J. Bennema

KNOW CALIFORNIA'S LAND

A LAND-CAPABILITY GUIDE FOR SOIL AND WATER CONSERVATION

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A LAND-CAPABILITY GUIDE FOR SOIL AND WATER CONSERVATION IN CALIFORNIA

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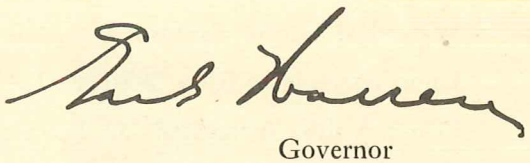
FOREWORD

This publication contains valuable information concerning California's land—the nature, distribution, extent, use and conservation of this basic natural resource. It is intended to help bring about the most beneficial use of our land in these days when we must have the maximum return from all our available resources.

Land with its variations in soil depths, texture, fertility, slope and climate may be likened to people with all of their varying characteristics and abilities. Bumper yields come from land producing crops adapted to it, just as human efficiency comes from healthy people doing the kind of work for which they are best qualified. We must know the capabilities of our land if we are to use it wisely and obtain from it continuing high production.

I am confident that the material in this booklet will be of great assistance in the furtherance of conservation education and as a guide to individuals and organizations, both private and governmental, in dealing with soil and water conservation matters.



Governor

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Cover—An illustration of how land-capability classes fit the land in the Mission Soledad Soil Conservation District, Monterey County.

KNOW CALIFORNIA'S LAND

A LAND-CAPABILITY GUIDE FOR SOIL AND WATER CONSERVATION

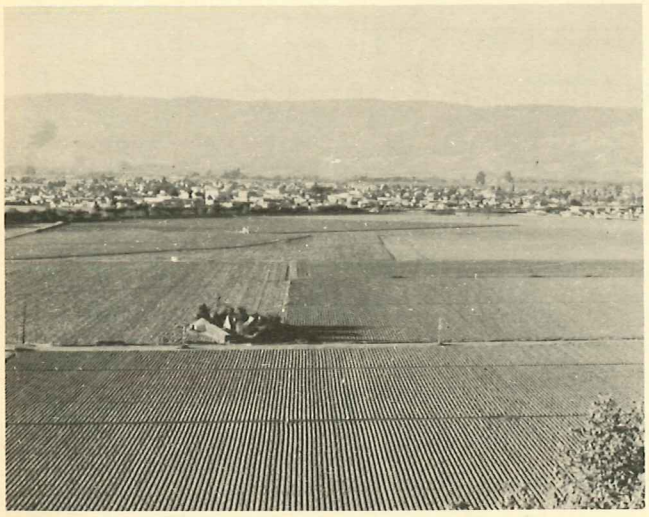
GOOD LAND IS A PRICELESS ASSET

Land is an indispensable natural resource. Products of the land furnish us food, fiber, wood and a long list of materials for industry. Watersheds made up of farms, ranches, forests and mountains, yield the water needed for irrigation, home and industrial uses. The well-being of the Nation, State, community or individual farm is measured by the sustained productivity of the land. Whether the future brings peace or war, the proper use of our land resources is of vital concern to every citizen of the State and Nation. If land is damaged by floods, erosion, or in other ways, the Nation loses valuable productive capacity. Without the products of our land we cannot live.

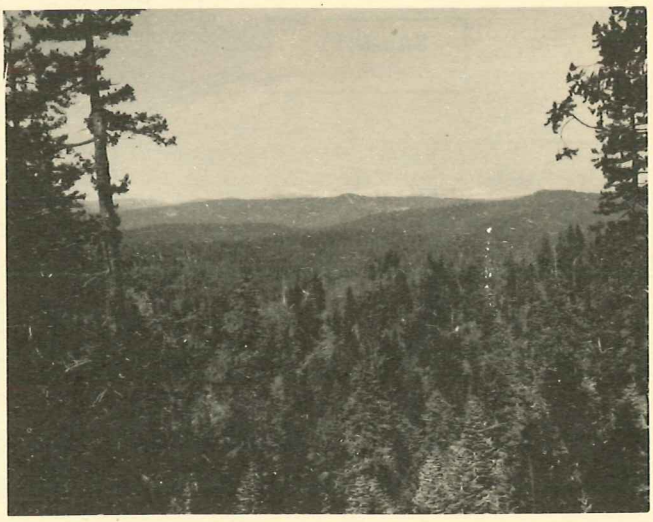
California consists of a little more than 100 million acres. Some of the best and some of the poorest land in the Country is found here. Of the total area in the State, about 10½ percent is used for crops, 28½ percent for grazing, 36 percent for forests and watershed, 4 percent for road, urban and industrial uses, and 21 percent is barren waste, mostly in the desert.

