from goats and it was difficult to get a pint of milk from six of them. Hardly less significant of the absence of a dairy industry was the testimony of the cattle of the hide-and-tallow breed of the Mexicans, of which it was said: "To get any milk at all the cow had to be lassoed, tied to a stake and allowed the company of her calf before a drop could be had."

Although the hunters and trappers who settled in California before the gold discovery probably had cows somewhat broken to milk, the first good cows to reach the State in any number were those led or driven across the plains by the gold-seekers. There were a good many of them. They were fed or grazed along the trail and contributed to the family menu on the way. They were probably the best cows the pioneers had or could find in the places whence they came. Such cows were the foundation stock of pioneer dairy efforts in the foothills and mountain valleys of the Sierra Nevada. When a family arrived across the plains it was quite usual for the men to go to gold-digging and the women to milking,

and the women often got more gold dust from the cows than the men did from the gravel. In the United States Patent Office report of 1851, Philip Lynch of Ophir, Placer County, reports on December 3 of that year: "About October 1, 1851, I bought two American cows, fresh with young calves, for $400. These cows have averaged 12 quarts each per day which I have sold at 50c per quart, totalling $720 for the two months. These cows I have fed on hay at $80 per ton, meal at $8 per cwt. and potatoes at $4 per cwt., at a cost of not over $100 for the two months. I would not sell my two cows for $1000."

How the eastern rim of the State was populated by the offspring of these good cows which had walked across the plains is amply shown by early records. Let a single instance suffice. In 1857, Honey Lake Valley, a few miles from American Valley, in which the pioneer town of Quincy is located, produced over 5000 pounds of butter, which sold at 75 cents a pound; and to show "the exceeding richness of the pasture and the high character of the dairy stock" it is recorded that Mrs. Taylor, "who personally superintends the whole work, milks only fifteen cows and makes 250 pounds of butter per week, which sells readily at 75 cents per pound."

Although some of these American cows and their offspring undoubtedly continued their journeys westward until they reached the coast, and some of the Mexican cows were taken to the mountain regions, it is probably true that the dairies along the coast were chiefly equipped with Mexican cattle. These

coast dairies began work early in the fifties, their opportunities being the San Francisco demand which was also drawing butter by ship from all parts of the world and paying high prices. It was a very rough kind of dairying at first and was carried on, as an old pioneer used to say, "by a lot of men who went into partnership with the calves" as the quick fluctuations in prices made it uncertain whether a man would do better by having butter or meat to sell, and so there was an effort to have both ready. However, this condition did not last long. The meat demand was met by driving in cattle from the western states and Texas and this made meat so cheap that four-year-olds could be bought for $10 a head and the dairymen found this stock, though very poor for dairying, better than the Mexicans. For a time dairying with such cattle was profitable. In 1857 there were 130 dairies, of 25 to 200 cows each, shipping from Petaluma. In 1858 butter was worth a dollar a pound in San Francisco and cheese, made of skim-milk and buttermilk, sold at 25 cents a pound. Two years later these prices were quartered; the rough pioneer dairying could no longer pay and efforts for better practices and equipment began.

In improving this stock it was the influence of the Durham that one saw most clearly and frequently on dairy farms for two or three decades later. Although Devons, Ayrshires and Holsteins were introduced quite as soon, the Jersey made the first modifying drive on the Shorthorn. The Jersey bull

on the Shorthorn grade cow was very popular in the later seventies, and, until the reintroduction of Holland cattle as Holstein-Friesians in the eighties held undisputed sway. For three decades past the Jersey and the Holstein-Friesian have contended for supremacy. During the last decade several other breeds have made first entry or have been reintroduced in improved form and will become influential. At present, however, one sees California dairy herds largely black and white.

It was about 1860 that the system of dairy tenantry peculiar to California took form. In the coast region near San Francisco the lands were largely covered by Spanish titles, and these large tracts were cheaply obtained by men who had some money and some genius for finance. This coast region was seen to have large rainfall, covering a long rainy season, and therefore longer grazing and a cool summer. As all these factors naturally made for cheap feeding and easy milk-handling, it soon came to be thought that the coast could have no rival in dairy production and this impression prevailed for nearly a third of a century until it finally yielded to the refrigerator and the demonstration of the dairy value of alfalfa grown with irrigation.

While the impression of the dairy sovereignty of the coast region prevailed, large tracts of land were secured, dairy cattle were gathered, either by importation or by crossing Mexicans and Texicans with more or less pure-bred sires, also imported; sheds were built for milk racks, churns and vats; the cows

were kept under the sky and milked in corrals floored with mud or dust. These sheds and corrals were built here and there on the property, and a bunch of cows and men, including a cook and butter-maker, assigned to each. Later, these single places, to save the land-owner from worry and trouble, were leased to different tenants, the tenant paying the owner a cash rent for each cow and furnishing his own help and equipment and agreeing to raise a certain number of calves. For fencing and new buildings and other improvements, the landowner furnished the materials and the tenant the labor. The owner had to keep the cows up to the number assigned to the ranch in the lease and for such supply he grew to milking age on the home ranch the calves the tenants furnished him. Roughly, this is the way the system began about fifty years ago and, in improved form as to stock, barns, dairy buildings and methods and reduced rent for each cow, it still prevails in some districts. It enabled many to get a start with small capital and to accumulate something with which to establish themselves as owners in newer dairy regions. It gave the pioneer land-owners considerable money, some of which they used in securing better dairy stock and buildings and sometimes in improving pastures. One of the by-products of the system was the invention of many novel appliances useful in the old time, but now largely displaced by outfits belonging to newer methods of manufacture, and therefore chiefly of local historic interest. Thus, in early days, there came to be California styles of butter-

rolls, boxes, churns, butter-workers and the like, different from those used elsewhere.

In the mountains the dairies were established largely on government land and have always been chiefly owned by the operators. In the newer lands of the alfalfa districts, there is also a large prevalence of self-owning dairy farmers. This fortunate condition is one of the benefits of the establishment of creameries and skimming stations which have ruled out the necessity for much investment on the manufacturing side required in pioneer days. This has given the modern owner more time and sometimes more money to secure better stock and to furnish better feeding and care.

Although dairying to displace the huge importation of butter and cheese from distant parts of the world began very early, its progress must be counted very slow. It took only about five years to shut out grain and flour and only a decade or so to place California in the front rank of wheat exporting states, and even less to bring fresh fruit production to the limit of local consumption. Imported dairy goods, however, continued to move in freely until the third decade of American occupation and has never been wholly excluded at all seasons of the year.

From 1866 onward, local production of butter increased and importations were soon reduced from five million pounds a year to one million. It was not until 1878, however, that local production of butter first equaled consumption, exports at one season about

balancing imports at another. The production of cheese more speedily reached the local limit, for in 1866 more cheese was made than locally needed. These attainments were reached by evolution under purely local environment. In 1878 there was but one cow-milking barn in the State and that not a very large one; there was but one silo, and that a rough-board inclosure of a tank-frame which poisoned some horses with rotten silage; there was not a cream-separator, all cream being slapped from a pan with a stick; there was not a modern creamery, although some ranch dairy-houses were creditable in their way; there was not a refrigerating outfit, though the mountain valleys had some natural ice-houses; there was not a power-churn in the modern sense, though a few bulls were hauling around sweeps; the only dairy engine was such a bull; there was no cream-ripening outfit; there was no enduring dairy association although joint action had been occasionally secured; no dairy instruction, no dairy exchange; there were good dairy breeds but no definite breeding nor agreement on points to be attained, nor exact measures of what constituted excellence; there were only a few alfalfa pastures along the Sacramento River and their product was condemned; the sorghums were a curiosity; the interior valleys were practically conceded to be unfit for dairying and the dairy hope of the State was grounded in the coast and mountain fringes. Such, in the rough, was the dairy interest of California about forty years ago; and yet there were groups of good dairymen who struggled against all these handicaps and produced clean delicious butter

and made money. The achievements of these deep-seeing and energetic farmers laid the foundation of the recognition of the dairy suitability and resources of California and they and their children have been among the leaders toward the revolution of ideals, equipments and practices which has made the present product worth seventy-five millions a year.

The decade from 1880 to 1890 was a transition period during which revolutionary processes were in operation. Cream separators introduced in 1881 began to multiply; refrigeration was provided; alfalfa acreage began to increase in the irrigated colonies in the interior valleys. These three agencies, operated with human insight, ingenuity and enterprise, engaged in transformation of the California dairy interest from a provincial affair into competition with the leading regions of other states and countries producing for the world trade. The progress thus begun ultimately accomplished such notable results as these: it shifted the geographical leadership in dairy production from the coast region to the interior valley; it radically changed all old methods and forms of production from provincial to world standards; it displaced all old ranch provisions of buildings and equipments for manufacture to large coöperative and proprietary creameries of exemplary capacity and efficiency; it brought the products up to the requirements of interstate and export trade; it made practicable buildings on dairy farms, such as dairy barns, milk houses, power-plants, silos and other equipment for care and feeding of dairy stock, which were not known in its earlier history; and, finally, it

opened the way for export trade and manufacture of by-products which modern requirements of the dairy interest demand.

The decade in which tendencies in these directions became discernible, 1880 to 1890, did not see these attainments realized. The following decade was also a transition period not only in the growth of the tendencies which have been noted, but in the unfolding of others, mainly in the line of commercial problems to be solved, State enactment of promotive and protective laws to be secured and agencies for dairy education and research to be provided. All these were realized by organization. It is not necessary to describe the facilities now provided and the methods employed in the practice of dairy husbandry and the processes of dairy manufacture in California, because they are the same as in other dairy states and countries, with such minor modifications and adjustments as local climatic conditions make desirable. It is, however, pertinent briefly to present results which are a measure of attainment and a suggestion of meeting requirements essential to it.

The creditable volume and value of current dairy production in California and the interesting diversity of it are set forth officially in Appendix I. Geographical distribution is strikingly shown by compiling the 1920 products of the counties which produced more than two million pounds of butter and indicating in connection with each its situation in the regions outlined in Chapter I, viz.:

County	Region	Butter (pounds)	Cheese (pounds)
Stanislaus	4	6,554,986	1,797,489
Humboldt	1	6,377,516	1,111,663
Imperial	4	5,648,099	635,877
Tulare	4	4,685,140	200,342
Kings	4	4,548,172	.....
Merced	4	4,311,842	989,374
Sonoma	2	4,297,366	594,233
Fresno	4	3,264,002	154,570
San Luis Obispo	2	2,555,238	318,517
Marin	2	2,519,490	945,325
San Joaquin	4	2,353,005	841,992

These figures must not be taken as complete indication of relative prevalence of dairying in the regions indicated because San Francisco draws market milk away from manufacture in Region 2, Los Angeles does the same in Region 3, and both cities receive milk from Region 4. The compilation, however, shows that the chief dairying is now done in the great interior valleys of Region 4 where meteorological conditions were held forty years ago to be practically prohibitive of commercial dairying. The tabulation indicates the great geographical range of the dairy industry. Of the three counties which lead in production, Humboldt is on the coast in the extreme northwest corner of the State; Stanislaus is in the great valley in the center and Imperial is in the extreme southeast corner and 725 miles distant in an air-line from Humboldt. Divergence in conditions is as great as in distance, for dairying in Humboldt is done in a cool ocean atmosphere entirely by rainfall vegetation while in Imperial there is practically

no rainfall, everything is grown by irrigation and the heat is great.

HORSES

California was the birthplace of the American romance of the horse for it was here that the hidalgo met the west American pioneer and transferred to him his passion for the horse and his skill in horsemanship. Centuries earlier, of course, the horse and horsemanship came to the Atlantic states and carried westward chiefly English ideals and policies of both. Very different were the Spanish conceptions of the spirit both of the man and the horse and their relations to each other in the business of life. Very rapidly, however, the western pioneer seized and appropriated this strange conception and was so quickly transformed from his old thoughts and ways with the horse that he convinced his successors, in the great business of developing the Rocky Mountain region and the Pacific Slope of the United States, that they at first knew neither the man nor the horse. The cowboy in his highest romantic lines is a product of the contact of American spirit and resources with Spanish grandiosity. One who passed through this cowboy college writes of its course of study in this way:

"And big event indeed it was, the plaza thronged from dawn until far past midnight with a jostling throng, alight with the brilliant hues of serapes and rebozos, and blazing with the silver and gold decked

costumes of the men, where they were gambling, crowding about the bronco-riding contests in the bull ring, or lined thick the race course. Scattered among these hundreds of native Californians were always a few score Americans, bearded, heavy-booted miners; skin-clad, leather-faced trappers from the Sierra; ranchers, cowboys, and bronco-riders, these latter outgauding even the natives with bridle-bits and spurs inlaid with silver, sombreros and stirrup-leathers embroidered with silver and gold, pistol-butts set with twenty-dollar gold pieces—every last man-jack of the gringos more or less heavily and gaudily armed. For the bitterest enmity was constantly burning between the natives and the intruders; and while the former were still chiefly armed with only their traditional reatas and knives, their majority was so heavy that the latter would have been up against hopeless odds without their artillery." [1]

This was only the training school which made for skill and prowess; the application of both to the business in hand is, of course, the quality on which the fame of the cowboy rests. The same writer gives this suggestion of it: "The great intermountain region between the Sierra Nevada and the Coast Range was then a boundless field of wild oats upon which ranged and fattened uncounted thousands of wild cattle and horses. The exigencies of the situation produced a class of daring, clever horsemen never excelled in the world's history, habited always

[1] "The Vanguard" by E. B. Bronson. George H. Doran Co.

in the now well-known gorgeous trappings of the Mexican cowboy. And then their saddles! If any inanimate handiwork of man ever owned the dignity and grace, that in creatures animate we recognize as marking a thoroughbred ancestry, a product of generations of careful selective breeding, it is the characteristic California saddle. No saddle ever made has equalled it, either in beauty or for the safe handling of the most massive bull that ever ranged the foothills behind Visalia."

The horses by the help of which these dramatic things were achieved were those in which California abounded and were undoubtedly a product of selection toward a type which met the unique requirements of the life. Although the cattle and sheep were generic, the horse of the pioneer was specific and bred from the best available for its purpose. Before Americans came it had assumed a type, of which it was written at the time: "The native Mexican mustang has many excellent qualities. He is capital under the saddle and very quick in his movements. No horse excels him in keeping up a steady liveliness. He will subsist on scanty food and bear you sixty miles a day, upon occasion; his gait being always a gallop. He is light weight and not well suited for draft."

At first and for several years, until the American preference for wheeled vehicles asserted itself, Californians new and old, old and young, moved in the saddle. Horses were so abundant that on a journey one seldom bargained for a horse, but caught a fresh

one and left his jaded nag as a fair exchange. This condition speedily disappeared when Americans thronged in, but still what was seen of it by the early comers and heard for years following, had an influence in shaping attitudes and suggesting points of view to the pioneers. The freedom of the horse and his rider on the open unfenced landscape undoubtedly suggested breadth and freedom in thought and action which has been characterized as "western." Horses gone wild were also abundant; it was perhaps first in California that wild horses were shot to rid the range of them. If it had not been for the prejudice against it, probably horse meat would have served a good purpose when the throngs of gold-seekers had eaten the State short of cattle and sheep.

Although horses and the handling of them were the chief gifts of the Spanish régime to American agriculture in California, except in horsemanship which they admired and adopted, the American pioneers were not satisfied with what they inherited. The best of what came to be called American horses, to distinguish them from Mexican, crossed the plains by hundreds or thousands with their riders and drivers and established a new ideal of the agricultural horse. The horses which came to California across the continent were of excellent quality. They were selected for their youth and promise of endurance of weeks and even months of hard hauling on the trails, all errors in selection being left on the plains en route. Selected stallions came also, paying

their way by carrying or hauling. Thus there were streams of American horses pouring down the western slopes of the Sierra, easily purchaseable at the mines because the owners had seen gold and had no longer sight for horses, until their eyes were reopened and then they reëntered horse ownership by swapping mining claims for horses with later arrivals and followed their animals which had brought them across to the valley lands taken up for farming. In this way, the first American farms became equipped with horses of the best strains to be found at the time east of the Rocky Mountains and they were amply supplemented by importations especially for breeding purposes from all eastern and southern states and from the eastern Canadas which were then a treasury of high class horse-flesh. Proof of this victorious entry of the American horse to the territory of the Mexican may be cited. At the first live-stock show held under State auspices, in San Jose in 1856, thirteen premiums were awarded for American bred horses and two for mules. It is also recorded that four ladies and eleven men were entered for prizes in equestrianship, of whom, judging by the ethnology of their names, only one can be suspected of being of Mexican origin while the remainder were from more or less remotely English, Irish and German sources, that is, entitled to American registry. The records of subsequent exhibitions showed the same prevalence of American standards, both in horses and their owners, more and more abundantly to the present day. At first, of course, the proletariat of

California horses was Mexican, though over-lorded by American. Although the common horse stock of the State afterward became a predominant American infusion, the Mexicans remained in service and even to the present day enjoy adequate honor in the range activities to which their historical quality entitles them.

Although the picturesque sport features of Mexican horsemanship delighted the Americans at first and are still to be seen on occasion, they were always classified as spectacular and introduced at fairs as a wild element. Modern California ideals of sport with the horse, from the very first, were derived from the highest models of Kentucky and other states of the blue-grass region.

The selection and breeding of horses for speed in race-track performances began with the pioneers who made importations of blood from the greatest performers of their day in the eastern states and were inspired to greater efforts by the attainments of their offspring reared under California conditions. These beginnings were developed into unexpected achievements by the horse fanciers of 1870, and onward for three or four decades, until it could be claimed that Californians not only took a leading part in the development of the American trotting horse, but distanced all other states except Kentucky in large attainment, enrolled California-bred horses abundantly in the lists of champions of the United States and produced the horse which stood for a decade as the fastest trotter in the world. A generalization

and a specific instance of attainments are pertinent and significant, as described by W. M. Neal of San Francisco:

"California trotters figure prominently from year to year in the 'season championships' for all ages and sexes, over all kinds of tracks, in all localities where racing is conducted. Year after year the great families founded in California furnish from their diverse ramifications the leading contestants for the premier honors of 'fastest performers,' or for the spoils of battle to be wrung from the winning of rich stakes. Of all the horse-producing states, only Kentucky outranks California in prestige in the realm of the trotter. To a thousand farms across the mountains and deserts to the East, to the countries of the old world where harness racing flourishes, to the breeding centers of Australia and to the islands of the Pacific where the Anglo-Saxon has carried with him his favorite sports, California has given of her bounty in speed-producing blood until today, when champion upon champion appears, born without her confines, perhaps, but owning blood allegiance to the great houses of Electioneer, Guy Wilkes, Sidney, Director, Steinway, McKinney, Dexter Prince and others of an equally lasting though slightly less luster, the debt of the world to California and her horses and horsemen is incalculable.

"It fell to the lot of the Golden State to achieve her most startling success in the eyes of the whole world in the way of speed production when, on August 24, 1903, at Readville, Mass., the dainty Lou

Dillon (herself, her sire and her dam California-bred) settled once and for ever the long-mooted question of whether the 'two-minute trotter' should be classed as a reality or merely as the product of enthusiastic and optimistic conjecture. Piloted by Millard Sanders she swept to the quarter post in :30¼, to the half in 1:03¾, to the three-quarters in 1:31, and came to the wire in an even 2:00, later in the same year reducing that mark to 1:58½. There it still stands as a record for trotting mares, and there it stood as a record for all trotters until 1912, when Uhlan, tracing in direct line to Electioneer, clipped the half second and established the present figures 1:58."

It is interesting to add that while Lou Dillon spent her declining years in Kentucky as a breeding matron, and thus became an installment payment of California's equine debt to Kentucky, the inter-state honors were made easy by the removal of Uhlan to California, to residence on the farm of his owner, Mr. Billings, near Santa Barbara.

It may reasonably be claimed that the most enduring benefit from the demonstration of the quality of California-bred horses is probably the testimony it bears to the adaptation of the climate, soil, forage and water to the fullest development of excellence in the horse, which has more recently been demonstrated by national championships won by dairy and beef cattle. From an agricultural point of view, the several decades of breeding racing horses was no advantage, for it diverted the attention of too many farmers to breeding light and lanky animals instead of more

serviceable types for the road, field-work and heavy hauling. A sharp turn came in the popular idea of desirability in horses when the men who lavished effort and money on speed achievements passed from the scene and left-overs from racing stables largely constituted the offerings for ordinary equine serviceability. With the great owners of breeding farms there also passed away the idea of true sportsmanship which largely actuated them. Speed contests became so demoralizing because of race-track gambling and attending immoralities that they were abolished by the State Agricultural Society in 1906 and soon afterward prohibited by State law.

After the public lost its interest in sport under the old standards, commendable efforts were made by a number of breeders to promote the production of better types of useful horses and the breeding of roadsters, saddle-horses and drafters promised to regain the popularity which prevailed before the trotters and runners diverted attention from it. Good horses of all these types were bred, blood was freely imported from the best original sources and there has been a good demand for their offspring. California has not yet been able to regain her high figures for total number of horses in 1893 and of mules in 1909. The horse has been displaced by bicycles, automobiles and later by tractors and trucks until the appearance of teams even on the rural highways is rather exceptional. On the farms, however, the teams still render chief service and are unlikely to be displaced. The breeding of horses and mules to

keep pace with the multiplication of farms, which is now taking place, may restore the equine census and exceed it. It is also reasonable to expect that whether there be numerically either less or more, they will be better from the agricultural point of view. This generalization is supported by the enumeration of pure-bred horses in California by the United States Census of 1920 which sets forth the total number of pure-breds as 1615, of which 759 are Percherons, 152 Belgians, 147 Shires and Clydesdales, while Thoroughbreds number 113 and Standard-breds only 35 and "all other breeds" comprise the balance of 409 entitled to various registries.

SHEEP

Domesticated sheep were brought to California by the Franciscan padres, and by the soldiers who attended them on their mission-founding enterprise, in 1769. This introduction expanded into a large rude form of sheep husbandry very quickly. An early writer says: "Between San Diego and San Francisco in 1825 there were at the missions 1,003,970 sheep, and at the ranches away from the missions as many more." These figures have been impeached by later historians as exaggerations, but this writing is only concerned with the conception of the facts which exerted an influence in the early years of American occupation, and this indicates that the coast district of California had been a very great sheep country.

Another conception of the early days is interesting:

the American pioneers found a most lofty purpose in the mission sheep husbandry, and were so exalted by it that they forgot the services of the sheep in providing food for hungry soldiery and Indians and in supplying vast numbers of pelts and much tallow for sale to coast trading ships from Atlantic seaports. They looked on the padres' sheep as a direct Christianizing agency, for one writer says: "The Mission fathers reared their sheep solely for the purpose of obtaining a textile from which to fabricate garments for the savages as an auxiliary means of proselyting. Therefore they undertook sheep husbandry on such a scale, that in no long time, the rude inhabitants who flocked to the missions were clothed in garb more fitting their advent among those of Christian civilization."

Here, too, the picturesque conception of the pioneers has been pierced by later historians, who have rummaged through the narratives of travelers adventuring among the California sheep farmers of a hundred years ago. Not only do they forget to record the existence of any such tailoring establishments as would be required to fabricate for the Indians the elaborate and ornate costuming of the Spanish dons, but they distinctly repudiate the capability of such weaving outfits as they saw to produce Christian apparel. Though these narrators say that they saw, "at the larger missions, as many as two hundred or more women and girls at a time, spinning and weaving," they pronounce the resulting fabric suitable for coarse blankets, but unsuitable for clothing,

because it lacked the process of fulling. They say that the soldiers and their families would have been naked at times but for the clothes brought by the traders. Thus it becomes clear that the only weaving was for blankets, or, possibly, for rough clothing. However, it may be granted that the mission sheep did produce Christian clothing, but very indirectly, and then not for the Indians. The sheep gave the covering of their backs and kidneys for trade with ship captains, who brought fabrics and finery of all kinds for the personal adornment of the soldiers and rancheros and the families of both.

Although the pioneers believed that there had been two million sheep grazing the coast lands in 1825, so many had perished for their pelts and tallow during the secularization of the mission properties, and so many were probably required to appease the appetites of the first run of gold-seekers in 1849, that the first census taken in 1850 records the existence of only 17,514 sheep, or less than one per cent of the number said to exist twenty-five years before. J. E. Perkins, secretary of the first California Sheep and Wool Growers Association, which was organized in 1860, left this record of the mission sheep, which were then called natives:

"In size, form, vigor and disposition they were all that is undesirable—shearing two to two and a half pounds of coarse, uneven, kempy wool, suited only for the coarsest fabrics and scarcely worth the cost of sacking and transporting to market. Yet it is from this basis that our flocks of the present day

have mainly sprung, and we owe to this basis the demonstration of the suitability of our climate and grasses to the growing of superior sheep, to which we are now approaching."

It is probably not generally known to this generation how energetically, enterprisingly and swiftly the American pioneers lifted sheep husbandry in California to greatness in State development and to national importance. "California for sheep!" was the cry which followed first the world-stirring outcry: "California for gold." It arose before the greatness of either wheat or fruit was even dimly foreseen. The following is a public exhortation on wool-growing given by Colonel J. B. Crockett at the California State Fair held at San Jose on October 8, 1856:

"In California, owing to our mild and equable climate, sheep are liable to fewer diseases and multiply more rapidly than in any other portion of the world; whilst our mountains and valleys furnish them with the most inexhaustible pasturage the year around. The cost of rearing them is, therefore, exceedingly small, and, instead of importing them from abroad for daily consumption, our mountains and valleys should be dotted with sheep and every clipper ship that leaves our ports should bear away tons of wool to set in motion the looms and spindles of Great Britain and New England. The time will come and, in my opinion, is not very remote, when sheep culture on this coast will become a great and most lucrative branch of productive industry. Indeed, I am aware

of no greater benefit which an enterprising farmer can bestow upon California than by importing a flock of choice sheep of the best varieties to test our capacity to compete with Australia and other countries, in the wool markets of the world."

At this very fair premiums were awarded for exhibits of Leicestershires and Southdown sheep, and at the fair of 1857 awards were made to two exhibitors for imported French Merinos. Such sheep as Colonel Crockett prayed for were actually in California two years before the date of his oration. J. E. Perkins wrote this as history in an essay for which he was awarded a premium by the State Agricultural Society in 1864:

"In 1854 enterprising sheep raisers, believing from the fact that poor sheep did so well on California climate and feed, higher classes of sheep could be profitably grown for their fleece alone, set about importing purebred merinos from Vermont and New York. Curtis & McConnell of Sacramento brought the first Spanish merinos from Vermont. Other importations of Spanish and French merinos followed; also Cotswolds, Leicestershires and Southdowns. Large quantities of Australian sheep were also brought in and sold at extreme prices."

Introductions of pure-bred sheep which began apparently in 1854 continued in great variety and numbers, so that at the state fairs before 1860, there were exhibitors to the number of thirty-four, showing 200 pure-breds at a single exhibition. The breeds for which premiums were awarded were Spanish, French,

Saxon, and Silesian Merinos; Southdowns; Cotswolds; Leicestershires; Shropshires; Cheviots; Chinese. At the fair of 1861, W. M. Landrum exhibited Cashmere goats, "the first introduced into the state." Speaking of the array of pure-breds on exhibition, the committee of judges for 1860 enthusiastically reports: "No department of agriculture has more just claims upon attention of our people than wool growing. That many of our most enterprising farmers are actively awake to this idea is sufficiently attested by the numerous flocks of the finest classes of sheep already imported and reared here regardless of cost. We have seldom met so fine an exhibition in any part of the world, whether development of form or texture of fleece is considered." The spirit and achievement thus manifested by the wool-growers of the first American decade continued active and effective for the two following decades.

It is interesting to note that the first state-wide organization of flock owners was the California Sheep and Wool Growers Association organized on September 24, 1860 "to foster and promote the enterprise of sheep breeding and wool growing in all its branches; and to provide a remedy against a repetition of such efforts to establish a monopoly in the wool market of this state as characterize the operations of the wool buyers this year." The charter members of the first association numbered eighteen and they owned in the aggregate 64,825 sheep from which a spring clip of 157,000 pounds

of wool was shorn. It does not now appear just how the organization went to work at its local marketing problem sixty years ago. The coöperative action of California wool-growers, thus initiated, was influential in securing the wool tariff of 1867 which a representative of the woolen interest claimed "was imposed upon the wool manufacturers by the wool growers." However that may have been, the manufacturers have managed to get the cream of all the legislation since that time and will continue to do so unless the growers can amass more influence and acumen than they have hitherto.

It is also interesting to note that in 1866 California passed her first anti-dog law in the interest of the sheep owners, who demonstrated, to the satisfaction of the legislature, that they had sustained an aggregate loss by dogs of $828,095 between 1860 and 1865.

Very little of the old mission material survived pelt-killing, neglect and feeding the gold-seekers. A far greater amount of similarly poor foundation was, however, within reach. Between 1852 and 1857 551,000 sheep were driven into California from New Mexico. In 1858 the Apaches of the Southwest, aggravated by the amount of good meat run in front of their keen appetites without contribution, took such toll that they stopped the driving. Of the New Mexican sheep thus introduced, the butchers were probably chief buyers, but there was plenty left for sheep rangers, for between the years just named this record was made: "Immense increase of sheep raised

and the drives from New Mexico brought the supply of mutton beyond the demand."

Naturally the first thought of sheep-raising was to supply the local butchers and obtain the prices that all foods commanded during the great gold rush. This undoubtedly actuated the importation of the best mutton breeds of English sheep which have been noted as coming in so early that the first state fair awards went to them and not to distinctively wool sheep, which, however, quickly followed. As is the case with all new undertakings, the earliest pioneers in sheep-raising did not know where they were or whither they should go and their very first venture was a very poor one. Perkins writes in his historical sketch, already cited: "Scarcely anything but native or New Mexican sheep could be found and these, worthless as they were, were further debased by crossing with some Chinese rams imported in 1852. The only recommendation either of these classes of sheep possessed was their tremendous fecundity—the ewes often bearing triplets and sometimes five and even seven at a birth." Another account says that these Chinese sheep would drop two such litters in a year.

Evidently the first great question was whether to grow mutton or wool, but it was very quickly answered. J. D. Patterson, looking backward in 1867 to his work of a decade before, wrote: "Though I imported from the best flocks in England, Southdowns, Leicesters and Cotswolds, I believed that growing sheep chiefly for mutton could be overdone,

Plate IX. Rural homes and prune orchards in the Santa Clara Valley.

but wool growing for the whole world could not be overdone and I concluded that good wool-growing sheep, which are also good mutton sheep (though for that purpose alone not equal to the English breeds mentioned above) are best adapted to the wants of growers on this coast and I have paid most particular attention to the breeding of the merinos, both French and Spanish."

This conclusion of Patterson was practically that of all wool-growers, and for several decades the distinctively mutton breeds did not regain their popularity of the fifties. In fact, it has only been within the last two decades that the mutton breeds began to gain the recognition to which they are now entitled in this State and their relation to a new phase of California sheep husbandry has become clear.

As has been shown, Californians had introduced practically all the known kinds of Merinos during the first decade of American occupation. It would be interesting to note some of the details of the way they contended for supremacy, but only the result can be mentioned, which was the survival of two Merinos, the Spanish or American and the French. The latter contributed very little to the greatest wool achievement for there were very few flocks kept pure at the time of the greatest wool production, though they did survive and are now far more influential and popular than forty years ago. Patterson wrote in 1867: "The first pure merino sheep introduced into this state were purchased at my farm in Chautauqua County, New York, by Searle &

of the sheepmen in the inter-mountain states came from California or are the sons of men from California."

It was claimed by a writer of the time that one hundred and fifty thousand sheep were driven eastward from southern California and seventy-five thousand from northern California in 1881. Thus California largely passed on her flocks, flockmasters and herders to the great interior development of sheep husbandry when the industry in this State seemed hedged about by insurmountable difficulties.

During the two decades following 1890, the sheep interests of California passed through a very quiet period. The lowest point in numbers was reached in 1900 when the enumeration was 2,001,501 and the lowest point in valuation of sheep was in 1897, when the farm value was placed at $4,800,787 or $1.50 average value a head, for all sheep reported in that year. Conditions for grazing sheep in California remained adverse and public policy discriminated against the wool-producer. Associated efforts were put forth by leading California flock-masters to remedy both conditions but largely without avail. New interest was awakened in mutton sheep among which Shropshires have gained a leading place, there being, according to the Census of 1920, 6242 pure-bred Shropshires against 1372 pure-bred Hampshires, their nearest competitors. Other leading mutton breeds are in much smaller number though being severally promoted by enterprising breeders. There has also been interest in newer breeds both of

fine and long wool types. As all of these have been crossed on common Merino stock, the quality and value of California sheep as a whole has notably advanced, although the aggregate number is increasing very slowly. The popularization of small flocks on farms and arrangements which give sheep a fairer standing in the national forest grazing give the animal an upward outlook.

California wool-growers under the leadership of Ellenwood made a determined stand in 1912 and followed with a strong plea for consideration by Congress in 1913 for a tariff revision which would, by a fairer classification of wools, give American wool-growers a living protection. However, this was swept away by the free listing of wool in the tariff of 1913. The expected depression from this cancellation of government policy, which had prevailed, with a short-lived reversal, since 1867, was averted by the advance in prices caused by the outbreak of the world war in 1914. The high prices both for wool and mutton during the war and immediately following it notably increased the values of sheep and wool but did not greatly increase the numbers of sheep nor the wool product as these figures show:

In California	*1910*	*1915*	*1919*
Numbers of sheep ...	2,683,000	2,450,000	2,943,000
Value of sheep	$6,298,000	$12,250,000	$35,216,000
Wool, pounds	13,500,000	11,500,000	13,278,000

The advance which the figures show for California sheep husbandry is not of a character to indicate the

future of the industry. Valuation of the sheep of the State for 1920 was reduced about 10 per cent from that of 1919, although the numbers increased about 20 per cent. Decrease in value continued as war conditions faded away. It is reasonable to conclude that the future of wool production as a special industry will largely depend on the popular attitude toward wool-growing with sheep kept as a factor in mixed farming or toward sheep-farming instead of ranging, on lands not desirable for other purposes, or toward types of wool to be had from sheep grown chiefly for lamb and mutton. There are great opportunities for better sheep husbanded in better ways and in the breeding of pure-breds both for local use and sale and for the export trade with other states and countries. California conditions make for early maturity and exceptionally fine development. It is likely that sheep-breeding enterprises will draw qualified breeders to effort and investment in this State for pursuit of their high class production, even more abundantly in the future than in the past. The future of the sheep industry of California in all its branches depends on the terms on which competition with imported wools must be undertaken.

SWINE

Of all domestic animals the hog has most successfully eluded the commendable efforts to catch and tie it to an approximate sufficiency of production to supply local consumption. This has not been due

to lack of adaptation of local conditions for hog-growing but to two other facts, in the main, viz.: first, pork, until recently, was not undertaken as a primary product but as a by-product of dairying and, in a less degree, of fruit-growing and preservation; second, owing to the lack of up-to-date packing establishments, the demand for hogs for several decades was restricted to the supply of local butchers who made pork products only of the over-flow from their cutting-blocks, and gave it neither the quality nor style which characterized the "eastern" provisions from the Middle West. Until the operations of properly equipped packing-houses began about two decades ago, California hams and bacon could not compete with the imported articles. Both California pork and its products were inferior and the output, even as by-products, was of uncertain profitability. During the last decade there has been marked improvement in all these lines. Breeding, feeding and care of hogs has advanced rapidly toward the best standards. Better pork has been provided with better handling: local pork products are displacing introductions; they are entering inter-state and export trade, and will henceforward carry the highest American standards.

Swine were brought to California by the padres or by the soldiers who accompanied them, more likely by the latter. Probably they did not come with the initial expedition of 1769. At that time 229 animals are credited with arriving, but the kinds are not stated in such records as now appear. It is reason-

able, however, to exclude hogs, for one could hardly expect such pathfinders as Rivera's cowboys to drive such agile leggy beasts as the hogs of that day through such rough trail-less country as they traversed. However, pigs probably came in the ships which paralleled the land expedition, and came soon, for Captain William Shaler of the Yankee ship *Leilia* landed in San Pedro Bay in 1797 and "got supplies for a full year, including many hogs and sheep," which was, perhaps, the first export business in California hogs. The missions had hogs, though relatively so few that they were not often separately noted in their inventories. There is, however, segregation of the smaller animals in the statement that at seventeen of the missions in 1825 there was a total of 1000 hogs and 100,000 sheep. The ratio is probably about correct. The Spanish derivatives did not have all the early pigs. The Russians at Fort Ross in Sonoma County had hogs with their other live-stock in 1812. From such sources, probably, came the native Spanish hogs which the Americans found here on their arrival, although it was said in 1860 that "the common hog of California was first imported from the Sandwich Islands." It is probable that the common hogs came to California from various sources. The character of all of them is truthfully sketched in these words by C. H. Sessions, formerly a prominent swine-grower in Los Angeles County: "In former years, and in fact to the present day, there can be found on ranches in California numbers of the native Spanish hogs or 'razor-backs.'

They are very hardy, but are not proof against diseases of the more fashionably bred hogs. They take care of themselves and live in swamps and river bottoms, but it requires two or three years for them to mature ready for them to put on fat." Such hogs are still encountered on the over-flowed lands along the rivers of the interior valleys where they afford some sport to local hunters.

Hogs of the best blood of the time came to California in 1853, being included in the efforts for improved farming in that year. After satisfying demonstration of the success of this movement, the State Board of Agriculture in 1860 published this memorandum: "Seven years ago a few men saw the peculiar adaptation of our climate to the rapid development of animal existence and hence the richness of the field for the rearing and improvement of stock. They purchased at great expense of time and money, in distant portions of the earth, at great risk, a few choice specimens of blood cattle, horses, sheep and swine. Their growth and tendency to multiply more than verify the predictions of the projectors of the enterprise."

This importation was not by association; it was a group of individual enterprises in which many entered in their own ways. Contemporary records show that the breeds of hogs thus brought to the State were Westphalia, Bedford, Suffolk, Berkshire, Essex, Yorkshire, Leicester, Chester-White, Irish Grazier, and China. All these were shown at fairs previous to 1863, and this claim was officially made

at the San Joaquin Fair of 1861: "The 46 hogs of pure breeds, Essex, Suffolk, Berkshire, and Chester-White, exceeded all previous exhibitions in the State; indeed, could hardly be surpassed even in old England."

It was war time in 1861 and patriotism reached even to pigs, for J. D. Patterson of Alameda County exhibited: "Union Pigs, a new breed, product of an Essex boar and a Leicester sow, three months old and looking well." It was quite the habit of the time to cross the breeds and expect much from it, which, of course, was not realized.

It is interesting to note that the color question in breeds arose very early. In 1860, Carey Peebles of Santa Clara, who had pure-bred Suffolks, Berkshires and Essex, and was hogging-off grain with them, said that "the Suffolks are most profitable in the pen but they suffer when allowed to graze. On account of their thin hair they get sun-burned and have a mangy appearance." This decision against the white hogs is frequently repeated in subsequent records.

Out of the contest of the many breeds cited above, the Berkshire and Essex emerged as victors, in part on account of color, and later the Berkshire distanced the Essex largely because of superior size and range quality. Thus the Berkshire survived as champion over all the breeds introduced with it in 1853, most of which were utterly forgotten. Keeping pace with the development of the breed at the East and in England by scores of large importations by different breeders, the Berkshire armed itself for

the contest with the more modern breeds of American naming. Of these new breeds the earliest to arrive was the Poland-China, the first Magie hogs being shown by Moses Wick of Butte County in 1872 and the next year by several breeders. A few years after, Poland-Chinas began now and then to beat Berkshires and Essex in classes open to all, though the Berkshire still held the lead in such tests. Even the arrival of the Duroc or Jersey Red, by several importations in 1885, did not shake the Berkshire in open sweepstakes and dropped from notice until reintroduced as the modern Duroc-Jersey by H. P. Eakle Jr. in 1905. The Berkshire and Poland-China rivalry began its interesting course during the eighties and still continues, with the Durocs holding strongly against both of them.

Although it is true, as stated, that California pork producers have never caught up with the local consumption, they did at one time seem on the heels of it. The main purpose of spending so much time and money to get the best hogs in 1853 was to save the gold which was being sent away to pay for importations. The details of such achievements before 1860 demonstrated that the best hogs did better, in prolificacy and early maturity, than they did in the places whence they came; that barley and sorghum grain is as good as corn; that alfalfa is the best clover hogs ever grew on; that the cured meat from well-bred and well-grown hogs is exceptionally good and keeps well. The importation of salt pork was reduced from 51,169 barrels in 1853 to 29,444 in

1859. "Thus it is seen," said John Bidwell in that year, "that as we become able to supply ourselves with necessaries the importation of them declines." And during the next few years this truth became more apparent and in less than a decade H. D. Dunn wrote in 1867: "With the exception of a comparatively small quantity of salt pork, hams and sides, mostly imported in brine from the Atlantic ports, the domestic production supplies the home demand. But a few years will pass before importations will cease entirely and California become a large exporter of salted and cured meats to countries on the Pacific and to the interior."

In the latter sixties the war contracts ceased and the pork packers of the Central West had too much product and the overland railway opened. In 1867 Holden said, in his address at the Stockton fair: "Mr. Hancock, of Cragin & Co., Chicago, who was here recently, told me his firm, on taking stock a year ago, had on hand 71,000 barrels of pork worth $3,000,000 and bacon worth $500,000. That is the way our Chicago neighbors do business!"

It apparently occurred to Holden that the words of the enterprising Hancock were an inspiring incentive to local production, but Hancock was perhaps only the first of the procession of tired Chicago packers who have come to California since that time for recreation and have amused themselves with good strokes of business. Some of them have built up good local packing establishments and have been a great help in getting the California meat industry

as far ahead as it now is. Perhaps they did all they could profitably at the time but the fact remains that never again has the swine industry come so near to compassing the local demand and the hope of exports as it did just before the overland railway opened in 1869. This thoroughfare not only opened the way for the expansion of the packing industry of the Middle West to get its raw material in the beef and mutton line from the growing range industry of the farther west but it opened the way also for a freer westward movement of pork products of the Mississippi Valley states and acted as a safety valve against over-production for eastern consumption. California, having the largest population of the Pacific Slope states, was the main objective and was prospected for several decades by eastern packers as an outlet for pork products and not as a new producing field for them. More recently, however, their views and policies have changed, and with free investment and purpose toward local production by well equipped packers seems to lie the present prospect of supplying local consumption of pork products and of out-shipments in all directions.

Such an achievement is, however, still far from attainment. Though some packers are making what they call their "best brand" from selected California grown hogs and claim that such hogs are as good as can be grown anywhere, there is a large importation of pork products from the eastern packing centers and large quantities of live hogs are brought from adjacent states for slaughtering. During the World

War there was a powerful propaganda for larger local pork production; the promotion of pig clubs among school children stimulated popular interest in the animal and the organization of growers' sales by the farm bureaus in various counties showed the way for better selling, which has always been essential to encouragement of producers, but the business has been handicapped by high cost of production which average selling prices did not adequately recompense. In spite of this deterrence, however, the interest in pure-bred swine has been greatly stimulated and the general quality of the product has been advanced. The number of hogs in California in 1920 was slightly less than in 1919, when the peak in numbers was reached.

The geographical distribution of the swine industry has naturally followed the leadership of the dairy industry in its movement toward the great irrigated valleys of the interior where alfalfa is supreme and the growth of grain also most abundant. The ten counties leading in swine production are Imperial (which has nearly twice as many as any other), Kings, Tulare, Fresno, Merced, Los Angeles, Colusa, Yolo, San Joaquin and Stanislaus. All these counties are in Region 4 except Los Angeles which is in Region 3, as defined in Chapter I. There is, however, a distance of about five hundred miles between the extremes of the counties named and the swine industry is very widely distributed over the State. The basic factors of profitable pork production are alfalfa pasturage, skim-milk and barley.

POULTRY

Until very recently the poultry industry did not lift its product to the requirements of local consumption, which had to be met by shipments from the Middle West. Now, however, production has reached an annual total of $20,000,000 and large shipments of fresh eggs are made both by rail and sea to the Atlantic cities, 875 carloads moving in that direction during 1920. In 1921 direct shipments began to Europe via the Panama Canal and extension of the poultry interest entered a new phase, one feature of which was the ample capitalization of its coöperative association by setting apart one cent for each dozen of eggs handled, for that purpose. Expenditure for publicity to expand egg-consumption is contemplated.

It is perhaps a unique characteristic of the poultry interest that it has advanced by specialization and not by association with other farming. The packing of eggs in the back room of the store for shipment on store-keepers' account is a rare sight, because most store-keepers sell more eggs to farmers than they buy from farmers, except in poultry centers where they naturally have much such packing to do, though it is very small when compared with the traffic which regular producers do largely for themselves, or, in some sections, through the creameries which are their local emporiums and dispensers of cash payments. Specialization and concentration of the poultry interest is also shown by the fact that more than half the State product is shipped and sold

by producers, coöperative associations as indicated in Chapter VII.

It is not known when and by whose agency domestic fowls came to California. They may have been taken as a matter of course and, therefore, not entitled to entry on the records of the time. However, it is known incidentally that the padres and rancheros had them because snatching from the saddle a chicken buried to the neck in the sand was frequently mentioned in travelers' records. The improved breeds of fowls of their day were brought to California by the American pioneers and were shown at the state fairs of 1856 and later, but they apparently did not attract much attention nor are there recorded exhortations toward multiplying poultry products in the early days as were freely indulged in for the promotion of other branches of local production. But here again they may have been considered too incidental and a matter of course. Besides the chicken business was not, at that time, anywhere in America thought to be much of a pursuit for a man and the women may have shrunk from the trials of keeping hens in a wild open country which was a parade ground for skunks, wild-cats, coyotes and the like. Whatever the reason may have been, little was done with domestic fowls in the earliest American days and that came about and increased without particular promotion. As late as 1867 H. D. Dunn, who wrote a detailed promotive sketch of California opportunities, could only say this: "All the domestic fowls thrive well and increase rapidly in Cali-

fornia: turkeys, chickens, geese and ducks, as also their eggs, sell at profitable prices." In the same year the State Surveyor General made a census from the county surveyors' reports, which is contrasted with the last United States Census report in this way:

	Chickens	*Turkeys*	*Ducks*	*Geese*
1867	1,030,579	113,119	73,310	15,217
1910	5,665,964	116,002	40,061	14,195

The figures show that only in chickens was any notable progress made during the forty odd years between the collections of data. The same course has been followed during the last decade and very marked progress has been made, for now Sonoma County has probably as many fowls as were counted in the whole State in 1910. Poultry-keeping has advanced both by increased production and valuation of the output to a total, currently estimated by experts, to exceed $20,000,000 a year.