The food and fiber produced from this land is helping support the State's rapidly growing population. Sizable quantities of agricultural products are also exported. Since 1940 the State's population has increased over 3½ million, a little over a 50 percent increase in 10 years. With a present population of about 10½ million we now have about one acre of land in crops for each person in the State. It has been predicted that the population by 1960 will be approximately 14 million. To support this growing population will require a permanently prosperous agriculture—one in which all our land is used within its capability and treated according to its needs. Similar growth trends in agriculture and industry serve to emphasize the need to conserve and develop our land and water resources.

California lands are characterized by extreme variation in type of soil, slope, erosion, climate, flood hazard and related factors. These differences have a decided influence on wise land use and management. Detailed facts on the amount, character and distribution of our land resources are needed to guide sound programs for their development, improvement and conservation. Land inventories in sufficient detail for individual farm planning are in progress in 72 soil conservation districts and other areas of the State. The rate of progress on these detailed surveys is necessarily slow. It will require many years to cover the whole State at the present



A view of the prosperous irrigated agriculture in the Pajaro Valley near Watsonville



Well managed watersheds safeguard the quantity and quality of our water supply

rate of progress. In the meantime general information has to be used to guide state-wide program planning and education in soil conservation.

During 1949 and 1950 the Soil Conservation Service in cooperation with other agencies completed a rapid coverage reconnaissance land-capability survey of each county in the State. Information regarding soil, slope, erosion, drainage and land use was compiled on county maps at a scale of one-fourth inch to the mile. From these land facts a land-capability map was prepared for each county. These county maps were used in compiling the generalized Land-capability Map of California included with this publication. The State Land-capability Map is intended for use in general program planning and soil conservation education until such time as detailed land-capability surveys can be completed. It is not detailed enough to show specific land conditions on an individual farm or ranch.

FACTS ABOUT CALIFORNIA LAND

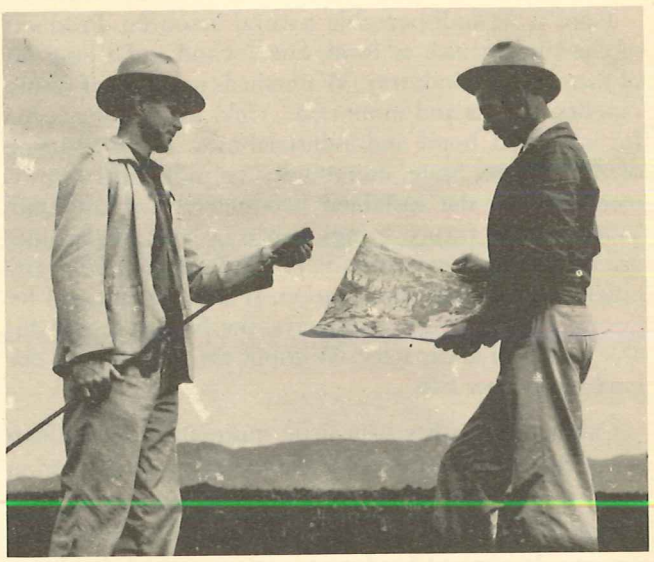
Land Differs From Place to Place

The common belief that all the land in one valley is good and the land in another valley is poor is far from the truth. Normally land varies considerably from area to area, farm to farm, and field to field. We can find, for example, some of the poorest and some of the best land in the different fields of a single farm in the San Joaquin Valley—one of the most productive valleys in the State.

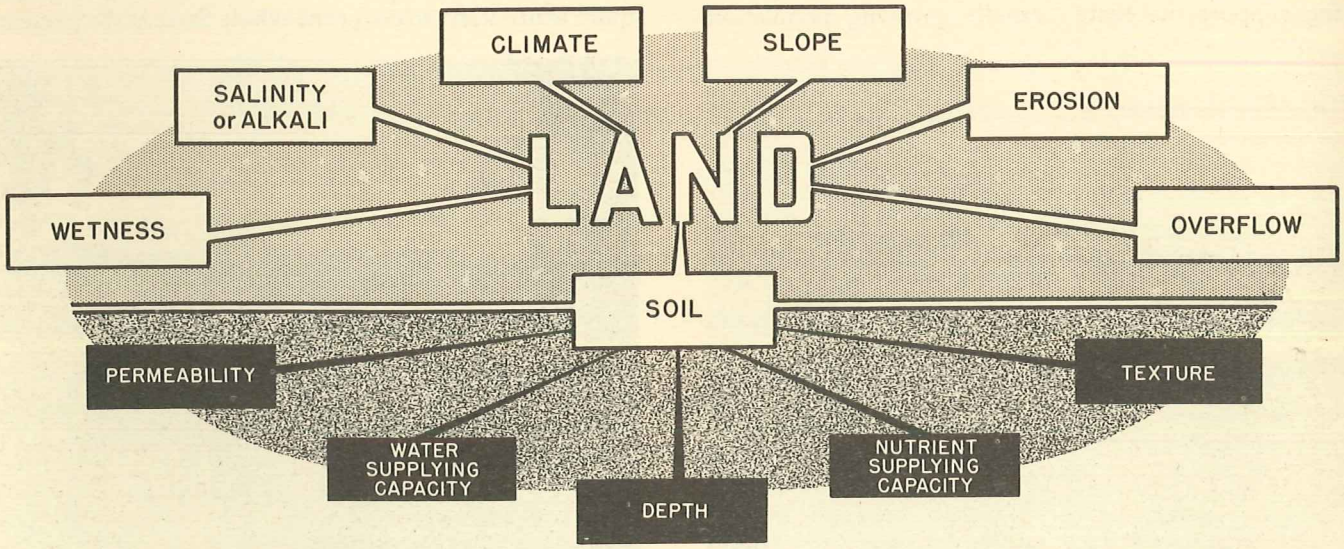
The factors that need to be studied in determining the best safe use for land are shown in the chart below.