The production of fowls and eggs is practicable everywhere in the State from the immediate coast across the hot valleys and up the foothills and mountains everywhere. The mild equable coast climates from end to end of the State make the least requirements in the way of shelter; the hot interior valleys demand shade during high temperatures; the mountains necessitate winter protection from low temperatures. Therefore, a farmer can keep fowls wherever he has his farm, if he gives them fair play. It may be that they will not keep themselves so easily as in countries with moist summers which are less favor-

able to mites and other small vermin and more favorable to natural growth of green feed. However, these questions, formerly zealously discussed, are now considered largely academic, as practical farmers keep fowls everywhere and because very large commercial production is now attained in localities which were formerly looked on as unfavorable to hens. In all parts of the State disappointments and sometimes disasters have attended ventures in poultry production as they have everywhere, but experience has demonstrated that they are more the fault of the man than of the hen, because her health and environment were not properly provided for.

The chief regions in commercial poultry production as designated by G. H. Croley of San Francisco, in their relative importance (and their location in the regional districting of the State according to Chapter I) is as follows:

1. Petaluma district, including Santa Rosa and Sebastopol—Region 2.
2. California south of Tehachapi—eight counties—Region 3.
3. Hayward-Livermore, including the suburbs of the city of Oakland—Region 2.
4. Santa Cruz-Watsonville-Salinas—Region 2.
5. San Jose-Gilroy-Hollister (Santa Clara Valley) —Region 2.
6. Sacramento-Stockton—Region 4.
7. San Joaquin Valley (beyond the portion included in No. 6)—Region 4.
8. Sacramento Valley (beyond the portion included in No. 6)—Region 4.
9. Sonoma-El Verano-Napa—Region 2.

10. Santa Maria-Arroyo Grande—Region 2.
11. Martinez-Concord-Walnut Creek (San Ramon Valley)—Region 2.
12. Northwestern Coast district—Region 1.
13. Northwestern Mountain district—Region 5.
14. Eastern Mountain district—Region 5.

It will be noted from the geography of California poultry production, as above set forth, that it has extended from the coast regions into the interior valleys. In this movement it has followed the progress of the dairy industry with this important difference, that in the latter, the greatest county and regional dairy productions have departed from the coast to the interior, and the poultry interest retains both of these attainments near the coast, though interior production has become large. The Petaluma district, taking its name from a town in southern Sonoma County, on the north shore of San Francisco Bay and connected with the city of San Francisco by both rail and water routes traversing about forty miles of distance, became the leading poultry region of California about 1880 and it has maintained leadership not only in the amount of product but in invention of methods and appliances, originality in choice of materials and in systematic policies in production, for about forty years. The town of Petaluma is an emporium of trade in eggs. The immediate region produces little poultry feed and train and boat loads of grain, alfalfa hay and meal and by-products of the meat industry are brought in. Petaluma is not only an egg but also a poultry factory, for

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the hatching of chicks is no longer done in farm incubators but in central hatcheries of which there are eight large establishments and twenty smaller concerns, which hatch annually approximately 13,000,000 chicks, of which 60 per cent are installed on the farms of the district. The largest hatchery has a capacity of 250,000 chicks every three weeks and an annual output of more than two millions. About five million chicks are shipped to other districts of the State and beyond. As soon as they are dry, they are taken from the incubators and placed in light ventilated cartons, some with one compartment, but most have four, each holding 100 chicks. The chicks are sent to any point within seventy-two hours from the place of shipment without feed or water, in fact, they are found to be better off for this enforced fast until their natural supply of nutriment is exhausted.

It is believed that the Petaluma district is unique in the world not only in its concentration and aggregate of poultry production but in the originality of its methods and policies. Naturally the activities of the district, both industrial and social, are extensively and pervasively gallinaceous as may be inferred from this delightful sketch written in 1919 by Miss Nellie Denman, president of the Petaluma Women's Club:

"The poultry farms literally circle the city of Petaluma, forming a veritable amphitheater, divided into farm centers and districts all touching each other in neighborly fashion, and forming one wonderful chicken world. Yet each farm with its broad

acres of chicken yards and colony houses, green kale patches and cozy bungalows sitting in the shade of the eucalyptus groves, has a privacy and individuality all its own. Some of the homes topping the gently rolling ground are modern bungalows, others are the colonial type—each one of them electrically connected with lights, telephone and other conveniences of modern homes. Farther out again within a six miles radius of Petaluma are more farms, but more scattered, covering a larger area of rolling hills and valleys with red-roofed bungalows, white sentinel-like windmills, shade trees and the ever-present flocks of white Leghorns."

From pioneer times the white egg has been in California the standard of desirability. This preference is conceived to be due to the fact that hens brought from Mexico were originally from the Mediterranean and, therefore, white-shell breeds, while the eggs which came by ship from northern Atlantic countries were prevalently brown. Therefore, one could tell at a glance the history of the egg and eggs of long experience were discriminated against. Later when breeds of fowls laying brownish eggs were introduced the question arose whether such eggs were not really richer, as the shell-color might indicate, but it was determined by careful comparative analyses at the Experiment Station that there was no difference in contents though the shells differed in hue. There seemed then no reason why the old preference for the white egg should not prevail though the reason for it had disappeared long before, when the importation

of seasoned eggs by ship was displaced by the copious receipt of fresh eggs by rail in carriers. As the White Leghorn took clear precedence in commercial production, the standard became the large white egg now chiefly characteristic of California eggs both in local and distant markets. Other breeds which now share commercial production with the White Leghorn are judged as to availability by their ability to rival the Leghorn in their large white eggs. In smaller production by devotees of different breeds and on farms and in villages, this character counts for less and is considered in connection with other forms of desirability in the breed. When shipments of winter eggs are made to eastern cities, white or brown eggs are sent to terminals in which a color standard influences local sale, and for the same reason white eggs are usually selected for shipment to California from other states.

As shown by the census figures, the hen and her relatives comprise more than 97 per cent of the poultry interests of California and other domesticated birds have not only relatively but actually decreased in numbers during the last half century. If these figures are accurate, the decline may be partly due to the decimation of the Chinese population which was great before the exclusion act of 1879, for the Chinese would not accept wild geese and ducks, which have always been abundant, as a substitute for tame birds. Turkeys also show but little increase during a half century and this may be attributed to two new conditions which have arisen, viz., the progressive

closing of the interior plains to range husbandry which best suits the turkey and the systematization of turkey production in some parts of the Mississippi Valley which includes the Pacific states in its sales' territory, and refrigerator cars and cold storage plants which promote the distribution of distant products in good condition. However, the California-grown turkey, which is predominantly the bronze type, is highly esteemed and leads in market values. It is apparently also advancing in production for estimates since the census of 1910 place the numbers now grown from half to three-quarters of a million, nearly five times as great as ten years ago.

The ostrich was introduced to California culture directly from South Africa in 1888 and ostriches have been grown in limited numbers for exhibition and for the plume product since that date, but they have never attained the popularity and profitability which were anticipated at the time of their introduction.

BEES AND HONEY

By the United States Census of 1910, California ranked third among the states in number of bees, with 201,023 colonies, and first in value of product which was placed at $729,793. The honey product has been for half a century greater than local consumption and yearly shipments to other states and exports to Europe and Pacific countries are undertaken, from 70 to 90 per cent of the product being shipped beyond state lines.

Nature supplied California abundantly with wild bees, both of the "honey" and "bumble" varieties, and considerable business was done by bee-hunters to supply the early American towns and mining camps. The complaint lodged against the bees in the records of the time was that they were too much disposed to "select trees of large dimensions in places not easy of access the felling of which requires excessive labor and it is not uncommon for them to break in falling, shattering the combs and rendering the honey valueless." The difficulties in securing wild honey profitably, coupled with the need for honey for the flap-jack essential of the miners' menu, no doubt hastened the enterprise of the pioneers to secure tame bees whose sweets could be more conveniently commandeered. Such bees were brought from the Atlantic side by sea and were installed before 1856, for in that year there were at last three apiaries of more than a hundred hives each belonging to F. G. Appleton, Mr. Briggs and Mr. Buck near San Jose and they were surprisingly productive both of swarms and honey and in the value thereof. It is recorded that four, six and, in one case, eight swarms came from one hive; that the value of a hived swarm was $100 and the price of honey 50 cents and $1 a pound, prices which endured for several years. It is, therefore, not strange that importations of bees continued. In 1857 J. S. Harbison brought bees from the East to the vicinity of the Sacramento River where it was prophesied bees could not live, and the fifty-four hives he imported in December, less twenty which he

sold at $100 each, had become eighty-one by the following summer. Harbison is entitled to rank as the premier pioneer in California beekeeping for he not only began early but he invented an improved frame hive which was largely used. He participated in the development of the honey industry until his death in 1912 in San Diego County, where he had established himself in 1869 and where he had become at one time, perhaps, the largest honey-producer in the State. Harbison was one of a large group of beekeepers who moved the apiaries beyond the cultivated area into the mountain canyons and upon the dry plains where the nectar of wild sages and other desert flora disputed superiority with white clover standard and where the producer had the advantage of limitless free range and surprising production whenever there was rainfall enough to make the desert bloom. From such wild waste places a large export product of honey came for several decades. More recently the bees have reëntered the cultivated area and the product from wild ranges is now exceeded by bees pastured on alfalfa, fruit-bloom, bean-bloom and other nectar-yielding agricultural flora in different parts of the State, even from the extremes of north and south boundaries.

Portability of apiaries, which became common at first to meet the exigencies of seasonal variation in honey flow on desert areas, has recently become systematically employed to meet bloom of large areas of cultivated plants, not only for the good of the bees but for the pollination of such bloom. Some

beekeepers now do a good business in renting the services of their bees in pollination of field plants and fruit-trees to increase seed or fruit production. A concrete instance of transforming bees into commercial travelers, as practiced during 1920, is the following:

"The owner of 200 stands of bees started the season in a large Santa Clara county prune orchard, where he was paid $2 per stand to keep the bees in the orchard during the blooming period. In addition to the money the beekeeper extracted a ton of honey and the bees built up strong colonies, which he moved over two hundred miles eastward to the orange orchards in Tulare county, with his hives filled with bees able to gather more honey than bees wintered in the district. The Tulare orange bloom lasted about five weeks, owing to cool weather. And then the bees were moved northward one hundred and fifty miles into Stanislaus county to get the benefit of various wild flowers and alfalfa bloom. In July the honey was extracted, the bees shaken from their hives into wire cages (to escape transmission of bee diseases), and then taken about two hundred miles northeastward into Nevada, placed in new, clean hives, and there gathered honey from alfalfa and wild flowers until fall when they were taken back to California in the wire cages. Thus the bees passed the season working full blast in four different localities; their honey was taken all away from them; and they were not even permitted to swarm.

"This great amount of moving is exceptional. It

is more common for a beekeeper to move from his home place in the region to the citrus country and to return after the orange bloom has fallen. In such a case the hives are loaded on a truck or trailer, stopped up so that no bees can get out, and transported to their temporary location where they are allowed to work until the supers are pretty full, when the bee-keeper sets up his extracting outfit in a movable screen room, and extracts the honey, putting back the empty supers. When they are filled again, they are extracted once more and in a normal season, the second extraction may finish the blooming period of the citrus trees. If it does, all the honey in the hives is extracted both in supers and brood frames, though the brood is not injured, and as soon as the bees are well settled in their hives they are taken back to the home place or to a new location. The honey is all taken out before moving because the seasonal heat, the weight of honey and the warmth of the confined bees while they are being moved would melt the wax and cause great damage to the comb."

In many ways the beekeeping industry has altered its methods and policies to keep pace with changing conditions, including organization for production and marketing, which will be noted in Chapter VII. Beekeeping is also increasing largely by installation of small apiaries on farms and in fruit plantations, such resources having recently been notably promoted by the patriotic propaganda to increase production of sweetening and by the demonstration of the effi-

ciency of bees in increasing fruit production of self-sterile varieties. According to the Census of 1910, California was the first honey and wax-producing state in the Union, with a product of 10,264,716 pounds of honey and 126,445 pounds of beeswax, thrice as large in honey and more than twice as large in beeswax as Texas, next in rank among the states. There is, however, great variation in the annual product owing to seasonal uncertainty of honey flow of the desert flora, as has been suggested. During the last twenty years there has been variation from one to ten million pounds of product. Fortunately the art of beekeeping has mastered expansive and contractive measures and policies to meet such variation and largely to maintain the bees in production commensurate with such quickly alternating extremes.

THE SILK-WORM

The pioneer silk-grower of California was L. Prevost of San Jose who grew his first brood of worms from eggs obtained in France, in 1854, having failed to secure a hatch from two importations of eggs from China. Prevost exhibited cocoons and appeared at many public occasions as the apostle of silk culture as an industry for California. He did a considerable business in mulberry trees and silk-worm eggs and before 1867 silk fabrics were manufactured at a small factory in San Jose; silk-worm eggs were profitably shipped to France in quantity, and in 1867 silk exhibits from California won honors at the Paris Exposi-

tion. Meantime silk enterprises had been entered on near Santa Barbara, Sacramento, Grass Valley and other points and large expectations were cherished of profits both from local silk manufacture and from production of eggs for sale in France. The latter expectation was arrested by the Franco-German War of 1870 and finally extinguished by the fact that California eggs were contaminated with the disastrous silk-worm diseases which Europeans were trying to escape. The calculation of profitable production of raw silk also proved illusory because, even with cheap Chinese labor then available, the cost of production was too great and all the earlier efforts at silk-culture were abandoned.

In 1880 agitation was revived on the basis of the suitability of silk-growing for a household industry. With this effort, which included promotive enactment and appropriation by the legislatures of 1883 and 1885, there was wide distribution of mulberry cuttings of several species imported and grown for that purpose, the establishment of an experimental filature and many publications. However, silk-growing was not profitable after the State ceased to buy cocoons at a high price for promotion purposes. It cost too much to hire labor to pick mulberry leaves and to wait on the worms. After State promotion was withdrawn about 1888, effort was continued by individuals and societies but neither popularity nor notable production has been attained, although considerable energy and enthusiasm have been manifested from time to time even to the present. In the line

of manufacturing, more has been achieved as there has been in operation for many years a silk thread mill at Petaluma with a capacity of 60,000 pounds a year. It uses raw silk grown and reeled in China and Japan. Although silk-growing has been practically abandoned, there is still a degree of confidence that silk manufacture from Oriental raw material will ere long be a great industry in California, and promotive effort in that line continues.

CHAPTER VII

COÖPERATIVE ORGANIZATIONS

THE chief difference between American agriculture and that which preceded it in California lies in the fact that the Spaniards had one sublime earthly purpose in their entrance on this territory, to Christianize the pagan aborigines and fit them for civilized use of the vast country of which their ownership was recognized. In the undertaking to keep the land for them and to fit them for development into national existence as a new gem for the crown of Spain, it seemed desirable to keep them free from contact with the outside world. Plans for colonization with white people were urged on the crown but were not approved, either because isolation of the savages with the means of regeneration was held to be essential or because funds were not available to promote colonization. The result was that trade was prohibited except as the mission padres conducted it and intrusion of foreigners was unwelcome, although hospitality to those who did gain access was generous and genuine. During the Mexican régime the earlier conceptions of service to the aborigines were largely abandoned and restrictions on trade and access of foreigners relaxed. However, agriculture had little

definite aggressive purpose and no initiative to serve such a purpose if it had been conceived.

In sharp contrast with this insurmountable barrier to progress was the attitude of the Americans who discerned opportunities for development in everything and advantages in the natural capability and geographical situation of the country. They at once entered on organized efforts for the attainment of a distinctive and diversified agriculture such as a semi-tropical climate and a potential opening in world trade invited. The method which they adopted to attain fully and quickly the results they conceived to be possible and desirable was that of coöperative organization. It is probably true that the farmers of no other American state ever discerned so early in its history the benefits of organization and began so soon to strive for them. They were of course disappointed again and again in the time required for realization, but the effort was never abandoned and conspicuous success came to the second and third generations.

In September 1851, just one year from the birth of the State, a state fair was held in San Francisco. It was not officially arranged for but was the result of spontaneous impulse on the part of the people to bring their products together and to compare their experiences. Products from valleys hundreds of miles apart were displayed, an oration was delivered and prizes were awarded. Other similar gatherings and fairs followed and in response to an appeal to the legislature the California State Agricultural

Society was created in 1854, endowed with an appropriation and authorized to hold state fairs in a series which has been unbroken to the present day. The early work of this society had this unique feature. Committees were sent to every point where agricultural effort was being put forth and official report was made of the undertakings and results of all persons with plants and animals so that all might profit by their experience in the pursuit of farming under conditions that were new and strange to all. The whole State was a popular experiment station. The education of the pioneers by this method was rapid and its influence in the promotion of the early agriculture was remarkable.

While organizations for holding exhibitions of achievements and for discussion of ways by which they were attained were multiplying, there was now and then an out-cropping of the idea that farmers should effectively organize for promotion of their industry and a fair consideration of it among other vocations. The first organized effort to secure a fair share of product value for producers was by the wool-growers, who formed an association on September 24, 1860, "to provide a remedy against efforts to establish a monopoly in the wool markets of the State," which wool buyers had in good working order at that date and on which the growers combination had a marked deterrent effect.

In January 1867 the secretary of the State Board of Agriculture addressed a "memorial to the people of California" in which it was said:

"California is exporting a large number of agricultural products: her grains, wines and wools are quoted in the markets of the world. Our farmers must make themselves familiar not only with our productions and home markets but with markets in which our surplus may be demanded. The channel through which such information may be obtained, to be reliable, should be created and controlled by the farmers themselves. Unless the farmers do so, they are at the mercy of the world and its multitude of sharp, unscrupulous tradesmen, instead of being the independent men they might make of themselves."

The result of this movement was the passage of a bill to promote the formation of coöperative industrial associations in the different localities of the State to hold local fairs and collect information, for which the State should furnish an amount of money equal to that locally contributed. The bill failed to receive the signature of the Governor, who was perhaps frightened by the financial possibilities it involved.

Five years later, in 1872, the State Board of Agriculture published an inflammatory declaration from which the following is taken:

"The truth is the grain merchants, the hucksters, the middle-men, the shippers, the railroads, the sack makers, the law makers, the assessors and the tax collectors manage to hold the agricultural classes in a condition of servitude unparalleled in a free country.

"It has been said that these things always regulate themselves. I question if anything regulates itself. The farmers and fruit growers must combine for their own protection, as the grain dealers and hucksters combine for their own profit—otherwise they will continue to labor for the benefit of those who, however useful as a class, produce nothing."

Such declarations resulted in a meeting, during the State Fair of 1872, of delegates from various farmers clubs and other local agricultural societies for the avowed purpose of organizing a state-wide association to "serve as a medium of communication between the local clubs, to canvass the condition of the agricultural interests and their relation to the other industries of the State and, if possible, to devise some means for the better promotion and protection of those interests in the future." Thirteen counties were represented and an address was issued to the farmers of the State "setting forth the disadvantages under which the agriculturists as a class are laboring, the grievances which they are suffering and showing the importance of strong and permanent organizations and early and united action." This organization was called the California Farmers Union, the name having of course no relation whatever with the existing Farmers Union, which was organized over thirty years later. This original California Farmers Union in its "address to the farmers of the State" made these two declarations, which will sufficiently indicate the temper of half a dozen others:

"When the farmer is so fortunate as to produce a surplus and desires to send that surplus to the best markets, whether at home or abroad, he finds that not only the carrying facilities within his own country but even those of the high seas are as effectually united and combined against him as if owned and controlled by one man, and though the article he has for sale bears a high and remunerative price in those markets, the exorbitant freight demanded and forced from him for moving it leaves no profit.

"The customs of these men have grown so burdensome and exacting that in many portions of the State large quantities of perishable products, such as fruits and vegetables, are annually allowed to go to waste rather than send them to market, and the producers are unwilling losers of millions."

It is also interesting to note that though several pages of such aggressive agricultural doctrine were spread in the Report of the State Agricultural Society in 1872, not a word about it ever appeared afterwards, and the Report for 1873 shows changes in the list of officers. Even now, nearly half a century later, it is clearly discernible that commercial and transportation interests realized that the farmers were getting troublesome, and caused the leaders of malcontent to be displaced by those who would confine the activities of the State Agricultural Society largely to horse racing, which they did very thoroughly for a decade or more.

However, the farmers of 1872 were not wholly cast down by the disaster to their project for a state-wide

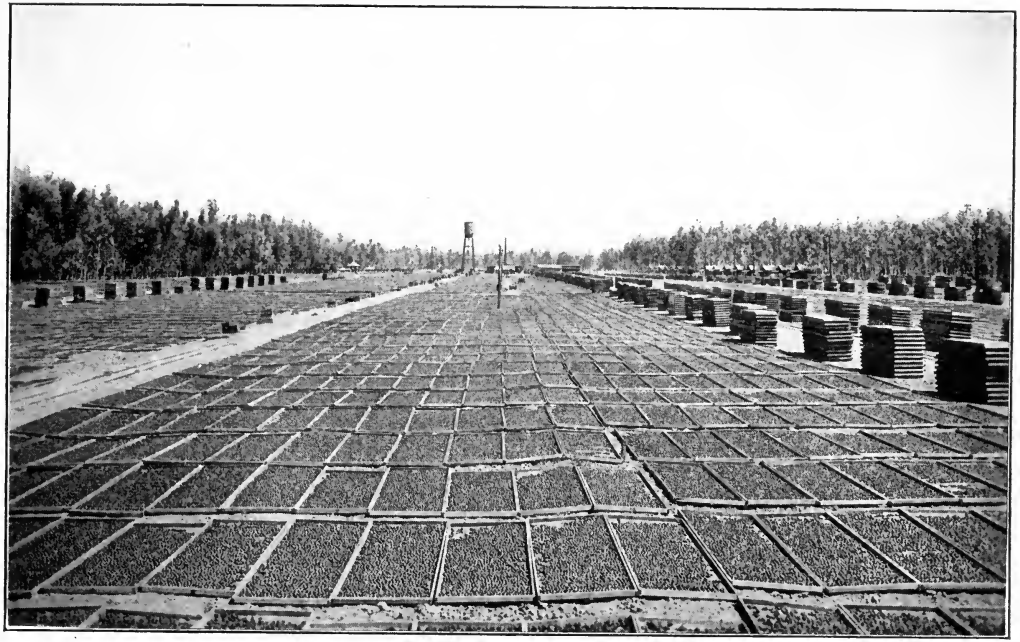

Plate X. Prune drying-yard with an environment of Eucalyptus trees.

protective organization to be realized with State aid, even though the California Farmers Union only lived long enough to send a memorial asking Congress "to regulate freights and fares on overland railways and protect the people against impositions and oppressions by railroad monopolies."