Soil depth, texture, permeability, water-holding capacity and nutrient-supplying capacity are some of the most important soil properties influencing plant growth. These properties of the soil are best determined by studying the soil in the field and in the laboratory.

Soil depth and profile characteristics are determined by examining the soil in the field with a soil auger.



Soils are sampled below the surface by using a soil auger. The findings are recorded on aerial base maps.

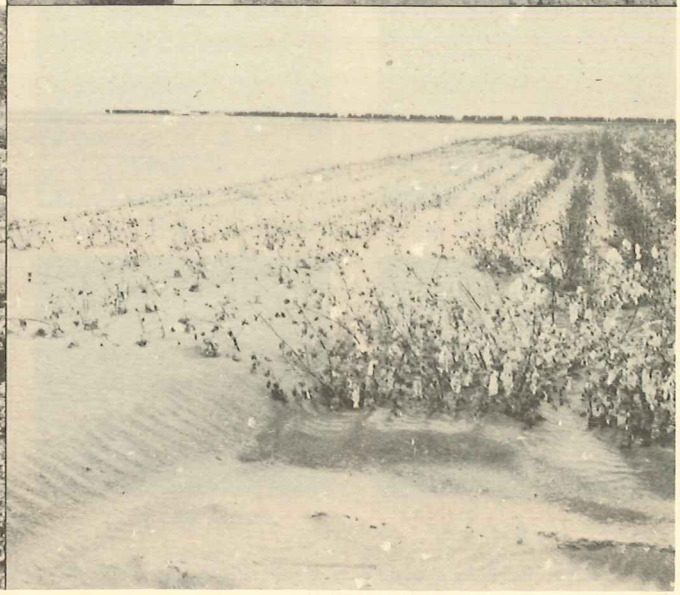


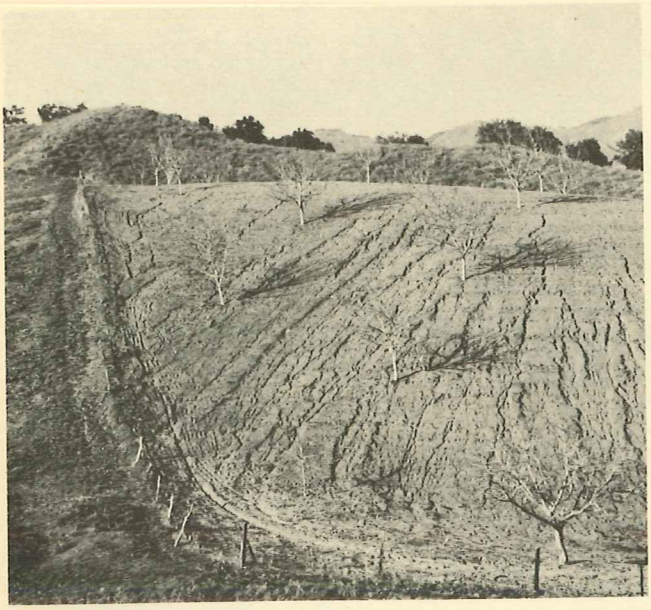
(ABOVE) A road cut showing very shallow soil over volcanic ash. (ABOVE, RIGHT) Profile showing about a foot of soil underlain by a dense claypan which restricts root and moisture penetration. (RIGHT) Deep, medium-textured soil growing walnuts. Note depth of roots.

Road cuts or other vertical sections through the soil provide a good opportunity to study the subsoil, depth of root penetration and other below-surface features.

Soils vary widely as to the amount of sand, silt and clay in the surface soil.

(BELOW) Heavy-textured clay soils have a high moisture-holding capacity and plant food supply, but are very difficult to cultivate. (BELOW, RIGHT) Light-textured sandy soils are easy to work but have a low moisture-holding capacity and plant food supply and are subject to wind erosion.