In 1873 the projectors of this Farmers Union joined with many others of the same kind and organized the California State Grange, a branch of the national order of Patrons of Husbandry, which was then valiantly attacking the old systems against the farmer in nearly all the states east of the Rocky Mountains. The California State Grange attained large membership and influence which endured for a decade or more, until much of its force was diverted to the Farmers Alliance. At the time of the greatest attainment of the Grange in enrolling farmers, which was about 1880, there had been no equal gathering of membership in any general farm organization. The Farmers Educational and Coöperative Union has a strong organization but is limited in geographical spread in California. Other undertakings have also attained limited area of influence and various lengths of continuous existence. The California Farm Bureau Federation (branch of the American Federation of Farm Bureaus) organized in 1919 had in 1921 a larger membership than any other association of all kinds of farmers has hitherto attained in this State and is working more aggressively in the general farming interests. The Farm Owners and Operators Association was organized in 1918 to

include actual farmers as full members, non-operative land owners as associate members and duly certified farm laborers as affiliated members. This association was reorganized in 1920 as the Federation of American Farmers, looking toward organization of proprietary farmers for promotion and protection of their interests by political policies similar to those adopted by the American Federation of Labor but toward somewhat contrary purposes.

SPECIAL COÖPERATIVE SELLING ORGANIZATIONS

The organizations which have attained greatest success in California and have given the State a reputation for successful coöperation are not those which undertook to associate all kinds of farmers in united action and influence. They are the groups of producers of particular products, the chief purpose of each being to give its own product the best merchantable form and quality and to control the marketing of it in its own way, in some cases through its own selling agencies, in others by price fixing to the general trade. Such associations now cover nearly all the leading farm products and their numbers and various fields of action may be learned from the list of those operating in 1922, as given in Appendix J.

Although few of these organizations existed in their present form and plan of action a decade ago, for most of them are much younger and all have vastly increased their operations and business facilities quite recently, nevertheless they may be looked

on as the offspring of aspirations cherished and of efforts put forth during the last four decades. Agitation for the special-purpose associations began in 1875 and many short-lived organizations were undertaken from time to time thereafter. Their demises were due to various conditions, viz., the impracticability of the plans proposed; the unwillingness of growers to take the risks; the opposition of private trading concerns which naturally desired to protect their vested interests; the advantages such concerns enjoyed at that time in rebates from transportation companies and in cheap capital from recognized commercial credit which was then not available to organized producers.

Various other causes and conditions operated against the earlier efforts at coöperation but there was one strong connecting line which led from one determined venture to another and from one disappointment to another until, by its continuous action, difficulties began to disappear and achievements began to be realized. This unbroken influence toward success was exerted by informal assemblies of fruit-growers, called California Fruit Growers Conventions, which began in 1881 and which have been held annually or oftener until the fifty-fourth of them convened in Los Angeles in 1921. At these conventions all coöperative organizations for fruit handling by producers have had either birth or christening and to these conventions all which succeed report their plans and attainments. From the very beginning hundreds of growers have gone from end to end of

the State and remained several days in session for the purpose of deciding what growers can do to advance the industry in which they are involved and taking the initial steps to do it. These conventions with their gatherings of fruit-growers for unprescribed discussion and untrammeled action are not only carrying progress forward from year to year but from generation to generation—as described on page 171.

On this foundation of continuous interest and confidence and of unbaffled effort, California's notable structures in special-purpose coöperation have arisen. They are original in design and function and novel in some of the particular purposes they aim to serve, and in the methods developed for such service. The architects who planned these structures, the master-builders who translated the plans into visible forms and the leaders in organized industry and trade who have brought plans and forms into concrete operation have been men of mature age whom the attractiveness of California life and investment induced to bring their training and experience in professional and commercial life, and their accumulations of capital, from other parts of the United States for undertakings in agriculture. They already were wise in legal requirements and possibilities and in financial and commercial policies and operations. They won the confidence of those who had hitherto had little experience or observation beyond the lines of crop production; they spoke with authority to the managers of transportation, of finance and of established trade. All these masterful resources they enthusiastically

made available to the effort to organize the fruit and other productions of California. In all the course of development of plans and conceptions into concrete operation, which covered several decades, there was a prevalent feeling of equality and mutuality among participators, whether their property holdings were small or large. The principles of true coöperation, which they sought to understand and apply to the settlement of questions of profitable production, exerted a strong influence on their attitudes and relations towards each other. Long and persistent effort toward coöperation, reason and fair play, not only attained these ends but constituted also an adult school in humanity and citizenship which has profoundly influenced the quality of California rural life.

During the first quarter of a century of production of special products for distant marketing (except in the dawning of great ideas of commercial independence for agriculture which have been noted), effort was naturally centered on cultural problems. About 1885 there arose to common view the imperative need (which previously had been dimly discerned) of beginning correspondingly strenuous and systematic effort on the commercial side. It then began to be clear that such great production of fruits as natural conditions favored and human enterprise and industry were capable to attain, could only encounter financial frustration unless the producers' ideal, of the greatest volume of production with reasonable profit, could be substituted for the traders'

ideal of the greatest profit from the least volume of production. The producers' plan was to use all suitable land and supply a world of consumers; the traders' purpose was to sell as much fruit as few buyers could pay high prices for, so that their margin would be greatest and his risk and investment least. There is, of course, an irrepressible economic conflict between these plans and the views and purposes which underlie them. It was in 1885 that the man who was then selling most California fruits in Chicago declared that "New York could take so little that it could be easily sent on by express from Chicago." It was poor prophecy, for in 1917 the carloads both of deciduous fruits and oranges which found a terminal in Chicago comprised only about one-sixth of the total shipments, five-sixths going east of Chicago. The declaration of the traders' conception of the opportunity for distant shipment in 1885 shows how futile would have been the effort to build up large production for distant shipment if growers had not discerned their commercial needs and taken steps to secure them for themselves.

It required many faltering steps to make any headway at all. In 1885 the first serious effort was made to attain self-marketing by growers, which the pioneers had declared fifteen years earlier would be the only solution for producing problems. In October, 1885, the Orange Growers Protective Union was organized in Los Angeles, and in November following the California Fruit Union was established in San Francisco. Neither of these organizations lived long

nor accomplished much, but after about thirty years of evolution in organization, not less than 75 per cent of the fresh and cured fruits are sold and distributed coöperatively by the growers thereof. In this thirty years' war California has not only rendered sure her own future in large production, but has set the pace for similar movements in all the large fruit regions of the United States. This attainment is the culmination of more than sixty years of broad conceptions, of clear foresight, of sustained and resolute effort and of investment of everything which makes for cultural and commercial success. Some measure of the attainment can be found in the facts that the fruit industries of California cover not less than one-fourth of the total value of the fruit industries of the United States and that California's output of all fruits and fruit products is much larger than that of any other single state.

This achievement would have been altogether impossible if the traders' point of view had not been resolutely rejected by the producers. The effect of one concrete fact is indisputable: five leading fruit-growers' organizations expended $1,780,000 for promotive publicity purposes in 1919, thereby developing a consuming demand which engendered prices beyond expectation.

METHODS OF COÖPERATIVE ORGANIZATION

Readers who study the list of coöperative organizations for agricultural purposes in Appendix J (page

383) will appreciate that no detailed analysis of principles, methods and materials can be undertaken in this connection. Details of ways of handling such diverse products as the very names of the associations indicate would fill a volume of close technical information. Usually readers who desire to know details about particular products can secure them by correspondence with the headquarters of the organizations covering them, which are located in the list especially prepared for this book, up to the date of publication. Discussion of the principles of coöperation which are applied in the operation of the California organizations is also apart from the purpose of this writing; nor is reference to them in detail at all necessary because careful treatises on the subject are available.[1] Other methods of organization are given in detail in the reports of the California State Market Director, an officer charged by law with promotion of producers' marketing organizations.

It will readily be inferred from the fact that three whole books and five reports, in addition to continuous popular publication, are required to outline and discuss them, that the policies and methods of California coöperative organizations are neither simple

[1] "Coöperation in Agriculture" by G. Harold Powell. New York. Also by the same author, "Fundamental Principles of Coöperation in Agriculture." Circ. 222, Calif. Exp. Sta., 1920. "Coöperative Marketing: its advantages as exemplified in the California Fruit Growers Exchange" by W. W. Cumberland. Princeton University Press, 1917. "Coöperative and other Organized Methods of Marketing California Horticultural Products," by John William Lloyd. University of Illinois Studies in the Social Sciences, March, 1919. Also by the same author, "Coöperative Marketing of Horticultural Products." Ill. Exp. Sta., Circ. 244, 1920.

nor uniform. It is also true that no universal formulas for organization and operation can be drawn from their experience because the organizations are still proceeding confidently in their several ways, each holding that its own way best meets the conditions of its own membership, the nature of its materials or the requirements of the trade therein. California organizations are, in fact, in spite of the immense volume and value of the products they successfully handle, still going through a period of experimentation with organic principles and methods and no one can confidently prophesy whether the final outcome will prescribe uniformity or diversity as the better policy.

Without undertaking to determine how far existing organizations claiming to be coöperative embody the principles of true coöperative organization of producers to do business for themselves, it may interest the general reader to know that two leading types of organization have been for several years in operation on a large scale. One is the non-profit incorporation legalized by a California statute of 1909, and given the same legal powers in carrying out its purposes as a capital stock incorporation, by a statute of 1921. The other is a capital stock incorporation, which, in its latest and best form, limits the holding of the stock to actual producing members and limits the reward of the stock-holder to reasonable interest on his investment and distributes all excess earnings among members as producers and not as holders of capital stock. Capital stock organ-

izations operated for the sake of dividing earnings among stock-holders, with or without reference to their standing as producers, are not sufficiently co-operative to be considered in this connection, although they may be so in the way all incorporations essentially are. So intimately, however, are the non-profit and capital stock plans associated that a central exchange may be organized on a non-profit basis while the local associations which are affiliated under its authority may proceed on the issuance of capital stock which is non-transferable and must be returned for proper consideration to the association when the holder is no longer qualified for membership as an actual producer.

Two concrete facts will enable the general reader to appreciate that California associations for giving special products acceptable commercial form and for selling them directly to large factors by private sale at fixed prices or by public auction to all bidders, or by their own agents, actually do control and market their own products. One is that an average of not less than 70 per cent of all the special products indicated by the names of the organizations in the list in Appendix J, are sold by producers' coöperative selling organizations. The other impressive fact is that in this way the return to producers was in 1919 an aggregate of over two hundred million dollars.

In order to present concrete facts about the operative means and methods of a number of Californian coöperative selling organizations, statements were secured for this book by questionnaire, the responses

thereto being presented in the table on page 302 which is representative of the procedures of all now active in California, both those of largest transactions (all of which are included), and several of smaller business dimensions.

The attitude of the public mind toward producers marketing organizations is seen in the fact that when the legislature of 1915 created the office of State Market Director and omitted from the prescription of functions to this officer specific reference to the organization of producers into marketing associations, the legislature of 1917 repealed that law and enacted a new one in which the promotion of organization of such associations was made one of the chief functions of the State Market Director. The conviction seems to prevail widely throughout the State that the achievements of such associations have been for the public good and that their continued and enlarged operation is one of the most important factors not only in the advancement of rural life in California but in the general development and prosperity of the State.

OTHER AGRICULTURAL ORGANIZATIONS

Special prominence has been given to organizations of producers for product sale and distribution and for manufacture or purchase of supplies and the like used in production, because such organizations are widely accepted as most distinctive and characteristic of California. Another line is, however, hardly less

RECORDS FOR 1919 OF COÖPERATIVE SELLING ORGANIZATIONS SHOWING VOLUMES AND METHODS OF TRANSACTIONS

Name	*Central Office*	*Number of Members*	*Capital Stock*	*Interest*	*Fix Prices*	*Sales in 1919*	*Per Cent of Product*	*Supplies Purchased*	*Value of Property*
Cal. Fruit Growers Exchange *	Los Angeles	11,000	none *	....	No	$54,627,586	75	$7,737,666	..... †
Cal. Assoc. Raisin Co.	Fresno	10,000	$1,657,653	8%	Yes	42,500,000	88	none	$3,750,000
Cal. Prune-Apricot Growers	San Jose	10,000	1,088,000 ‡	....	Yes	22,000,000	75	none	none ‡
Cal. Peach Growers Inc.	Fresno	6,000	1,000,000	8%	Yes	10,000,000	80	none	961,000
Cal. Fruit Exchange	Sacramento	3,000	100,000	10%	No	10,127,039	30	850,000	1,500,000
Central Cal. Berry Growers	San Francisco	240	none	....	No	1,500,000	33	27,000	2,000
Sebastopol Apple Growers	Sebastopol	500	40,890	....	Yes	701,629	80 §	none ‖	50,000
Cal. Walnut Growers Assoc.	Los Angeles	3,000	none	....	Yes	12,390,028	80	.....	764,000
Cal. Almond Growers Exchange	San Francisco	3,700	none	....	Yes	3,000,000	85	40,000	350,000
Cal. Lima Bean Growers	Oxnard	1,400	none	....	No	15,000,000	60	80,000	none
Cal. Bean Growers Assoc.	San Francisco	1,566	none	....	No	2,462,104	37	15,621	none
Pac. Rice Growers Assoc.	Sacramento	487	25,000	....	No	14,000,000	76	none	5,000
Assoc. Milk Producers	San Francisco	200	95,815	5%	Yes	2,958,727	65	.....	300,000
Imperial Valley Assoc. Milk Producers	El Centro	400	.....	....	No	2,000,000	60	none	.....
San Diego Milk Producers Assoc.	San Diego	62	none	....	No	440,660	85 ¶	none	500
Cal. Milk Producers Assoc.	Los Angeles	600	100,000	....	No	2,101,233	80	309,301	.....
North Cal. Milk Producers Assoc.	Sacramento	1,400	none	....	No	3,500,000	50 ¶	60,000	350,000
Poultry Producers, Central Cal.	San Francisco	1,500	250,000	8%	No	4,680,065	50 ¶	none	50,000
Poultry Producers, So. Cal.	Los Angeles	525	45,204	....	No	1,369,345	35 ¶	.....	.....

* The California Fruit Growers Exchange handles oranges and lemons, through a central and 200 auxiliary local exchanges. The Central Exchange has no capital stock; funds derived from assessments a packed box of fruit. Some auxiliaries have capital stock receiving only current interest rates: others operate on same plan as Central Exchange.

† Very large, including 210 packing-houses, costing from $10 to $250,000 each: lumber tracts, sawmills, etc.: manufacturing and supply plants operated by subsidiary corporations.

‡ Subsidiary Corporation. Packing & Warehouse Co. capital stock, $2,000,000, owns properties. Original association reorganized in 1921 with no capital stock.

§ Percentage of product of district.

‖ Fruit received in bulk and boxes furnished.

¶ Of milk marketed in San Diego and Sacramento: of eggs marketed in San Francisco and Los Angeles.

original and significant and that is organization to provide for irrigation outlined in Chapter VIII. Besides these two groups of undertakings which are locally original in design and method, California participates in others which are more widely prevalent throughout the United States. One of these is Farmers' Mutual Insurance which was provided for by a special enabling act of the legislature and which had been pursued to satisfactory local operation in several counties. In 1920 there were twenty farmers' fire insurance companies in operation, writing insurance to the amount of $22,624,656.30, receiving premiums and assessments (net) of $211,329.60 and paying losses of $98,422.99.

Organizations, usually proceeding without incorporation, such as farm bureaus, cow testing, stockgrowers' and range cattlemen's associations, agricultural fair and stock show associations and the like, are widespread and active in promotive and protective work. They are for the most part operating for the purposes and by the methods prevailing in other states and are notably successful and influential.

CHAPTER VIII

IMPROVEMENTS IN IRRIGATION PRACTICE AND IN HIGHWAYS

Irrigation practice is very complex and broad, for it begins with the fundamental relations of the plant to the soil and air in which it grows and ministers to the subsequent development of the plant until its commercially valuable product is attained. Irrigation enterprise is also broad and complex for it shapes and provides for everything, from the gathering of small waters from springs or pumps to the diversion of a river from its majestic natural flow to lose itself in wandering through the miles of canals and ditches prepared for it over thousands of acres of hillsides and plains. California experience and achievement show that irrigation is an art which immediately employs every true discovery of scientific research or common observation on the well-being of plants and their products, appropriates widely the principles and practices of hydro-engineering and hydro-economics and attains its greatest achievements by the originality and successfulness of its appeal for service to statesmanship, legislation and finance. It may appear to the casual observer that a rivulet trickling from a spring or stream and

hiding itself in verdure wherever gravity leads it, while all the surrounding landscape may be sere and bare, is a very simple thing. It is, however, quite otherwise. It is the suggestion on which the greatest civilizations of antiquity arose and also the great civilizations of the future will arise because the largest areas of earth surface salutary to man and the plants he lives on are more or less deficient in rainfall to serve his highest broadest purposes. The peoples of northern and central Europe, North America and Asia which now dominate the world, are naturally disposed to look on irrigation as a vain attempt to make good some creative incompleteness and to claim that by the accident of irrigation arid countries may become habitable. They forget that it was the accident of rainfall which made the narrow belt of adequate heat and moisture for a few staple plants during a short growing season capable of sustaining them. Irrigation is not merely a remedy for drought: it is a primary process of production.

California has made notable contributions to the advance of irrigation science and practice. All the oranges and lemons, nearly all the raisins, walnuts, melons and alfalfa, the greater part of the peaches, table grapes, apricots, shipping plums, berries and summer vegetables and fractions of almost all other commercial products are secured by irrigation. This demonstration of the value of irrigated products on the markets of the world has exerted a marked influence and created a wide demand for information concerning Californian policies and methods, not only

in new regions desiring to follow in this line of advancement but in old countries, chiefly in the Mediterranean regions, in southern Asia and in South America where irrigation has been practiced for centuries. During the decade preceding the World War nearly all foreign nations, either occupying semi-arid country or interested therein by colonial possessions, sent expert investigators to examine and prepare reports on Californian achievements in irrigation engineering, organization and production. The United States government has maintained irrigation investigations in California continuously for the last twenty years, covering all branches of irrigated farming. The national policy of arid land reclamation by the erection of vast irrigation works in the arid states of the Pacific Slope, as provided for by the national irrigation law of June 17, 1902, was largely based on and its constructive and operative methods suggested by the individual, corporate and cooperative irrigation achievements of California.

Thus, through reports of governmental investigations and enterprises, through the publication of descriptions and comments by foreign experts and through private publication in popular periodicals and in technical journals and text-books, there has been created an irrigation literature so varied and extensive that the bibliography of it alone would fill a long chapter (if not a whole volume) and in this literature California enterprise and achievement occupy a large place. In this connection it will be the purpose to set forth a few facts and considerations

which may indicate the relations of irrigation to the development of the State and to the phases of rural life and industry that may be traced to parentage in artificial stream-flow rather than in rainfall.

California cannot claim to be the area on which irrigation farming was first practiced in the United States, because there are vestiges of prehistoric irrigation works in Arizona, New Mexico and Colorado and records show that the padres from Spain who entered Texan territory in the first half of the sixteenth century found the natives irrigating their gardens and learned the practice from them. Thus the irrigation introduced by the padres in 1769 was a new thing only in California, where the Indians were unskilled in agriculture. Nor can California claim to be the pioneer in irrigation by Anglo-Saxons, unless the small-scale work of a few American settlers who established themselves on land-grants or purchased secularized mission lands, before the gold discovery, can establish such priority. It is customary to award to the Mormons, who turned a Utah river out upon the plains in 1847, priority in large-scale organized irrigation in the United States. They led, however, by a narrow margin because the California gold-miners in 1849 were diverting streams to uncover their beds for mining and to get water for flow in artificial channels to distant uses to an extent and variety of enterprise which the Mormons did not attain. The relation of such undertakings by miners to agricultural development, from the be-

ginning to the present day, is suggested in Chapter IV.

The history of irrigation in California as it might be set forth in terms of dates and places, persons and achievements would have local interest but no wide significance. It will be more useful and interesting to try to discern the times and ways in which certain conceptions of the relation of irrigation to crop production under California conditions arose, influenced achievement and became demonstrated as principles and practices of permanent acceptability and importance in the agricultural development of the State.

The Spanish padres brought the irrigation idea to California in 1769 and during the following thirty-five years established twenty-one missions between San Diego and San Francisco at all of which irrigation was, to varying extents, provided. Although these establishments occupied a linear distance of about five hundred miles, they were all within the same cultural division of the State (Regions 2 and 3 as defined in Chapter I) and, therefore, characterized by somewhat similar climatic conditions. They did not know, except by hearsay, anything about the much greater areas of the State which varied severally in their natural moisture from one-fourth to four times as much as the padres had to work with in their fields and gardens. They knew neither the parts of the State where irrigation is indispensable nor where it is unnecessary and therefore undesirable, because they never moved far from their establishments. It

was quite otherwise with the American settlers for they roamed the State from end to end and from side to side almost as soon as they entered it.

Coming from Spain by way of Mexico, the padres brought the idea that irrigation was necessary for the trees and vines they wished to grow. They soon saw that annual grains and forage plants could be grown by rainfall almost everywhere throughout their possessions, but they held to the idea that trees, vines and plants which continued growth into the dry season must be grown on ditch-banks. The early Americans visited the missions but did not embrace their irrigation doctrine. They remembered their experience in carrying corn through midsummer droughts of the Middle West and eastward by hoe and cultivator and they began almost at once to apply this teaching to California conditions. They soon demonstrated by the behavior of the plants that applications of water were not needed as frequently as the mission farmers made them. They used less water and more surface stirring until they discovered that plants which made their chief growth in the warm, moist, winter weather and those which rooted deeply like fruit-trees and vines, even though they had to grow all through the dry summer, could reach satisfactory production without any artificial application of water, if the normal rainfall was adequate and the soil retentive enough naturally and sufficiently cultivated during the growth of the plant. This was the first demonstration in the semi-arid region of the principles which are now the chief asset of the dry-

farmers of the inter-mountain states and which are sometimes claimed to be their more recent discoveries. Seventy years ago California began to have "non-irrigators," who made a virtue of their creed and their practice, and though they often claimed too much relatively, they did demonstrate the feasibility of dry-farming by tillage for grain and forage crops, winter truck farms, summer crops of beans, tomatoes, and the like, and the greater areas of orchard and vineyard, except of citrus fruits and raisins, were made productive by dry-farming with an average rainfall of 15 to 18 inches, taking the whole area together. This was the earliest large-scale demonstration of the efficacy of tillage to render a small rainfall sufficient to produce a valuable crop of some kind.

The Americans demonstrated that the supreme efficacy of tillage in moisture conservation is to be realized on irrigated areas and not on dry lands, and that tillage as a substitute for irrigation was an incidental, though immensely valuable, suggestion from experience in irrigation. The mission farmers knew no tillage except the opening of the soil in the first instance to receive the seed or cutting of a fruit-tree or vine. When it began to grow, water was run over the surface. When the surface dried and cracked more water was run over it. When the surface soil became a solid mass of root-fibers drawn up in the almost vain attempt to secure the water that rippled over the surface, which they had rendered almost impervious, these masses were hewn out

with mattocks, fresh soil put over the main roots and more water run over it, which penetrated the new soil and gave the main roots a new inducement to produce another outfit of feeding fibers. These grew until they in turn became matted, shut off their own moisture supply and were themselves finally hewn out, this proceeding in endless succession.

Thus by departing from the methods of their predecessors, early American Californians demonstrated that under certain conditions crops can be grown under scant rainfall by tillage instead of irrigation. They also determined another fact of even wider importance, viz., that irrigation is not a proper substitute for tillage and that instead of being feasible to keep pouring more water to save the cost of tillage, it is required for the thrift of the plant that the more frequent the application of water the more frequent must be the tillage. Instead of a rule of "more water less tillage," which the Spanish settlers of California seemed to proceed on, the true rule as demonstrated by their American successors is "more irrigation more tillage." This is now the accepted policy and practice in other irrigated regions.

When the early American settlers found that grain and hay could be grown without irrigation (for the hay consisted almost entirely of grains cut before maturity); that such plants and others, such as potatoes, beets and other roots, cabbage and most other foliage plants, peas, could be grown in the rainy season wherever frosts were too light to injure them;

and that deciduous fruit-trees, grape-vines and tender plants like corn, beans, squashes and melons would make satisfactory summer growth with the moisture from winter rains which was conserved in the soil by tillage, they concluded that irrigation was not required for either winter or summer growth where the annual rainfall was about twenty inches. This amount of rain or more was usually received in the region of San Francisco and in the valleys northward, also on the riverside lands of the Stockton and Sacramento districts where the chief part of the early agriculture was practiced. Some settlers who had hastened to provide themselves with irrigation works in imitation of the padres abandoned them. From this experience there arose and widely prevailed three misconceptions, viz., that the need for irrigation depended entirely on the amount of rainfall; that products grown by rainfall were better than those raised by irrigation; that irrigation was an unnatural proceeding and, therefore, deplorable even if not actually impious.

These three misconceptions influenced settlement for some time and delayed development of those vast areas of interior plains and mesas from which the greatest volumes of distinctively Californian products are now secured. It is, therefore, pertinent to outline the truer conceptions of relations of rainfall to irrigation which gained ascendancy about 1870 and led to the wide improvement of lands by irrigation which began about that time. The following seem to be warranted conclusions.

1. On fairly retentive soils a winter-growing short-season grain like barley or a short-season wheat may make a good grain crop with ten inches of rainfall evenly distributed during the rainy season. However, the crop will be surer and larger if the crop is irrigated either before sowing or during growth. The profit will be determined by the seasonal distribution of rainfall and the selling-price of the crop.

2. On a deep fairly retentive soil a deep-rooting plant like alfalfa will give from one to three cuttings of hay with fifteen to twenty inches of rainfall, but will yield from five to ten cuttings by adding the same amount or more of water by irrigation during the season of continued growing temperature of the long summer and autumn.

3. On an average soil a drought-resistant plant like a grain sorghum will make a good growth of forage with fifteen inches of rainfall conserved by spring tillage for planting when the local frost-free date is reached. With a retentive soil and continued summer tillage, the same plant will make a grain crop. On a less retentive soil a heavier grain crop, or continued cutting of forage, may depend on summer irrigation.

4. With fifteen inches of rainfall on a fine retentive loam soil, deciduous fruit-trees and grapevines can be brought along to bearing age by good winter and summer tillage, but the same trees or vines will need a total of twenty to thirty inches of water, either from rainfall or irrigation, when in

full bearing to produce full crops of merchantable fruit.

5. Evergreen fruit-trees, like citrus fruits, need summer and fall irrigation (and sometimes winter irrigation also) irrespective of rainfall, although the amount of irrigation required will be influenced to some extent by the rainfall.

6. Shallow-rooting plants, like most berries and summer-growing vegetables, require irrigation irrespective of the soil character and the amount of rainfall and may die outright in the dry season if they do not amply receive it.

The foregoing generalizations, which may admit of some exceptions in the case of certain plants and natural conditions, justify the conclusion that the desirability of irrigation cannot be determined by the local rainfall. There are places in California where the average annual rainfall is more than forty inches and yet irrigation is essential; there are other places in which the rainfall is even less than half as much and yet irrigation is needed only for citrus fruits, berries and vegetables which start their growth in the early summer, except on naturally moist low lands. These two regions of widely divergent practice may be within sight of each other.

Experience has shown that it is beyond human wisdom to prescribe amounts of water desirable to produce best growth of all plants in all places, because: *(a)* different plants require varying amounts of water and the same individual may need diverse amounts of water at different times in the growing season;

(b) dissimilar soils require different amounts of water to produce satisfactory growth of plants; *(c)* local climates, chiefly because of the degrees of thirst in the air, require different amounts of water and unlike intervals between applications, for the same crop; *(d)* the size, quality and commercial value of all crops is dependent on adequate moisture according to the needs of particular plants to discharge their agricultural functions.

The disagreement among early Californians about the desirability of irrigation arose largely from their lack of understanding of the relation between the highest thrift of the plant and the quantity and quality of its product. It required a number of years of experience to reach a general appreciation of what a plant will do under certain circumstances. Then came the perception that irrigation improvements, under all conditions which require them, consist of assuring the plant the constant and adequate water supply which favors full development and productiveness. It appears, then, that the successful grower must know the needs of his plants, the water capacity of his soil and the rate of use by the plant as well as the rate of waste at different times of the year, and depend on rainfall alone or on rainfall supplemented by irrigation or by irrigation alone, according as either form of practice is required.

A concrete illustration of the behavior of a plant under various growing conditions may be drawn from the possible performances of the peach, which ranks next to the prune as the most largely grown decidu-

ous fruit-tree in California. A peach tree of an early variety, maturing three months from blooming, may perfect its fruit and buds for the next year's fruitage with an amount of moisture in the soil which would not enable a late variety to reach good size and juiciness four or five months from the bloom, nor sustain strong bud growth for the next year. The grower, then, with such a tree has poor fruit during the current year and a scant crop or none the following year. It may cast its bloom the next year, and then it will turn all the available moisture into foliage and new wood, carrying fruit-buds, and fruit again the year after, thus establishing a habit of bearing on alternate years. If it is a variety of very prolific habit, it may continue to bear each succeeding year smaller fruit until it fails of growth enough to hold a fruit-bud. In its struggle to maintain its life against late summer and autumn evaporation, it will lighten its burden by allowing some of its branches to die back from the top. The roots thus gaining relatively greater strength by the reduction of the upper branches, will be able to force out a growth of shoots near the main forks, and a new crown of foliage will appear at a lower level than before, but the old struggle begins again and proceeds in the same way toward the same end, until, if the situation is very dry, the tree finally dies, a prey to vegetative debility, the first cause of all the trouble being lack of moisture supply adequate to its uses. In nature the species would either disappear or be modified in such a way that its fruit would be no

longer valuable from a commercial point of view. In cultivation the obligation rests on the cultivator to improve nature by irrigation so that the tree may be enabled to meet the expectations placed on it.

What has been said about the peach tree is true as to the growth of all economic plants and trees, each according to its own degree, in view of its environment, its growth habit, and the requirement which man places on it. The plant comes out from its natural into an artificial life. New standards are unfurled, new service is required, new purposes are in view, proper practices must prevail, and proper agencies be chosen. Among these agencies are rainfall and irrigation; either of them may be dispensed with or both of them may be required; it is man's duty to know where and when.

In early times irrigation was often looked on as a misfortune, because rainfall products were held to be better in quality and to maintain better condition during transportation. Of course, an excess of water will result in fruit low in quality and very perishable, providing the excess does not kill the trees which would bear it, but the result would be the same whether the excess of water came from the clouds or from the ditch, though the danger from the latter source is greater. The general facts are that not less than three-fourths of all the fruit which California is now selling to best advantage in the most distant markets is from irrigated trees and vines, and that the greatest butter-producing regions which were formerly on the coast are now found in the ir-

rigated alfalfa-growing valleys of the interior; also that the city milk supply, both of San Francisco and Los Angeles, is drawn from irrigated districts and is of such quality that it may stand some irrigation after transportation and still meet metropolitan standards. All this demonstrates that investment for irrigation is like other investments for the improvement of land, and governed by the same economic laws. Irrigation is in exactly the category with fertilization and drainage from the point of view of greater quantity and higher quality of products whenever either of them is required for that end.

The United States Census of 1920 summarizes the irrigation achievements of California as follows:

Acreage in irrigation enterprises	7,204,366
Acreage irrigated in 1919	4,095,247
Acreage which enterprises were capable of irrigating	5,486,929

These acreages were 31.2 per cent, 43.7 per cent and 51.6 per cent respectively greater than in 1910, showing that the practice of irrigation has increased more than one-half during the last decade.

Concerning the capability of the State for irrigation development and the relation thereof to the extension of production, Frank Adams of the University of California, also connected with the irrigation investigations of the United States Department of Agriculture, makes this statement:

"In at least 65 per cent of the 22,000,000 acres that make up the valleys, agricultural plains and foothills of California, intensive agriculture, if pos-

sible at all, is not permanently profitable without more moisture than the normal rainfall supplies; and even in the remaining 35 per cent, possibly excepting the narrow coastal areas of the most northerly counties, irrigation is distinctly a needed advantage. Only about 4,000,000 are now irrigated—mostly from unstored stream-flow and underground sources. About 2,000,000 acre-feet of water-storage has been developed. Over 10,000,000 acre-feet additional storage capacity is known to exist where water is presumably available to fill it. The whole state is becoming increasingly conscious that only by the storage of flood waters now going to waste and the more economical use of irrigation water, can California fully achieve her agricultural heritage."

California irrigation undertakings were originally predominantly proprietary and the product of individual or corporate enterprise. Of those classed as coöperative, very few of the older ones were organized that way except in a progressive policy which attached shares of water stock to the land and finally constituted water users as water owners and sharers in management. The relation of public and community control to proprietary interests as it existed when the United States Census was taken in 1910, and in 1920 is shown in this way:

	1920	*1919*	*Percentage of Increase*
Individual and partnership	1,502,870	961,136	56.4
Coöperative	1,215,696	779,020	56.1
Irrigation districts	577,168	173,793	232.1
Commercial	873,499	746,265	17.0

Thus a remarkable increase in coöperative ownership and regulation of irrigation enterprises is made clear.

It is interesting to note that from the earliest days in California there has been a popular conception of public ownership and distribution of irrigation water struggling for domination over private ownership and sale. Before 1870 and afterwards, it took the form of demands on United States engineers to make surveys of the great interior valleys to determine their availability for irrigation and the adequacy of existing stream flow to irrigate them. Such surveys were made and their conclusions favored public enterprise but the cost was always far beyond any financing which seemed practicable. Later, individual investors took up parts of the general enterprise, bought land and appropriated water. Others followed them on different lands but could not own the water because it was claimed, beyond all capacities of the streams, by prior appropriators. Issues arose in the courts and famous trials were held. The old riparian rights of the English common law came into conflict with the appropriation rights which California miners constituted the law of the land and which appropriators for irrigation engrafted their claims on. The common belief after several court decisions was that California should have the best irrigation laws of the world while in fact it had the worst. Every legislature which assembled at the State capital after a year of short rainfall was urged by a public conscience awakened to the need of irri-

gation, to undertake a general irrigation law which would establish public rights and abolish private wrongs. Such a law was never passed nor even widely agreed on and yet agitation for public ownership of water and distribution of it fairly and beneficently continued. Societies were organized and public assemblies held to promote the popular conception. Sometimes it has been urged by genuine reformers and publicists, sometimes by rival interests to get some advantage over each other, but it has never been achieved in the dramatic way in which it has been dreamed of. It, or the ends it aims at, may perhaps still be possible of attainment in some more round-about way.

In 1887 the legislature passed what has since been known as the Wright Irrigation District Law. The apparent purpose of the enactment was to restrain large holders of land who did not desire to meet the cost of providing irrigation for them, or those who already had both land and water of their own, from preventing other owners of land in the same community from also securing irrigation by coöperative enterprise. The plan was to enable a certain number of those owning dry land to act together and force others to take part with them in a community organization which would be empowered to acquire water, construct irrigation works and assess the cost on all the property benefited, roughly as a district is empowered to acquire a site, build a school-house and establish education within its own boundaries. This achievement was much more easily attained

on the statute book than on the land. Application of the plan was held up in the courts and when it struggled through such barriers it fell into financial entanglements because no one would pay cash for the bonds. Recourse was then had to letting contracts for construction payable in bonds and this induced all sorts of constructive and financial limitations and disadvantages. Bad plans were laid, bad bargains made and the effort became a by-word for folly and inefficiency. Besides it all fell in a time of depression; buoyancy had gone out of the land enterprises which were previously booming; produce prices were low because adequate long-distance distribution had not been fully achieved; interest in all rural investments was slack and confidence was at low ebb. In 1897, a decade after the bad start was provided for, the law was amended, making it less liberal to those who desired to move coöperatively after water and restricting the powers of those organizations which were able to pass the preliminary obstructions. In spite, however, of all difficulties, some districts pulled through to success and became the exemplars for later undertakings. Their success also increased public interest and confidence and the achievements of their membership in profitable production reawakened a sense of reward and security to those who made dry land safe for farming by irrigation. The restrictions on organization of districts by the law of 1897 prevented proceeding on a basis which was unsound either in engineering, finance or agriculture but it did not preclude

all coöperative proceeding, as perhaps some of those who planned the restrictions intended that it should.

The present state of district enterprises is directly interesting not only to land-owners who are personally engaged in building up large, productive and praiseworthy social communities within their borders, but also to the multitude of individuals and financial concerns which are investing in their securities in all parts of the country and beyond. District organization seems clearly to be the agency through which all earlier anticipations of broad irrigation development for California will be attained. On the basis of the broadest coöperation, not only of the actual users of water among themselves, but of those most directly concerned with the public, as represented by the state and national governments, and with investors everywhere, California looks forward not only to the reorganization of all old enterprises which need extension adequately to serve their communities but to the creation of new enterprises until all available water is brought to the land that needs it. The period of lessened activity during the World War has been followed by an era of greater energy than has ever been known hitherto. The State is actively participating in irrigation development. The law makes it the duty of the State Department of Engineering to assist those contemplating the formation of irrigation districts, and the same interest is now being shown irrigation districts by the State Water Commission, the agency in California which

has administrative charge of the appropriation of water. In fact all public agencies in California look on proper irrigation organization under some district plan, in which the owners of land exercise control and in which they possess the sovereign power of taxation for financing the construction, maintenance, and operation of necessary irrigation works, as essential to the proper development and prosperity of the State, and therefore worthy of their support. While in some of the newer district enterprises there is still much to be desired in the way of better business and engineering methods, there are already enough well-managed irrigation districts in the State to demonstrate that irrigators are themselves fully capable of handling very large and very important irrigation systems. There are in California eight successfully operating districts with areas exceeding 70,000 acres each, of which four exceed 125,000 acres, three exceed 175,000, and one contains over 600,000 with 400,000 acres already irrigated. Out of a total of seventy-four districts in existence in March 1921 thirty-six were in active operation early in 1921 and many other newer districts which had recently entered on organization at that date. Some leading facts about those in active operation are given in Appendix K, page 386.

Irrigation development in California is now definitely reaching the stage when all of the summer flow of even the largest streams is either fully utilized or in process so that the overshadowing effort is now distinctly toward conservation of flood waters for

irrigation season use. When this is attained there will result a saving of waste water of which measurement estimates would be intelligible only to engineers, but the outcome of it will be at least a doubling of the present irrigated area and coincident with this the making available of hydro-electric power in such vast quantities, especially on the great Colorado, as almost to stagger the imagination. To accomplish all of this, there promises to be such a further perfecting of irrigation district legislation and such a coordination of water use for irrigation, power, municipal use, and navigation as shall insure the widest possible spreading of the benefits of the water resources of the State. For several past decades this has been, as it still is, the goal toward which the various agencies of the national and state governments (the United States Geological Survey and its offspring, the United States Reclamation Service; the Irrigation Investigations of the United States Department of Agriculture; the California State Department of Engineering; the California State Water Commission; the California State Railroad Commission; and the College of Agriculture of the University of California) have been or are now working. Recent enactments by the legislature, especially the Water Conservation Act of 1921 and the Santa Clara County Irrigation District Act of the same year, have for their purpose a larger realization of the idea of community control of water through the irrigation district plan. This is to be accomplished by making it legally practical to join together in single

effort for larger conservation purposes all of the separate irrigation districts or interests dependent in common on a given water source or related group of sources. Besides these extremely important acts, the legislature of 1921 enlarged the powers and increased the funds of the State Water Commission to permit it the more effectively to correlate and protect, in the interest of the public, the control of waters for the principal uses named above. Furthermore, it made a liberal appropriation to the State Department of Engineering (consolidated with other related State agencies into the State Department of Public Works) to enable it to extend greatly the public study of the water resources of the State and their fullest utilization for the public good. The ultimate attainment, however, seems to require that the great enterprise of the future, for the heartening both of those who plan and achieve it and those whose capital shall furnish it forth, shall be a world concern, certified to all mankind by the public credit of the State, possibly of the nation also.

HIGHWAYS

The system of highways now installed which gives California distinctive position among the states for the mileage, gradients, and smoothness of her rural roadways, has been realized by a process of evolution. During Spanish and Mexican possession, the population moved in the saddle along bridle paths and

cattle trails. The early American pioneers asserted their preference for wheeled vehicles but as they seldom desired to stay long in a place and were even doubtful of their desire to remain long anywhere in the country, they were content to move across the landscape on any streak of mud or dust which would not upset them. As their early activities were chiefly along the foothills and across the mountains and the upsetting of a stage or a packed animal was serious, road-building on the grades became first imperative. California became famous for mountain roads while on her valley highways it was a pardonable exaggeration to say that vehicles could pass unseen because of the depth of mud in the rainy season and the density of the dust in the dry. There were, of course, exceptions where the nature of the soil worked for good roads and where the supervisors of a county were honest, but generally the people were heavily taxed for decades for road purposes and still had no roads worth the name. It was not until 1895 that the legislature resolved to install system and method in road work and created a Bureau of Highways consisting of three commissioners to proceed toward that end. In its report of investigation this Bureau declared that California had during eleven years, 1885 to 1895, expended eighteen million dollars for highway purposes and had nothing but "deplorable roads because the money had been wastefully and injudiciously expended." The Bureau of Highways of 1895 designed a system of State highways, prescribed methods of construction and upkeep and was

followed by a Department of Highways with a single Highway Commissioner who continued exhortation toward desirable ends but no funds adequate for the realization of results were available.

During the first decade of this century while cemented highways seemed wholly out of reach, much attention was given to promotion of oiling dirt roads and careful specifications were issued, based on wide observation and study, by the State Highway Commissioner. This recourse was a satisfactory makeshift and when the soil was sufficiently firm and the oil adequately and properly applied, the result was so good that oiling has been practiced to the present day, one county using more than 100,000 barrels of road oil at a cost of $229,951 in 1919, although the oil had practically doubled in value since it was first employed. There was also in other counties increasing expenditure for road-grading, wells and water-wagons for systematic sprinkling and excellent results and good repute were achieved by progressive county policy in this direction. It was, however, not until owners of motor vehicles multiplied and insisted on good roads to run them over, that the system of highways which is now one of California's chief agencies of industry and development began to be realized.

The foundation for a system of cemented highways in California was laid in 1910 by the passage of a State Highways Act by the legislature which provided for the issuance of bonds to the amount of $18,000,000. The bonds were voted by a bare

Plate XI. Typical large dairy plant in the alfalfa districts.

majority at a popular election. The funds available from the sale of these bonds were expended before January 1917, but this fact was foreseen and a second bond issue of $15,000,000 was popularly voted in 1916 by a vote of nearly four to one, the roads previously constructed generating a wide demand for more. In spite of the financial and constructive embarrassments of the war, the work still went on and public sentiment grew apace until a third bond issue of $40,000,000 was voted in 1919 by an overwhelming majority. Although these bonds were not salable in 1920, because the rate of interest (4½ per cent) was less than other securities offered, and the prosecution of contemplated extensions of the State system was retarded, there was a gain in mileage of cemented highways through expenditures by various counties to secure them, the aggregate of county bond issues being 63 per cent of that which the State itself has provided. In this way and by the public and private contribution to extend the State system and to connect with national expenditure as provided by Congress and to carry the "ocean to ocean" highways to various points on the California coast line, the work will be continued until the large expenditure, which the people have already approved by vote, becomes available.

The following summary of provisions for highway construction by the California Highway Commission or in coöperation therewith and under its supervision, is prepared as of the date of May 18, 1920:

Bond issues authorized by the State	$ 73,000,000
Bond issues by California counties	46,093,000
Total amount allotted to California from Federal Aid Road Act	8,378,175
Total	$127,471,175

Of the foregoing the bond isues of 1909 and 1915 ($33,000,000) were expended. The bond issue of 1919 ($40,000,000) remained in the State treasury until the interest rate was raised to a limit of 6 per cent by popular vote at the election of November 2, 1920.

According to a compilation by the State Highway Engineer, there had been constructed up to January 1, 1922, 1,765 miles of concrete-base roads, many reinforced with steel rods, and many surfaced with asphalt, 305 miles paved with asphaltic concrete of other materials, and 937 simply graded roads. The State system, including the roads specified in the bond issues and those provided for by special State appropriations, includes 6,300 miles or close to 10 per cent of all dedicated public roads in the State, exclusive of incorporated cities. The Highway Commission program called for expenditure of $15,000,000 in new construction during 1922.

A few facts about the way state highways are constructed are interesting. When previously existing road locations are used, they are corrected as to grade and alignment and to avoid traveling around section corners. Rights of way are of uniform width, preferably sixty feet. In mountainous country the maximum gradient is 7 per cent and minimum radii

on center lines of fifty feet and slopes flattened and cleared to afford clear sight of at least one hundred and fifty feet. Permanent culverts, gutters and ditches are provided when needed to prevent water from standing on the roadsides. Bridges are of reinforced concrete, twenty-one feet wide in the clear and designed to carry sixteen-ton tractor engines. A minimum width of roadway of sixteen feet is required in the mountains; an average width elsewhere through the State of twenty-four feet, twenty-one feet through cuts and twenty-two and one-half feet where the road is part cut and part fill.

After grading and rolling, a cement pavement was laid, for which the following specifications were chiefly used: The concrete base was generally fifteen feet in width and of prevailing thickness of four inches. When necessary the roadway was often widened by three-foot macadam or gravel shoulders on each side of the pavement. Upon the concrete pavement a bituminous wearing surface was placed, consisting of half an inch in thickness of heavy asphaltic road oil and screenings, which has been very satisfactory in protecting the concrete pavement from wear.

It should be noted that there is an intimate relation between climatic conditions and the success of the highway system which has been for years extending to greater mileage. No state which has a wintry climate can safely use such specifications. As the California Highway Engineer remarks: "It must be admitted that a concrete base as thin as four inches would not be at all suitable in localities

where the frost penetrates deeply into the ground and nowhere in California has concrete been laid under such conditions." In high mountain districts different and more expensive construction is employed but perhaps nine-tenths of California highways will be constructed in valleys and foothills where ground freezing is infrequent and then only superficial.

Although the specifications have made good against such freezing as the valleys and foothills receive, recent experience indicates that a thicker base may be necessary to enable the roads to carry the heavy weights of freighting trucks, which were not foreseen when the roads were built. Since truck-hauling has been resorted to to fill the lack of transportation caused by the war duties and deprivations of the railways, there has been injury done to the cement highways which may require heavier construction. The roads were planned for much lighter traffic than they have recently carried. In view of this fact it is significant that the Bureau of Public Roads of the United States Department of Agriculture reported in May 1921 that 87½ per cent of the main concrete highways of the State (1262 miles) were in good condition. Even if additional expense should be required to render greater service to industrial transportation, California still enjoys an advantage in highway construction in the fact that all materials employed are abundantly produced not only within the State but at several distributed points. Suitable rock and cheap power for crushing are widely avail-

able; cement manufacture on a large scale is pursued in all the chief divisions of the State; California petroleum prevalently has an asphaltum base and finishing materials are abundant from local sources.

Highways constructed as has been outlined and crossing the State at least twice from end to end and from side to side, have been in operation for several years and have demonstrated their swiftness, smoothness and service; California in 1920 stands third in per capita of motor vehicles in the country, and fifth in the United States in number of motor vehicles owned, only New York, Ohio, Pennsylvania and Illinois having more. The actual number for California in February 1922 was 680,613.[1] During the year ending February 1, 1921, the State collected $2,395,880.75 for motor vehicle licenses. As has been intimated there is a striking inter-relationship between the automobile and the good road in California experience.

Cemented highways and the automobile add greatly to the joys and diversions of rural life and cause farmers to indulge in the recreations and inspirations of outings in the forests and beside the streams of the mountains adjacent to all California valleys. The prevalence of such uplifting recreations among farmers as well as the freedom of their social intercourse and their constant conference in farm service may be inferred from the fact that California farmers as a class surpass all other classes in owner-

[1] Numbers of auto vehicles in California counties are given in Appendix F.

ship of motor vehicles. It was carefully calculated that of the 477,450 automobiles recorded by the State Motor Vehicle Department in 1919, 241,175 were owned in the open country and in communities of distinctly rural character. At a farmers' picnic on the University Farm in the Sacramento Valley in April 1920 there were 2,417 automobiles parked and counted. It was estimated from other data that there were 14,000 persons in attendance. Without automobile transportation from the farms of the valley, it is doubtful whether one-quarter of that number of persons would have participated.

The almost continuous traversing of the countryside by observers in automobiles is rapidly extending knowledge of the agricultural geography and topography of the State. Real estate dealers claim that they need to be more careful than formerly in their descriptions of farms for sale and the environments of them, because most parts of the country are so generally known that exaltation of a locality beyond its due is soon detected.

CHAPTER IX

GOVERNMENTAL WORK FOR COUNTRY LIFE

In state work for the promotion and protection of agriculture, California has provided broadly and generously for the last forty years. From the first this provision took the form of commissions provided by the legislature with executive authority and appropriations for each line of productive effort which presented its claims with sufficient force at the capitol. Thus state work for farming was the product of coöperative effort by farmers. The first undertaking in 1880 consisted of a special commission devoted to the promotion of viticulture, followed in 1881 for horticulture, especially for the suppression of insect pests and plant diseases. This work has been liberally and continuously supported ever since and developed into an effective system for the exclusion of trees and plants from states and countries infested by pests until protective policies long prevailing in California developed into a national exclusion act in 1919.

The State has also enacted laws by which the policies of its general executive commissions could be locally applied through the appointment by the supervisors of county commissioners to enforce ordi-

nances conserving particular local producing industries in horticultural lines. The several commissions having charge of special branches of agriculture acted independently of each other, each maintaining its own executive outfit and defining its work, to whatever extent the laws and the appropriations enabled it to do so. They had the privilege of applying to the legislature for new laws and more money and usually secured both, if their clientele among producers was sufficiently insistent. Thus a considerable aggregate expenditure for agricultural service was attained and advocates of economy in the use of State money, thinking the same work could be obtained at less cost by reorganization, secured from the legislature of 1919 an act combining several previously existing agricultural commissions in a State Department of Agriculture in charge of a Director of Agriculture. This closed the careers of such commissions and entered on the solution of the problem of determining whether as good work can be done more cheaply by more concentrated organization. This new plan went into operation on July 22, 1919, by the appointment of G. H. Hecke as Director of Agriculture. Hecke was previously State Commissioner of Horticulture and he worked out the details of the reorganization. The legislature of 1921 continued the work by merging other special commissions with agricultural intent in the State Department of Agriculture and assigning others to the newly created executive departments with which their higher and more distinctive tech-

nical aims and requirements naturally associated them. As it stands in 1922, the State undertakings for the advancement of agriculture and rural life, apart from the general provisions for the public welfare in which they share, may be scheduled as follows:

State Department of Agriculture—Invested with all the duties, powers, purposes, responsibilities and jurisdiction hitherto assigned by law to the state commissioner of horticulture, state board of horticultural examiners, state dairy bureau, state veterinarian, stallion registration board, state board of viticultural commissioners, board of citrus fruit shipments, cattle protection board, state superintendent of weights and measures, state market director and state market commission. The State Department of Agriculture is organized in five divisions, viz., plant industry, animal industry, agricultural chemistry, markets, weights and measures.

State Department of Public Works—highways, irrigation and drainage, land settlement.

State Department of Labor and Industrial Relations—workmen's compensation insurance and safety, immigration and housing, industrial welfare.

State Department of Education—industrial training in primary and secondary schools.

State Forestry Commission—forestry and fire prevention.

State Fish and Game Commission—regulation of hunting and fishing.

Board of Regents of the University of California

—higher education, research and extension in agricultural science and practice (see Chapter X).

FINANCING FARM ENTERPRISES

California farming began with the handicap of very high interest rates on loans for undertakings and improvements in farming. There were the basic rates for far western loans, higher naturally as the State was the farther west and to these geographically normal rates was added the increment usually imposed on loans for mining. In this way 1 per cent a month seemed a very moderate figure and if it was doubled and compounded nobody was surprised. There were no usury laws; any interest agreed to was legal, and it is so to this day. As decades advanced, rates became lower but indisposition to country loans was more marked than at first, as the city banks grew larger and more metropolitanized and country bankers alone would take country chances and naturally exact full pay for their favors. No great change took place in the cost of farm financing until land development was taken up by competent persons who came to California with personal credit gained in their earlier commercial and professional lives and were able to deal with banks in something like their accustomed ways. Also some advantage was gained by coöperative warehousing of grain, as noted in Chapter V. No marked change was realized in bringing farm producers nearer to a parity with dealers in commercial commodities in

interest rate making until the coöperative product-selling agencies were organized by producers and officered by those who knew how to talk and act in the bankers' chosen way. During the last twenty years and increasing vastly in the last decade, organized growers of special products have been able to secure the capital needed for equipments and operations on terms and rates which have not encouraged them to make complaint. Their credit has been good and their burdens considered fair.

However, this progress did not reach the individual farmers very widely and in the largely unorganized lines of general farming, dairying and stock-growing, money was rarely obtained except on terms which were too short and at rates altogether too long. Agitation for loans to all individual farmers of responsibility and good repute, on terms and at rates which would enable them to use money successfully, began very widely throughout the State early in this century and discussion and effort for organization and financing of a system of rural credits were particularly pointed in California. This need was impressed on the "Commission on Country Life" [1] (appointed by President Roosevelt in 1908) and which submitted its report in 1909, in the following words:

"The American farmer has needed money less perhaps than land workers in some other countries,

[1] L. H. Bailey, New York; Henry Wallace, Iowa; K. L. Butterfield, Massachusetts; Walter H. Page, New York; Gifford Pinchot, Pennsylvania; C. S. Barrett, Georgia; W. A. Beard, California.

but he could be greatly benefited by a different system of credit, particularly where the lien system is still in operation. It would be the purpose of such systems, aside from providing loans on the best terms and with the utmost freedom consistent with safety to keep as much as possible of the money in circulation in the open country where the values originate. The present banking systems tend to take the money out of the country and to loan it in town or to town-centered interests. . . . All unnecessary drain from the open country should be checked in order that the country may be allowed and encouraged to develop itself."

Following this declaration discussion of ways to provide rural credit continued in California as also in other states. The legislature of 1913 provided for two delegates [1] to proceed with the American Rural Credit Commission authorized by the government (as suggested by the late David Lubin of Sacramento) to study European methods of providing loans to farmers. After the return and report of this commission, the legislature of 1915 created a commission of "rural credit and land settlement," as considered in connection with the latter subject in Chapter IV.

In 1916 Congress passed an act organizing twelve district Federal Farm Loan Banks on the basis of National Farm Loan Associations, the latter being constituted of those who desired to make loans on the security of lands and farm buildings. The Eleventh District consists of California, Nevada,

[1] Harris Weinstock and E. J. Wickson.

Utah and Arizona and the bank of the district is the Federal Land Bank of Berkeley, already mentioned as adjacent to San Francisco, where the Federal Reserve Bank of the district is located. The law also provides for organization of "joint stock land banks" of which one is in operation in California. The Federal Land Bank of Berkeley was organized in 1917 and continued to make loans as provided until arrested in its work in 1920 by unfavorable conditions following a suit in the supreme court of the United States against the constitutionality of the law under which it was proceeding. This suit was decided in favor of the law on February 28, 1921, and activity was resumed. The Federal Land Bank of Berkeley has, in 1921, 176 tributary National Farm Loan Associations of which 102 are in California. This bank has loaned to farmers through these associations $17,777,000 of which $10,894,300 is loaned in California, the 3246 borrowers thereof being located in practically all the agricultural counties of the State. Organized under the same federal law is the Joint Stock Land Bank of San Francisco which on March 31, 1921, had made loans to the amount of $1,848,700 to 128 borrowers.

The growing appreciation of the character of agricultural security for loans, the recognition of the relation of fair financing of farming to State development and the prosperity of all industrial activities and, finally, the operation of the national law in organizing rural credit and in securing capital for agricultural uses on terms suited to farmers' needs

and at rates of interest more comparable with those at which capital for manufacturing and trade is supplied, have all profoundly influenced the attitude and practice of California money-lenders toward their farming clients. Farmers have always had the social good will and industrial esteem of all other Californians, as has been amply suggested in preceding chapters. To such consideration there has been added recently notably fairer business attitude and transaction.

CHAPTER X

THE EDUCATIONAL AND RESEARCH ORGANIZATIONS OF CALIFORNIA

It is obviously beyond the scope of this writing to undertake discussion of the development of general education in California either from historical or pedagogical points of view. Those desiring to view the subject from these angles will find both facts and philosophy in the ample literature of the subject.[1] General characterization of the spirit and achievements of the California public school system, which extends from the most remote district school, through an ascending series of primary, grammar and high-schools to the University of California and which has also side-lines through a full complement of normal and technical schools and institutions for those either physically or mentally deficient, all under the superintendence of the State and directly supported by it, will be enough to assure the reader that California has from the beginning as an American state occupied a leading place in provisions for public instruction.

[1] Reports of the California State Superintendent of Public Instruction, Sacramento: of the Commissioner of Education, U. S. Department of the Interior, Washington: of the National Educational Association, etc. Current events and discussions are presented in two educational journals: The *Western Journal of Education* and the *Sierra Educational News*, both published in San Francisco.

The first public school in California was opened in San Francisco on April 3, 1848, in advance of the gold discovery, when the city had a population of 850. An early writer naïvely declares that it "would have been opened sooner if the population had not been to so large an extent already grown up." The constitution on which California was admitted to the Union in 1850 provided for a system of common schools to be supported in all districts of the State. Immediately also private schools and colleges were established by the missionaries which many religious denominations sent to guard the spiritual welfare of the gold-seekers. Thus, from the very beginning, the educational outfit of the State was developed not to meet a crying need of a juvenile population but anticipatory of it. This was fortunate because it enabled the pioneer educators to proceed more leisurely toward the realization of a system of public instruction which included many improvements on methods and policies prevailing in older states. During several decades this condition continued in California and afforded educational reformers an excellent opportunity for progressive work. More recently, however, with the swift gain in population, the demand for instruction has increased to such an extent that though outfitted for public instruction of all grades, from primary schools to the University, on most democratic plans and although public expenditure has been most liberal (over fifty millions a year), California is finding it difficult to meet the demand for educational facilities although the equipment is rela-

tively greater than in more populous states. The population having more than doubled in the last twenty years (Chapter IV), the popular demand for vocational training having been met as far as possible and the compulsory requirement that all youth shall attend schools until sixteen years of age are among the fundamental facts which constitute a demonstration that California must make new provisions of equipment and expenditure to justify and maintain her old standards of State policy in public instruction.

What these standards have been in the past and especially the relations to rural life of the chief characteristics of the public school system are picturesquely outlined by the late Edward Hyatt, Superintendent of Public Instruction 1907 to 1919, as follows:

"The most striking characteristic of California schools, perhaps, lies in the provision and care of the children in the remote rural regions. No mountain top is too inaccessible to have its school; no plain too distant; no sage brush desert too far removed. Where half a dozen children dwell there you will find a district school. And mark this: this remote school, so far away, so small, so weak has a standard school house, a standard teacher, a standard equipment and a standard length of term. There will be eight or nine months of school in a year. The teacher will have the same education and the same certification as in the proudest city. The books, apparatus and other educational appliances will be of the same

character as in the populous cities. It is the idea of a generous state that one child is as good as another, no matter where he happens to dwell. The expense of all this does not fall upon the parents of the children or upon the residents or property owners of the local district. It is provided by the general tax upon state and county property.

"In towns, villages and well-settled fruit and farming regions . . . beautiful school houses dot the landscape everywhere. High schools, normal schools and other higher institutions abound. One of the strikingly original features of the California school system is its plan of furnishing text books to the children. It is the only state in the Union which manufactures its school books in a state printing office and distributes them free to the pupils."

Having reached such attainments in a state system for general education in elementary and secondary branches of learning, California during the last two decades introduced into school work practically all the connecting links between academic studies and industries which were held to impart useful knowledge to the pupil and to promote his sympathetic interest in the character and opportunities of his environment. However, none of these seemed to reach ultimate desirability as conceived by parents and by progressive teachers. This conviction led to the reorganization of school initiative and control by providing in 1913 a State Board of Education consisting of citizens who are not of the pedagogical profession and empowered them to appoint experts

to study questions of education from the point of view of popular conceptions of desirability and of pedagogical practicability. This State Board of Education appointed three Commissioners of Education to superintend and revise elementary, secondary and vocational instruction; four State Supervisors to deal with instruction in physical culture, agriculture, home economics and vocational war work. All these agencies were supplementary to the State Superintendent of Public Instruction, an elective officer existing from the beginning of the State government. Every session of the legislature has much to do with the re-fitting and extension of the school law and tries to keep pace with the progressive development of the school system in the public and the pedagogical mind. The system has become very extensive as the statistics in the Appendix will sufficiently indicate. The work of the State Board and of its expert commissioners resulted in great progress toward an ultimate attainment in courses of study and equipment and ability in the use of them, which shall satisfy the public mind as to what the schools should do to fit youth for practical life. There is at least a wide conviction that the schools are moving forward in the right direction. The new point of view and direction of effort are indicated by the following declaration by the Board of Education in its report of 1918:

"The most distinctive movement in education not only in California but throughout the United States, wherever the problems of elementary and high school

instruction are well solved, is along the line of practical, direct-to-life instruction for the youth of high school age. For some time there has been a tendency to break away from the solid academic character of secondary education and while leaving ample opportunity for the ten per cent of students who will attend higher institutions of learning to meet entrance requirements, yet giving more adequate attention to the needs of the ninety per cent whose education must end with the completion of the high school course. This revolution is practically completed in California where nearly every high school has its courses in commercial and domestic arts, manual training and mechanical arts, agriculture and school gardening. This instruction, however, with very few exceptions, is purely pre-vocational . . . and still falls far short of providing the youth with a mental and manual equipment for immediately entering a trade or industry. The real need, therefore, was seen to be an entirely new type of education; an education so practical in its nature and application that it would not only lead to a life work but be a valuable productive unit in the line of industry undertaken."

The undertaking thus outlined actuated the State Board of Education and its Commissioner of Vocational Training. Its purpose is to impart better preparation to those who desire to pursue higher technical training and better to equip those who go from the secondary schools directly to participation either in rural industries or in urban commercial or

mechanical activities and make both rural and urban youth more competent in their respective environments and more actively interested therein. It is a great undertaking and requires qualified instruction and large public expenditure, both of which are difficult to compass. However, popular approval indicates that all its requirements will be ultimately provided, both through the funds by the general government and supplementary appropriations by the State itself. The legislature of 1921 merged the control of all State educational institutions (except the University of California) in a newly created Department of Education, one of seven chief divisions of the State government—and provided liberally for its work.

UNIVERSITIES

As discussion in this connection is necessarily restricted to the point of view of rural life, it is only incidental that the constitution with which California was admitted to the Union in 1850 contained provision for the establishment of a University as well as the organization of a system of district schools which should embrace all parts of the State. It was not then foreseen that the University would become the "cap-sheaf of the California public school system" but that fact was realized when the University was actually established in 1868.

It was also provided by the constitution of 1850 that "the legislature shall encourage by all suitable means the promotion of intellectual, scientific, moral

and agricultural improvement." This is notable for its inclusion of agriculture in a category of the greatest possible concerns of the new State and notable also because agriculture is the only vocational interest mentioned in such connection, although at that date the State was just entering on its spectacular career in gold-mining. Mining education and research were provided for later; it is strange that they were overlooked at the beginning, when the public mind and the public purse were so full of gold. However, agitation for the establishment of a college of agriculture proceeded at all the fairs and assemblies of farmers and in farming publications of the time just as agitation for a university was continued in the "intellectual" assemblies and publications of the professional classes. The farmers desired a college of their own without high-brow domination; the religious denominations each desired that the institutions they established should develop into a "university" and some of them adopted the name for their academies in anticipation of such event. The determining force which merged conflicting views and ambitions was the Morrill Act of 1862 under the provisions of which the State organized the University of California to constitute the "industrial college" and to inherit all the educational bounty which the United States has poured out to endow and to promote higher education. Thus the two unrelated duties imposed by the first constitution of California, viz., to create a University "for the promotion of literature, the arts and sciences" and "to promote

agricultural improvement" were fulfilled by a single enactment, and the highest learning of the old school and the highest technical training of the newer educational standards were irrevocably joined and placed beyond legislative divorcement by the incorporation of the entire organic act creating the university in the new constitution of the State which was framed in 1879.

The University of California has become a great institution, ranking first in the country in its enrollment of students [1] and among the leading universities of the world in its instructional resources, equipment and achievements. It is situated in Berkeley near San Francisco and it has a Southern California branch in Los Angeles. It has also institutions for research and instruction at several other points. The following is a condensed statement of its organization and policies:

"The University of California is an integral part of the public educational system of the State. As such it completes the work begun in the public schools. Through aid from the State and the United States, and by private gifts, it furnishes instruction in literature and in science, and in the professions of engineering, art, law, medicine, dentistry, and pharmacy. In the Colleges of Letters and Science, Com-

[1] Raymond Walters, registrar of Lehigh University and secretary of the American Association of Collegiate Registrars, in his statistics of registration in thirty American universities on November 1, 1920, gives first place to the University of California, with registration of full-time regular students of 11,071; a grand total of resident students of 16,379 and a final sum total of all students instructed of 36,904 persons.

merce, Agriculture, and Engineering these privileges are offered without charge for tuition, to all residents of California who are qualified for admission. Non-residents of California are charged a tuition fee. In the professional colleges, except that of Law, tuition fees are charged. The instruction in all of the colleges is open to all qualified persons, without distinction of sex."

The Leland Stanford, Jr., University, one of the greatest American educational institutions on a private foundation, is situated at Palo Alto, also near San Francisco. The following is an outline of the field covered by Stanford University:

"In its internal organization, and in the scope of its instruction, Stanford conforms to conventional types. There are many departments, each representing a larger or smaller field of knowledge, and covering ancient and modern languages, philosophy, education, mathematics, history, economics and political science, the physical sciences, the biological sciences, and the more formally professional schools of law, medicine and engineering. Each department aims to provide equipment and opportunity for independent work, thus making the department, for those who have the ability and the calling, the equivalent of a vocational or professional school for those interested in its vocational or professional bearings, and a research laboratory for those devoted to pure scholarship. Stanford University has made a sensible contribution to the educational progress of the Pacific Coast, because of the boldness and the vigor

with which it has stressed definiteness of aim and result as the possibility and the glory of the higher education. Tuition fees are charged. Both sexes are admitted but the total number of female students at any time is limited to five hundred. The institution does not undertake agricultural instruction. The enrollment of students in 1920-1921 is the largest in the history of the institution."

The possession of two great universities by a state so new as California is altogether unique and the provision for the pursuit of the highest learning per capita of population is exceptional. Besides the institutions named, several others, privately governed and maintained and scattered through the State, are providing instruction of college grade and making an honorable contribution to the educational resources of California.

AGRICULTURAL EDUCATION AND RESEARCH

The chief institution of agricultural education and research is the College of Agriculture of the University of California with its central establishment at Berkeley and its branches and auxiliaries in all the leading divisions of the State. It was established at the organization of the University in 1868 and planned both for instruction and for research as an agricultural experiment station. Instruction was begun by E. S. Carr in 1870 and plantings on the grounds were made from that date until 1874, but chiefly for the ornamentation thereof. The conscious

agricultural life of the institution began with the appointment in 1874 of E. W. Hilgard as Professor of Agriculture and he continued his active leadership until 1905, and his honorary interest until his death in January 1916. Dr. Hilgard was not only the founder but the architect and builder of scientific achievement for agriculture in California and was one of the small group of men who were really original and influential in conceiving and determining institutional effort for agricultural advancement in the United States. His contention for the recognition of agricultural studies as entitled to the dignity of higher learning and possessed of pedagogic value; his success in commanding respect and support for agricultural science when the very existence and usefulness of it in relation to farming were doubted or denied by those whom he sought to serve; his demonstration of the indispensability of illumination by science to all the practical arts of food production—all these and services like them were fundamental in the development of California and influential everywhere.

During the fifteen years which have followed Dr. Hilgard's retirement, activities both in agricultural instruction and research have attained notable expansion under the direction of his successors and California has thus maintained a position among leading states in the advancement of institutional effort and provision for agriculture.

At the University of California in Berkeley (which is ten miles eastward and across the bay from San

Francisco), the College of Agriculture occupies two main buildings of concrete and granite, three frame buildings of considerable capacity and numerous outbuildings including greenhouses and barns. From its headquarters at the University seat, the College of Agriculture and Experiment Station direct their work of instruction, research and extension which is pursued in all parts of the State.

University instruction in agriculture is carried on at Berkeley by seventy-three professors and instructors, teaching their subjects in 1921 to 611 regular students enrolled in agriculture, 450 students enrolled in other colleges, and to 5625 students in correspondence courses. The Experiment Station published in 1920, 850,000 copies of bulletins and circulars, and pursued in the laboratories fifty-eight research projects. At Berkeley also are the headquarters of the Agricultural Extension work with a large local staff administering the service of county agents in thirty-seven counties (in twenty of which there are also assistant agents) and of home demonstration agents in twelve counties.

On the University Farm at Davis comprising 779 acres (with 100 acres additional leased), there is an outfit of thirty-one instructional and housing and farm buildings. Forty-seven instructors and assistants give instruction to 87 University students from Berkeley; to 727 Farm School students taking instruction of high-school grade (chiefly in agricultural and horticultural practice) for one to three years as they may elect; to 497 students in short

courses and 88 students in teacher training courses. The University Farm is equipped with an irrigation system, breeding herds and flocks, field cultures, orchards, vineyards and gardens and an operating commercial creamery. Research work in sixty experiment projects is also pursued.

At Riverside the College of Agriculture conducts a "Tropical School of Agriculture" with sixteen instructors and research men using 698 acres with laboratories and outbuildings, pursuing 63 experiment station projects chiefly in growing and marketing of citrus fruits. Instruction is confined to graduate students and specialists, although the equipment of a farm school is contemplated and partly provided for.

At Fresno two hundred acres of the 5000-acre Kearney Ranch, owned by the University, is used for research projects in reclamation of alkaline soil, and in fruit and field-crop growing.

At Porterville a branch experiment station is dealing with the growth of citrus fruits on heavy hillside soils, in coöperation with the citrus work at Riverside. Another Riverside outpost is at Whittier, a laboratory equipped for study of plant diseases.

At Meloland in the Imperial Valley forty acres of land and farm buildings are used for experimental work with the growing of dates, cotton and grapes in a region wholly dependent on irrigation.

At Mountain View in the Santa Clara Valley are research headquarters and laboratories for the study

of deciduous fruit problems in culture and pest control.

At Shingle, Eldorado County, a leased property of 4000 acres and adjacent forest range of 17,000 acres are used for experiments and demonstrations with range cattle, in connection with the University Farm at Davis.

At Petaluma a station for investigation of poultry diseases supplementary to the poultry work at the University Farm is maintained in coöperation with the Supervisors of Sonoma County.

In connection with its instruction and research in forestry, the College has arboretums at Chico, Butte County, and at Santa Monica, Los Angeles County; also a fine tract of natural forest of sequoias in Tulare County.

In the various undertakings enumerated, the College of Agriculture expended during the year ending June 30, 1920, $884,513, of which $165,722 were received from federal sources.

As incidentally suggested here and there in preceding chapters, the general interest and appreciation of agriculture among Californians who are pursuing other vocations is very marked and widespread and the influential participation of farmers in the social and industrial organizations of cities with rural environments is very great. In such places the chambers of commerce and boards of trade are for the most part rural development and improvement agencies which bring urban and suburban people into close social and industrial relations with

the strictly rural interests and activities. This fact is productive of a degree of homogeneity in feeling and point of view which is characteristic of the State. It is not unusual to find producing farmers at the head of city organizations of various kinds and farmers' wives leading the women's clubs and other organizations of urban women.

There is of course close association between the people of the villages and the surrounding farming country. The pastors of rural churches and the teachers in rural schools take earnest part in farmers' assemblies and welcome them to their meeting-places. Such associations are tending strongly toward the development of community spirit and effort throughout the whole countryside of California, but in the manner of it there is perhaps nothing which can be claimed to be novel or distinctive.

LIBRARIES

California has collections of books, both institutional and privately owned, which are very creditable, considering the youth and population of the State. Of those that are public or institutional, the table on page 359 may be cited.

As in other states, the provision of public libraries was stimulated and promoted by the Carnegie gifts of buildings which were scattered throughout California and served as exemplars of what the public should do for itself. An initiative in this line was put forth by the late James L. Gillis, who served as State Librarian from 1899 to 1917. His concep-

	Volumes
California State Library, Sacramento	320,000
San Francisco Public Library	212,807 [1]
San Francisco Mechanic's and Mercantile Library	77,140 [1]
Los Angeles Public Library	256,581
Oakland Public Library	225,906
University of California Library	414,000
Stanford University Library	262,850

tion was that a state library should be directly at the service of the people and not merely an adjunct of administration and legislation at the capital. In 1903 Gillis organized "traveling libraries," collections of books sent from Sacramento to local guardians for circulation in communities which applied for them. By 1911 five hundred and ten communities were being served with collections of fifty volumes at a time. It was decided that the State was too large a unit for distribution in this way from the capital, and Gillis secured the enactment of a law providing for the establishment of county libraries which should serve as centers from which distribution could be made, the State Library becoming then a source from which distribution to county libraries could be made of materials not in their collections. Gillis did not live to see the full fruition of this work—in which his successor as State Librarian, Milton J. Ferguson, was associated with him. Ferguson furnishes the following sketch of the law and its operation:

[1] These two libraries were compelled to start anew in 1906, the former having lost 106,344 and the latter 300,000 volumes in the fire which destroyed the city at that date.

"Under the California law of 1911 the county library is created by ordinance of the board of supervisors, the governing body of the county, and remains under the general control of the board without the interposition of appointive trustees. This is a feature of great strength because the supervisors are the tax-levying power and are more readily disposed to give the library an adequate fund since they are directly responsible for its success. The maximum tax-rate is fixed by the statute at one mill on the dollar of assessed valuation.

"The county librarian is appointed by the board of supervisors but since the law requires that candidates eligible for appointment must hold certificates issued by the Board of Library Commissioners, only after a searching professional examination, the bugaboo of politics has been effectively banished. Under the direction of the librarian the county system is organized and developed and this officer has very wide professional latitude in the selection of books, the employment of assistants, the establishing of branches and, in the history of the service, has, almost without exception, given entire satisfaction to the over-lords, the supervisors, and to the patrons, the people.

"In 1921, forty-six of the fifty-eight counties of the state have county libraries in operation. Three other counties have established libraries but have not levied the taxes for their support. The reports of the county librarians for the year ending June 30, 1920, showed that there were 3584 branches of county

Plate XII. Typical scene on the paved state highways which thread the California countryside.

libraries. A bird's-eye view of the county library system of California will show not only thickly settled communities receiving splendid library service through branch libraries but also the most remote sections of each county having at their command all of the resources of the county library and through it free access to the State library. Many branches are from fifty to one hundred miles from a railroad and quite a number of them have their books sent to them on pack animals over the trails."

The State Librarian not only gives effective support and promotion to the county libraries but holds in his official eye all the libraries of the State and publishes a quarterly (now in its sixteenth volume) entitled *News Notes of California Libraries,* which is devoted "to the interests of the libraries of the state," one number each year being a "Statistical Number" which gives the dimensions, characters and personnel of all California libraries, except those of schools, churches and individual owners. This publication for October 1920 shows that the forty-one county libraries already mentioned received from public taxation during the year ending June 30, 1920, $718,984.03 and that they contained volumes aggregating 1,510,331. California has two hundred and eight library buildings, of which one hundred and sixty-eight were gifts, including one hundred and forty-two from Andrew Carnegie.

To provide training for those desiring to qualify themselves for library service, the Los Angeles Library school was opened at the Los Angeles Public

Library in 1892 and has done good work. The California State Library opened a school in 1914 and continued until 1920 when similar instruction was undertaken at the University of California. There is also a School of Library Service well maintained in connection with the public library at Riverside.

STATISTICAL APPENDICES

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Appendix F—Numbers and Distribution of Auto-Vehicles in California.

Appendix G—Quantities and Values of California Farm Crops of 1920.

Appendix H—Commercial Uses of California Fruit Crops, 1920.

Appendix I—Quantities and Values of California Dairy Products, 1919-20.

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Appendix K—Statistics of California Irrigation Districts, March 1921.

Appendix L—Statistics of California Public Schools, 1920.

APPENDIX A

California Counties: Area, Population, Number and Value of Farms

Compiled from United States Census of 1920

County	*Area Sq. Miles*	*Population Urban*	*Population Rural*	*Number of Farms*	*Value of Farms, Buildings, Tools and Live Stock*
Alameda	732	314,575	29,602	2,778	$ 57,341,179
Alpine	776	.....	243	21	584,524
Amador	601		7,703	479	7,859,755
Butte	1,698	12,679	17,351	2,219	53,399,133
Calaveras	1,027	.....	6,183	606	88,964,798
Colusa	1,140		9,290	816	41,101,229
Contra Costa	714	25,416	28,473	1,676	47,930,387
Del Norte	1,024	.....	2,759	130	3,452,392
Eldorado	1,737		6,426	728	8,028,401
Fresno	5,950	53,756	75,023	8,916	303,024,622
Glenn	1,337	.....	11,853	1,320	45,474,611
Humboldt	3,575	12,023	24,490	1,756	40,672,483
Imperial	4,089	17,076	26,377	2,843	69,171,545
Inyo	9,991		7,031	518	14,945,798
Kern	8,003	21,955	32,888	2,020	76,915,646
Kings	1,159	5,888	16,143	2,171	67,900,505
Lake	1,238		5,402	771	12,764,520
Lassen	4,531		8,507	606	20,396,238
Los Angeles	4,115	790,629	145,826	12,446	396,596,914
Madera	2,112	3,444	8,759	1,402	39,485,188
Marin	529	10,856	16,486	718	19,954,684
Mariposa	1,463		2,775	367	5,107,025
Mendocino	2,539	2,616	21,500	1,758	30,267,265
Merced	1,995	2,974	20,675	2,846	102,044,796
Modoc	3,823		5,425	743	22,009,931
Mono	3,030		960	74	2,596,663
Monterey	3,330	12,761	15,219	1,712	61,899,333

Napa	783	6,757	13,921	1,428	29,478,221
Nevada	974	4,006	6,844	481	5,135,345
Orange	795	30,310	31,065	4,188	176,663,249
Placer	1,411	4,477	14,107	1,280	22,718,017
Plumas	2,593		5,681	150	4,317,073
Riverside	7,223	23,470	26,827	3,948	95,466,776
Sacramento	983	65,908	25,121	2,975	87,983,650
San Benito	1,392	2,781	6,214	945	32,852,189
San Bernardino	20,175	45,573	27,828	4,023	99,728,993
San Diego	4,221	85,236	27,012	3,200	64,081,885
San Francisco	42	506,676		98	1,619,862
San Joaquin	1,448	45,146	34,759	4,500	140,702,764
San Luis Obispo	3,334	5,895	15,998	1,803	61,515,149
San Mateo	447	22,296	14,485	624	18,676,195
Santa Barbara	2,740	23,384	17,713	1,485	69,254,833
Santa Clara	1,328	53,624	47,052	5,015	149,875,095
Santa Cruz	435	15,930	10,339	1,759	27,109,492
Shasta	3,858	2,962	10,399	949	16,095,556
Sierra	923		1,783	77	2,172,015
Siskiyou	6,256	2,528	16,017	1,052	20,315,672
Solano	822	23,800	16,802	1,358	50,393,638
Sonoma	1,582	14,084	37,106	5,739	112,294,373
Stanislaus	1,450	12,635	30,922	4,566	110,595,497
Sutter	608		10,115	1,437	51,378,460
Tehama	2,925	3,104	9,778	1,414	34,960,408
Trinity	3,096		2,551	377	2,991,851
Tulare	4,856	19,365	39,666	6,373	198,984,821
Tuolumne	2,190		7,768	363	5,015,180
Ventura	1,858	12,726	15,998	1,543	98,182,960
Yolo	1,014	4,177	12,058	1,613	66,248,770
Yuba	632	5,461	4,914	487	14,274,307
The State	155,652	2,331,729	1,095,132	117,690	$3,431,021,861

APPENDIX B

California Climatic Characters

Monthly and Annual Means and Extremes of Temperature (in
fornia points from the records of the U. S. Weather Bureau,
different points. Proceeding southward from northerly
of latitude of the coast and interior

Location	*Meteorology*	*Jan.*	*Feb.*	*Mar.*
Eureka, Humboldt Co.	Mean Temp.	47	47	48
Region 1. Elev. 64 ft.	Highest "	77	72	78
Coast	Lowest "	20	24	29
	Rainfall, inches	1.63	7.93	6.97
Sisson, Siskiyou Co.	Mean Temp.	34	27	40
Region 1. Elev. 3,555 ft.	Highest "	63	66	73
Interior mountain	Lowest "	—9	—3	10
	Rainfall, inches	8.24	5.60	5.40
Red Bluff, Tehama Co.	Mean Temp.	45	50	54
Region 4. Elev. 367 ft.	Highest "	77	82	91
Interior valley	Lowest "	18	22	26
	Rainfall, inches	3.94	3.62	3.76
Santa Rosa, Sonoma Co.	Mean Temp.	48	50	52
Region 2. Elev. 181 ft.	Highest "	83	80	94
Coast valley	Lowest "	20	19	26
	Rainfall, inches	6.85	5.32	5.11
Sacramento, Sacramento Co.	Mean Temp.	46	50	54
Region 4. Elev. 71 ft.	Highest "	72	80	82
Interior valley	Lowest "	19	21	29
	Rainfall, inches	3.69	3.14	3.01
San Francisco, San Francisco Co.	Mean Temp.	50	51	53
Region 2. Elev. 207 ft.	Highest "	78	80	80
Coast valley	Lowest "	29	33	33
	Rainfall, inches	4.33	3.70	3.14
San Jose, Santa Clara Co.	Mean Temp.	48	51	54
Region 2. Elev. 95 ft.	Highest "	78	82	86
Coast valley.	Lowest "	18	24	26
	Rainfall, inches	2.88	2.54	2.98
Stockton, San Joaquin Co.	Mean Temp.	46	50	54
Region 4. Elev. 23 ft.	Highest "	68	79	80
Interior valley	Lowest "	22	24	31
	Rainfall, inches	2.86	2.35	2.26
Salinas, Monterey Co.	Mean Temp.	48	50	53
Region 2. Elev. 40 ft.	Highest "	78	81	84
Coast valley	Lowest "	21	24	30
	Rainfall, inches	2.95	2.31	2.41
Fresno, Fresno Co.	Mean Temp.	45	49	55
Region 4. Elev. 293 ft.	Highest "	72	83	87
Interior valley	Lowest "	20	24	28
	Rainfall, inches	1.60	1.33	1.76
Porterville, Tulare Co.	Mean Temp.	48	52	56
Region 4. Elev. 464 ft.	Highest "	76	81	88

APPENDIX B—(*Continued*)

Condensed and Compared

degrees Fahr.) and rainfall (in inches) at representative Calicovering periods of twenty to seventy years (April, 1921) at points the observations are grouped according to similarity situations which they represent

April	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Year*
50	52	54	56	56	55	53	51	51	51
75	78	85	73	79	82	84	81	70	85
31	35	40	43	45	36	36	27	28	20
3.93	2.54	1.06	.11	.10	1.11	2.65	5.67	7.25	46.05
47	55	62	70	69	58	51	41	35	50
90	101	103	108	106	95	87	83	80	108
21	23	28	33	33	28	22	—7	—4	—9
2.36	2.15	.67	.16	.29	2.54	1.36	6.13	6.13	38.80
59	65	75	60	60	73	64	54	46	62
96	110	110	115	114	108	98	88	76	115
30	35	44	53	52	45	32	26	25	18
1.85	1.32	.46	0	.02	.80	1.58	3.19	4.49	25.03
56	60	65	66	65	64	60	54	48	57
90	100	107	112	103	108	101	85	78	112
29	27	35	40	34	30	24	31	18	18
1.64	1.52	.25	.05	.01	.53	2.02	3.26	5.61	32.07
59	64	69	74	73	70	62	53	47	60
89	103	106	110	110	106	98	81	69	110
35	37	44	47	48	44	36	27	24	19
2.00	.98	.15	0	.01	.39	1.04	2.15	3.53	20.09
54	56	57	57	58	59	58	56	51	55
88	97	100	98	92	101	94	83	72	101
40	42	46	47	46	48	45	38	34	23
1.32	.81	.17	.01	0	.29	1.29	2.47	4.24	22.27
57	61	65	67	67	60	60	54	50	58
82	104	104	108	101	106	93	84	78	108
29	32	35	41	42	37	31	25	22	18
1.41	.68	.08	0	.04	.34	.90	1.89	3.05	16.75
50	64	70	73	72	69	62	54	47	60
91	102	103	108	106	95	87	83	80	108
31	40	40	42	40	45	36	25	23	22
1.11	.67	.12	0	.01	.21	.70	1.56	2.78	14.63
56	60	62	63	62	61	58	53	50	56
98	96	97	92	94	110	95	97	83	110
32	33	39	40	40	40	30	28	20	20
1.17	.51	.13	0	.02	.20	.70	1.38	2.36	14.14
61	68	76	82	81	74	65	55	47	63
101	110	112	115	113	111	100	84	74	115
34	38	42	50	51	42	36	27	23	20
.71	.63	.10	0	0	.27	.72	1.03	1.52	9.68
63	70	79	85	83	75	65	55	48	65
101	103	110	114	114	110	102	95	85	114

APPENDIX B—(*Continued*)

Location	*Meteorology*	*Jan.*	*Feb.*	*Mar.*
Interior valley	Lowest Temp.	24	25	31
	Rainfall, inches	1.85	1.62	1.84
Santa Barbara, S. B. Co.	Mean Temp.	54	55	56
Region 3. Elev. 130 ft.	Highest "	81	86	92
Coast	Lowest "	31	29	34
	Rainfall, inches	4.06	3.46	2.79
Los Angeles, Los A. Co.	Mean Temp.	53	54	56
Region 3. Elev. 293 ft.	Highest "	87	88	99
Coast valley	Lowest "	30	28	31
	Rainfall, inches	2.84	2.91	3.00
Riverside, Riverside Co.	Mean Temp.	56	57	63
Region 3. Elev. 851 ft.	Highest "	92	91	102
Coast valley	Lowest "	21	24	25
	Rainfall, inches	2.01	1.98	2.34
San Diego, San Diego Co.	Mean Temp.	54	55	56
Region 3. Elev. 87 ft.	Highest "	83	85	99
Coast	Lowest "	32	34	36
	Rainfall, inches	2.00	1.96	1.70
Calexico, Imperial Co.	Mean Temp.	54	58	64
Region 4. Elev. 0 ft.	Highest "	78	88	94
Interior valley	Lowest "	24	31	38
	Rainfall, inches	.28	.80	.27

APPENDIX B—(*Continued*)

April	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Year*
32	28	40	44	50	41	35	36	22	22
.79	.71	.11	.03	.01	.29	.52	.76	1.49	10.02
58	59	63	65	67	66	63	59	56	60
97	94	97	108	86	100	98	91	84	108
36	40	43	48	49	45	40	34	33	29
1.18	.43	.09	.02	.01	.37	.86	1.54	3.33	18.14
58	60	64	67	69	66	62	58	55	60
100	103	105	109	106	108	102	96	89	109
36	40	46	49	49	44	40	31	30	28
1.13	.48	.07	0	0	.06	.77	1.48	2.90	15.64
67	69	79	78	77	76	69	62	51	68
104	103	118	110	111	112	108	98	91	118
31	35	40	46	44	40	31	26	21	21
.68	.85	.05	.02	.14	.14	.54	.77	1.57	10.59
60	64	70	76	76	71	64	57	62	61
96	98	94	93	93	101	96	93	82	101
39	45	50	54	54	50	44	38	32	32
.74	.41	.03	0	0	.06	.46	.83	1.82	10.01
70	75	83	90	90	84	72	62	53	71
104	116	113	117	114	108	105	90	78	117
46	48	56	62	56	50	42	32	26	24
.08	.09	.03	.07	.70	.09	.16	.34	.37	3.28

APPENDIX C

California Soil Surveys

Specific description of various California soils and their collocation in various parts of the State have been in progress since 1900 by the Bureau of Soils of the United States Department of Agriculture and the results have been amply set forth both in text and mapping in the annual reports of the Bureau. The following enumeration indicates the regions alphabetically and designates the year of the Report in which the local exposition is made:

Anaheim Area 1916
Bakersfield Area 1904
Butte Valley Area ... 1907
Colusa Area 1907
El Centro Area 1918
Fresno Area 1900
Fresno Area 1912
Grass Valley Area ... 1918
Hanford Area 1901
Imperial Area 1901
Imperial Area 1903
Healdsburg Area 1915
Honey Lake Area 1915
Indio Area 1903
Klamath Reclamation Area 1908
Livermore Valley Area 1910
Los Angeles Area .....1903 and 1916
Lower Salinas Valley Area 1901
Lower San Joaquin Area 1915
Middle San Joaquin Area 1916
Upper San Joaquin Area 1912
Madera Area 1910
Marysville Area 1909
Merced Area 1914
Modesto-Turlock Area 1908
Paparo Valley Area .. 1908
Pasadena Area 1915
Porterville Area 1908
Redding Area 1907
Red Bluff Area 1910
Riverside Area 1915
Sacramento Area 1904
Sacramento Valley Region 1913
San Bernardino Area 1904
San Diego Area 1915
San Fernando Area... 1915
San Gabriel Area ... 1901
San Jose Area 1903
San Francisco Bay Area 1914
Santa Ana Area 1900
Santa Maria Area.... 1916
Southern California Area 1917
Stockton Area 1905
Ukiah Area 1914
Ventura Area 1901 and 1917
Willets Area 1918
Woodland Area 1909
Yuma Area 1904

Except in the case of a few of the most recent, perhaps, these reports cannot be secured from the government. They must be sought among second-hand book-dealers or consulted in the public libraries.

APPENDIX D

California Mining Products—Quantities and Values for 1920

From the annual "Production Report" of the State Mineralogist

Substance	*Amount*		*Value*
Asbestos	*		*
Barytes	3,029	tons	$ 20,795
Bituminous rock	5,450	tons	27,825
Borax	127,065	tons	2,794,206
Brick and tile	.....		5,704,393
Cement	6,709,160	bbls.	14,962,945
Chromite	1,770	tons	43,031
Clay (pottery)	203,997	tons	440,689
Coal	2,078	tons	5,450
Copper	12,947,299	lbs.	2,382,303
Dolomite	42,388	tons	132,791
Feldspar	4,518	tons	26,189
Fuller's earth	600	tons	6,000
Gems	.....		36,056
Gold	.....		14,311,043
Granite	.....		495,732
Graphite	*		*
Gypsum	20,507	tons	92,535
Infusorial and diatomaceous earths	60,764	tons	1,056,260
Iron ore	5,975	tons	40,889
Lead	4,903,738	lbs.	392,300
Lime	463,144	bbls.	557,232
Limestone	90,120	tons	298,197
Lithia	10,046	tons	153,502
Magnesite	83,695	tons	1,033,491
Magnesium salts	3,150	tons	107,787
Manganese ore	2,892	tons	62,323
Marble	29,531	cu. ft.	92,899
Mineral paint	779	tons	8,477
Mineral water	2,391,791	gals.	421,643
Natural gas	58,567,772	M. cu. ft.	3,898,286
Petroleum	103,377,361	bbls.	178,394,937
Platinum	477	fine oz.	68,977
Potash	26,298	tons	1,465,463
Pumice and volcanic ash	1,537	tons	25,890
Pyrite	146,001	tons	530,581
Quicksilver	10,278	flasks	775,527
Salt	230,638	tons	972,648
Sandstone	10,500	cu. ft.	2,300
Silica (sand and quartz)	25,324	tons	96,793

Substance	*Amount*	*Value*
Silver	.....	$ 1,859,896
Soapstone and talc	11,327 tons	221,362
Soda	32,407 tons	1,164,898
Stone, miscellaneous † ..	.....	6,803,557
Zinc	1,188,009 lbs.	96,229
Unapportioned	.....	*
Total value		$242,099,667

* Unapportioned—includes asbestos, graphite, and columbite (tantalum ore).

† Includes macadam, ballast, rubble, riprap, paving blocks, sand, gravel and grinding-mill pebbles.

APPENDIX E

National Forests, Parks, and Monuments in California

National Forests	*Location (Counties)*	*Acreage*	*Standing Timber (Ft. Board Measure)*
Angeles	Los Angeles, San Bernardino	1,165,300	1,299,765,300
California	Mendocino, Glenn	1,061,000	6,500,208,000
Cleveland	San Diego, Riverside	1,813,616	678,000,000
El Dorado	El Dorado	835,800	4,658,702,000
Inyo	Inyo	1,249,282	600,000,000
Klamath	Siskiyou	1,734,665	14,873,391,000
Lassen	Shasta, Lassen	1,321,243	11,662,000,000
Modoc	Modoc, Lassen	1,582,859	2,975,387,000
Mono	Mono, Alpine	874,861	600,000,000
Plumas	Plumas, Butte, Lassen	1,432,860	14,871,302,000
Santa Barbara	Monterey, San Benito, Santa Barbara, Ventura, Los Angeles	2,288,788	1,550,500,000
Sequoia	Fresno, Tulare, Kern	2,021,609	12,834,497,000
Shasta	Siskiyou, Shasta, Trinity	1,586,880	4,783,424,000
Sierra	Mariposa, Madera, Fresno	1,662,560	14,654,000,000
Stanislaus	Calaveras, Alpine, Tuolumne, Mariposa	1,136,500	9,406,196,000
Tahoe	Sierra, Butte, Yuba, Nevada, Placer	1,167,587	6,991,985,000
Trinity	Trinity	1,746,147	10,879,826,000
National Parks			
Yosemite	Mariposa	719,622	Valley of world-famed beauty
Sequoia	Tulare	161,597	Big Tree National Park
General Grant	Tulare	2,536	Sequoia, 35 ft. diameter
Lassen Volcanic	Shasta, Lassen	79,561	Enclosing Lassen Peak

APPENDIX E—(*Continued*)

National Monuments	*Location (Counties)*	*Acreage*	
Muir Woods	Marin	295	Redwoods nearest San Francisco
Devil Post-Pile	Sierra	800	Hexagonal basaltic columns
Pinnacles	San Benito	2,080	Rock spires 600 to 1000 ft. high
Cabrillo			Cabrillo's discovery in 1542
Lassen Peak	Shasta	1,280	Active volcano

APPENDIX E—(*Continued*)

SUMMARY OF CONDITIONS AND OPERATIONS OF CALIFORNIA DIVISION OF THE UNITED STATES FORESTRY SERVICE FOR THE FISCAL YEAR ENDING JUNE 30, 1920:

Number of National Forests	17
Area of public land, acres	24,003,190
Area of private land included, acres	5,111,929
Timber cut: 143,066,000 ft., value	$328,452.73
Forage for 211,186 cattle and horses, value	$152,841.26
Forage for 548,858 sheep and goats, value	$78,459.77
Receipts from 5,000 "special uses"	$40,656.25
Total receipts	$723,465.68

Value of improvements including:

355 miles of road	
4,233 miles of trails	
480 fire-breaks	
4,653 miles of telephone lines	
71 bridges	
103 look-outs	$1,718,943.00

Number of fires handled:

1,338, of which 641 were "lightning" and 204 were "campers" fires which burned over an acreage of	129,728

ESTIMATES OF CALIFORNIA FOREST RESOURCES

Area of forested lands (22 per cent of State area)—approximately one half in National Forests	44,700 sq. miles
Standing Timber (Board Measure)	350,000,000,000 ft.

Roughly classified as follows:

Redwood	80,000,000,000 ft.
Sugar pine	33,265,000,000 "
California white pine	85,421,000,000 "
Douglas fir	46,407,000,000 "

APPENDIX E—(*Continued*)

White fir	34,997,000,000 ft.
Incense cedar	8,481,000,000 "
Red fir	24,792,000,000 "
Various	40,000,000,000 "

The United States Forester in 1919 estimated the value of the pines, firs and cedar in the foregoing to be worth $7,001,190,000 at the mills at $30 per M. Adding to this the redwood, the total valuation would be about $10,000,000.00. It is also estimated that California has trees enough to last a hundred years without reforestation—at the rate of cutting her 375 sawmills have recently adopted. The policy of protection, economy and reforestation, however, promises to render California's timber supply perpetual.

Relative Lumber Production from Various Trees

The following comparative figures are taken from the United States Census of 1910 as production during the last decade has been irregular owing to labor cost, building demand, etc., viz:

Kind of Lumber	*Feet, Board Measure*
Redwood	543,493,000
Yellow pine	399,067,000
Douglas fir	103,169,000
Sugar pine	101,561,000
White fir	65,420,000
Incense cedar	20,846,000
Spruce	14,105,000
Oak	4,376,000
Hemlock	2,723,000
Ash	206,000
All others	160,000
Total	1,255,126,000

APPENDIX F

Distribution of Auto-vehicles in California by Counties

Compiled by State Motor-Vehicle Department at Sacramento

	1920		*1921*	
	Auto-mobiles	*Trucks*	*Auto-mobiles*	*Trucks*
Alameda	36,139	2,111	42,018	2,221
Alpine	32	2	43	5
Amador	793	60	942	55
Butte	5,671	314	6,471	329
Calaveras	699	68	852	63
Colusa	2,380	138	2,539	130
Contra Costa	5,815	371	6,803	415
Del Norte	279	34	354	33
El Dorado	753	85	938	93
Fresno	30,899	1,589	34,093	1,663
Glenn	2,915	144	2,806	139
Humboldt	4,503	307	5,427	360
Imperial	7,984	432	7,870	353
Inyo	1,303	38	1,276	37
Kern	12,697	723	15,860	773
Kings	4,841	207	4,928	197
Lake	936	64	960	66
Lassen	1,122	42	1,309	39
Los Angeles	161,736	18,888	211,678	11,142
Madera	2,117	135	2,576	132
Marin	2,638	164	3,397	170
Mariposa	300	36	361	39
Mendocino	2,485	201	3,028	246
Merced	4,295	247	4,808	229
Modoc	875	22	943	229
Mono	113	2	125	28
Monterey	4,309	218	5,046	249
Napa	2,766	166	3,216	197
Nevada	889	43	1,089	33
Orange	14,250	469	18,406	513

APPENDIX F—(*Continued*)

	1920		*1921*	
	Automobiles	*Trucks*	*Automobiles*	*Trucks*
Plumas	2,865	231	3,690	256
Placer	2,865	230	722	55
Riverside	8,362	312	9,828	337
Sacramento	14,263	1,125	17,457	1,178
San Benito	1,823	102	1,882	110
San Bernardino	11,491	499	14,036	508
San Diego	17,644	852	22,109	901
San Francisco	47,969	4,894	56,104	5,135
San Joaquin	14,714	861	17,424	892
San Luis Obispo	4,138	335	4,948	189
San Mateo	4,138	335	5,025	364
Santa Barbara	7,824	268	9,018	279
Santa Clara	16,605	1,013	19,810	1,110
Santa Cruz	4,141	301	5,169	352
Shasta	1,931	168	2,284	184
Sierra	191	21	249	12
Siskiyou	2,197	153	2,644	149
Solano	5,059	301	5,616	278
Sonoma	9,418	659	10,963	734
Stanislaus	10,840	457	12,330	457
Sutter	2,281	160	2,284	165
Tehama	2,282	105	2,572	113
Trinity	169	6	171	7
Tulare	13,156	656	15,478	692
Tuolumne	901	55	1,153	59
Ventura	5,528	244	5,992	231
Yolo	3,858	225	4,132	233
Yuba	2,009	144	2,269	154
Totals	532,934	41,689	645,522	35,092

APPENDIX G

Quantities and Farm Values of the Specified Farm Crops of California for the Year 1920

Compiled from the reports of the Bureau of Crop Estimates of the United States Department of Agriculture

Crop	*Production*	*Farm Value*
Almonds	5,500 bushels	$ 1,980,000
Apples	3,000,000 boxes	9,605,000
Apricots	115,000 tons	9,775,000
Cherries	15,000 "	3,000,000
Figs	10,000 "	900,000
Grape-fruit	328,000 boxes	984,000
Lemons	4,500,000 "	2,700,000
Oranges	18,700,000 "	51,425,000
Olives	10,000 tons	800,000
Peaches	345,000 "	26,320,000
Pears	90,000 "	8,100,000
Plums	35,000 "	3,150,000
Prunes	95,000 "	19,000,000
Walnuts	21,500 "	8,000,000
Grapes, raisin	180,000 * "	55,800,000
" table	160,000 "	12,000,000
" wine	380,000 "	24,700,000
Corn	3,150,000 bushels	3,780,000
Oats	5,425,000 "	5,316,000
Barley	28,750,000 "	28,750,000
Wheat	9,100,000 "	16,380,000
Potatoes	13,015,000 "	19,522,000
Onions	2,925,000 "	2,194,000
Sweet potatoes	1,056,000 "	1,690,000
Sugar-beets	1,037,000 tons	14,124,000
Hay	5,183,000 "	102,320,000
Sorghum (grain)	4,050,000 bushels	4,252,000
Rice	9,720,000 "	11,761,000
Hops	21,000,000 pounds	7,350,000
Beans	2,850,000 bushels	9,405,000
Cotton, lint	71,580,000 pounds	12,884,000
" seed	83,500 tons	1,419,000
Total		$479,386,000

VALUES OF CALIFORNIA FARM CROPS (EXCLUDING ANIMAL PRODUCTS)

From the United States Census of 1920 and 1910

Groups of Crops	*1919*	*1909*
Cereals	$108,570,469	$ 28,039,826
Other grains and seeds	38,349,277	7,318,211
Hay and forage	96,121,846	42,206,252
Vegetables	47,377,821	12,121,958
Fruits and nuts	270,910,698	50,706,869
Other crops	26,279,380	6,133,035
Totals	$587,609,491	$145,526,151

APPENDIX H

COMMERCIAL USES OF CALIFORNIA FRUIT CROPS OF 1920

Fruit	*Fresh Shipments* * (*carloads*)	*Dried* (*tons*)	*Canned* † (*cases*)
Apples	4,615	5,000	9,000
Apricots	312	10,000	2,312,020
Cherries	494	.....	648,000
Dates	.....	125	.....
Figs	.....	10,000	.....
Grapes (wine, table)	24,065	.....	.....
Grapes (raisin)	.....	180,000	.....
Lemons	8,680	.....	.....
Oranges	38,077	.....	.....
Peaches	3,107	24,000	6,750,000
Pears	4,376	2,500	300,000
Plums	2,533	.....	165,000
Prunes	.....	95,000	.....
Blackberries	.....	.....	162,000
Loganberries	.....	.....	15,000
Strawberries	.....	.....	5,500
Unclassified	314	500	15,500

* Apple shipments are chiefly within State lines: all other shipments are wholly beyond and chiefly across the continent.
† Cases of fruits contain 24 2-lb. tins or equivalents.

APPENDIX I

California Dairy Products: Year Ending June 30, 1920

From California Department of Agriculture, Division of Animal Industry, Circular 3, 1921

No. of Firms Reporting	*Article*	*Amount*	*Approximate value*
173	Butter	68,126,560 lbs.	$42,136,276
129	Cheese (all types except cottage)	13,018,468 lbs.	4,060,104
18	Cottage cheese	1,280,093 lbs.	102,407
9	Evaporated whole milk	69,017,497 lbs.	8,627,187
2	Sweetened condensed whole milk	9,057,465 lbs.	1,539,769
4	Evaporated skim-milk	5,426,647 lbs.	237,144
4	Sweetened condensed skim-milk	1,424,557 lbs.	156,601
8	Powdered skim-milk	5,260,004 lbs.	1,052,000
1	Powdered buttermilk.	2,500 lbs.	225
6	Milk sugar (crude and refined)	3,222,767 lbs.	870,147
10	Curds, lactein, semi-solid buttermilk	5,998,302 lbs.	269,923
16	Dried casein	5,279,495 lbs.	791,924
129	Market milk, pasteurized	43,888,936 gals.	17,336,129
269	Market milk, raw	15,942,462 gals.	6,297,272
107	Market cream, pasteurized	3,057,317 gals.	4,515,753
48	Market cream, raw	58,716 gals.	76,260
8	Certified milk	1,272,750 gals.	1,018,200
170	Ice-cream	6,468,745 gals.	9,703,117
16	Skim-milk (for human consumption)	944,812 gals.	118,101
26	Buttermilk (for human consumption).	958,196 gals.	95,819
	Total value		$99,004,358

* State law requires manufacturers to report their operations. The factories enumerated are scattered throughout the State—only three mountain counties reporting no commercial dairy production.

APPENDIX J

California Coöperative and Product-Selling Associations

1922

California Fruit Distributors, Sacramento.
California Fruit Exchange (deciduous fruits), Sacramento.
California Fruit Growers Exchange (citrus fruits), Los Angeles.
California Associated Raisin Company, Fresno.
California Cherry Growers Association, Sebastopol.
California Olive Growers Association, Fresno.
California Peach and Fig Growers, Fresno.
California Prune and Apricot Growers, Inc., San Jose.
California Walnut Growers Association, Los Angeles.
California Almond Growers Exchange, San Francisco.
California Pear Growers Association, San Francisco.
California Grape Growers Exchange, San Francisco.
California Date Growers Association, Coachella.
California Association of Nurserymen, San Francisco.
Fruit Growers of California, Inc., San Jose.
California Orchard Company, Inc., Penryn.
California Avocado Association, Los Angeles.
Watsonville Apple Distributors, Watsonville.
Sebastopol Apple Growers Union, Sebastopol.
Associated Olive Growers of California, Corning.
San Joaquin Table Grape Growers Association, Lodi.
California Coöperative Canneries, San Jose.
California Canning Peach Growers, San Francisco.
Tulare Canning Peach Association, Visalia.
Central California Berry Growers Association, San Francisco.
California Dairy Council, San Francisco.
Associated Dairymen of California, Inc., Sacramento.

Associated Milk Producers, Inc., San Francisco.
Milk Producers Association of Central California, Modesto.
California Milk Producers Association, Los Angeles.
Northern California Milk Producers Association, Sacramento.
San Joaquin Valley Milk Producers Association, Fresno.
Milk Producers Association of San Diego County, San Diego.
Imperial Valley Milk Producers Association, El Centro.
Salinas Valley Dairymen's Association, Soledad.
California Cattlemen's Association, San Francisco.
California Wool Growers Association, Red Bluff.
Poultry Producers of Central California, Inc., San Francisco.
Poultry Producers of Southern California, Los Angeles.
Pacific Egg Producers, San Francisco.
California Honey Producers Coöperative Exchange, Los Angeles.
Alfalfa Growers of California, Los Angeles.
California Asparagus Growers Association, Walnut Grove.
California Lima Bean Growers Association, Oxnard.
Lima Bean Growers Association, Oxnard.
California Bean Growers Association, San Francisco.
Goleta Lima Bean Growers Association, Santa Barbara.
Coachella Valley Onion Growers Association, Coachella.
Turlock Melon Growers Association, Turlock.
California Vegetable Growers Association, Los Angeles.
California Vegetable Union, Sacramento.
Imperial Valley Vegetable and Melon Growers Association, Calipatria.

Pacific Rice Growers Association, Sacramento.
El Dorado Potato Growers Association, Placerville.
Sonoma-Marin Potato Growers Association, Sebastopol.
Carlsbad Vegetable Association, Carlsbad.
Thermal Growers Association, Thermal.
Coöperative Seed Growers Association, San Jose.
Escondido Vegetable Growers Association, Escondido.
Merced-Stanislaus Sweet Potato Association, Livingston.

APPENDIX K

California Irrigation

	Name of District	*County*
1.	Alpauh	Tulare
2.	Alta	Tulare-Fresno
3.	Anderson-Cottonwood	Shasta
4.	Banta-Carbona	San Joaquin
5.	Baxter Creek	Lassen
6.	Beaumont	Riverside
7.	Black Rock	Inyo
8.	Browns Valley	Yuba
9.	Butte Valley *	Siskiyou
10.	Byron-Bethany	Contra Costa
11.	Cardiff	San Diego
12.	Carmichael	Sacramento
13.	Citrus Heights	Sacramento
14.	Compton-Delevan	Colusa
15.	Corcoran	Kings
16.	Cordua	Yuba
17.	Crooks Canyon *	Modoc
18.	Fairoaks	Sacramento
19.	Feather River	Sutter
20.	Foothill	Fresno-Tulare
21.	Fresno	Fresno
22.	Glenn-Colusa	Colusa-Glenn
23.	Grenada	Siskiyou
24.	Happy Valley	Shasta
25.	Honcut-Yuba	Yuba-Butte
26.	Honey Lake Valley *	Lassen
27.	Hot Spring Valley	Modoc
28.	Imperial	Imperial
29.	Jacinto	Glenn
30.	James	Fresno
31.	Knightsen	Contra Costa
32.	Laguna	Fresno
33.	La Mesa, Lemon Grove and Spring Valley	San Diego
34.	Lemoore	Kings
35.	Lindsay-Strathmore	Tulare
36.	Little Rock Creek	Los Angeles
37.	Lone Tree	Contra Costa
38.	Long Valley Creek *	Lassen
39.	Madera	Madera
40.	Maxwell	Colusa
41.	Medano	Madera-Merced
42.	Merced	Merced
43.	Modesto	Stanislaus
44.	Mojave River *	San Bernardino
45.	Naglee Burke	San Joaquin

* Formed without State Engineer's approval.

APPENDIX K—(*Continued*)

DISTRICTS—MARCH 9, 1921

Year Organized	*Area Acres*	*Bonded Indebtedness*	*Address of Secretary*
1914	8,069	$ 283,000	Alpaugh
1888	130,000	442,500	Dinuba
1914	32,500	1,255,000	Anderson
1921	18,000		
1917	11,000		Lassen
1919	5,161	230,000	Beaumont
1915	1,210		Big Pine
1888	44,328		Browns Valley
1920	37,320		Macdoel
1919	17,600	550,000	Byron
1916	700		Cardiff
1916	3,006	90,000	Sacramento
1920	3,028		Sacramento
1920	12,655	575,000	Colusa
1919	48,438	760,000	Corcoran
1920	5,422	192,000	Marysville
1919	6,480	80,000	Alturas
1917	4,000	200,000	Fairoaks
1920	3,027		Nicolaus
1920	58,000		Orosi
1920	242,000		Fresno
1920	103,000	2,570,000	Willows
1921	5,055		Grenada
1891	18,210	765,000	Olinda
1919	26,500		Honcut
1896	33,150		Amadee
1919	51,200	96,000	Alturas
1911	603,840	8,500,000	El Centro
1916	11,596	238,000	Glenn
1920	26,108	1,000,000	San Joaquin
1919	9,961		Knightsen
1920	30,400		Laton
1913	14,794	1,232,500	La Mesa
1920	52,300		Lemoore
1915	15,285	1,650,000	Lindsay
1892	3,072	60,000	Littlerock
1920	2,393		Brentwood
1916	34,000		Doyle
1920	353,000		Madera
1918	8,000	260,000	Colusa
1921	14,000		Le Grand
1919	181,920		Merced
1887	81,183	4,209,261	Modesto
1917	27,665		Victorville
1920	3,346		Tracy

APPENDIX K—(*Continued*)

Name of District	*County*
46. Newport Heights	Orange
47. Newport Mesa	Orange
48. Oakdale	Stanislau-San Joaquin
49. Oroville-Wyandotte	Butte
50. Palmdale	Los Angeles
51. Paradise	Butte
52. Plainsburg	Merced
53. Princeton-Cadora-Glenn	Glenn-Colusa
54. Provident	Glenn-Colusa
55. Redrock Creek *	Lassen
56. Riverdale	Fresno
57. San Ysidro	San Diego
58. Scott Valley	Siskiyou
59. Southern Lassen *	Lassen
60. South San Joaquin	San Joaquin
61. Stratford	Kings
62. Surprise Valley *	Modoc
63. Terra Bella	Tulare
64. Tranquility	Fresno
65. Tulare	Tulare
66. Tule	Lassen
67. Turlock	Stanislaus-Merced
68. Victor Valley *	San Bernardino
69. Walnut	Los Angeles
70. Waterford	Stanislaus
71. Webster	Madera
72. West Side	San Joaquin
73. West Stanislaus *	Stanislaus-Merced
74. Williams *	Colusa

* Formed without State Engineer's approval.

APPENDIX K—(*Continued*)

Year Organized	*Area Acres*	*Bonded Indebtedness*	*Address of Secretary*
1918	1,400	160,000	Costa Mesa
1918	670	50,000	Costa Mesa
1909	74,246	2,399,500	Oakdale
1919	17,700		Oroville
1916	4,756		Palmdale
1916	11,250	490,000	Paradise
1919	5,717		Plainsburg
1916	13,861	175,000	Princeton
1918	20,836	1,000,000	Willows
1918	3,700		Ravendale
1920	16,000		Riverdale
1911	492	25,000	San Ysidro
1917	6,540	125,000	Ft. Jones
1915	21,500		Doyle
1909	71,050	3,835,000	Manteca
1916	9,200		Stratford
1918	17,500		Fort Bidwell
1915	12,000	1,000,000	Terra Bella
1918	11,300	260,000	Tranquility
1889	39,360		Tulare
1920	15,305		Standish
1887	178,798	6,770,000	Turlock
1917	71,517		Victorville
1893	869		Rivera
1914	13,577	670,000	Waterford
1916	15,000		Madera
1915	11,828	500,000	Tracy
1920	35,681		Crows Landing
1920	9,021		Williams

APPENDIX L

Statistics of California Public Schools

From the Report of the State Superintendent of Public Instruction for the Year Ending June 30, 1920

Numerical Statement

Number of elementary school districts	3,560
Number of high schools	318
Number of normal schools	7
Number of teachers employed in all schools—	
Kindergartens	756
Elementary schools	15,319
High schools	5,794
Normal schools	205
California Polytechnic	17
Institution for the Deaf and the Blind...	41
University of California	754
Total	22,886
Students enrolled in all public schools—	
Kindergartens	32,944
Elementary schools	500,367
High schools	162,650
Normal schools	2,484
California Polytechnic	145
Institution for the Deaf and the Blind.....	284
University of California	13,944
Total	712,818

Total Expenditures from State Funds

Kindergarten, elementary and high schools..	$47,455,938.51
Offices of county superintendents, county boards of education and city boards of education	1,170,003.56
Offices of Superintendent of Public Instruc-	

tion, State Board of Education and entire cost of textbooks	$ 563,292.54
State institutions (normal schools, California Polytechnic School, Institution for the Deaf and the Blind, and University of California)	6,772,151.44
Total expenditure from state funds...	$55,961,386.05

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