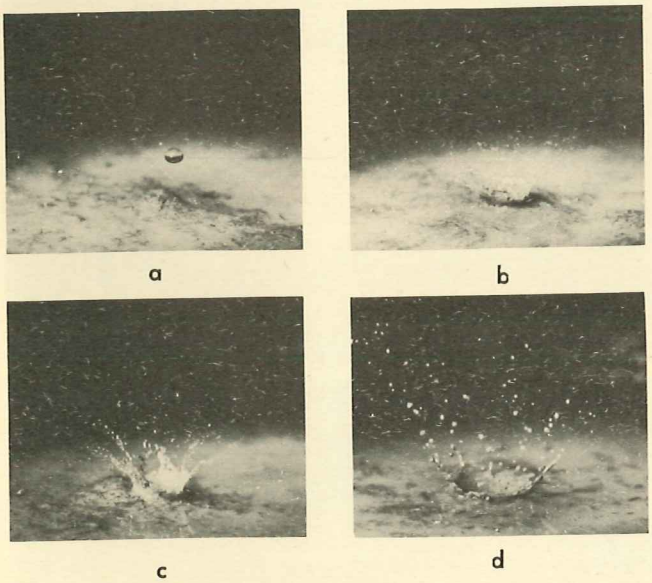




This land is too steep for clean cultivation. Note the severe soil erosion on the cultivated portions (right) and absence of soil loss where protected by vegetation (left).

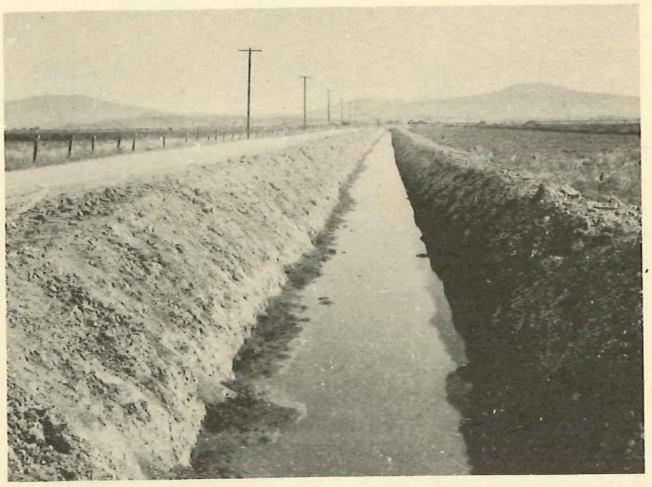
The slope of the land affects velocity of water runoff, rate of soil erosion, method of irrigation, use of farm machinery and other operations having a bearing on good land use.

Forest litter, grass, cover crops, and surface mulches provide an ideal cover to protect land against the bombardment of rains. Clean tillage, burning of litter, and overgrazing expose the soil to the direct impact of the rain and wind and open the way for soil erosion. The impact of raindrops on bare soil splashes soil into suspension. This produces muddy water which tends to seal the pores in the soil making it less absorptive.



The soil splash caused by a single drop of rain striking bare soil is shown in four stages (a to d)

Other lands are flat but have problems caused by high water table or ponding of surface runoff.



A high water table causes poor soil aeration and restricts root penetration. Open drainage ditches are one method of removing excess water.

Toxic amounts of salts (saline or alkali) may be brought up to the surface of the soil when the water table is too high.

Some of the most productive soils in the State occur along streams and rivers which periodically flood, causing land and property damage.

Overflow has deposited debris on this land while bank cutting has destroyed several large productive walnut trees

The position that land occupies in a watershed must be considered in arriving at its best safe use.

Finally the climate of an area must be evaluated. A good soil in the desert is essentially worthless for agricultural production until water can be developed for irrigation. An equally good soil at high elevation might also have little value because of a short growing season which limits the crops that may be grown.

These examples serve to illustrate some of the more important ways that land differs and emphasize the need to know our land in planning for its most productive permanent use.

Collection of Land Facts

Most land users know the places where crops grow well and where they do poorly. They do not, however, always know the reason for the differences in plant growth nor how to correct the causes of poor growth.

Soil scientists trained in soil conservation surveying can help determine the problems of the land just as doctors diagnose the ills of humans. In both instances a thorough examination of the conditions is needed to determine the causes and the corrective measures needed.

A soil scientist, in making a physical examination or inventory of your land, studies such surface features as slope, erosion, soil texture, and position with respect to overflow. He also studies the conditions below the surface by boring into the earth's surface with a soil auger. This enables him to determine the depth of the soil, the ease with which roots and moisture can move through the soil and the ability of the soil to supply moisture and food for plant growth. The nature, extent and distribution of the significant differences in land are recorded on a suitable base map.

The next step is to classify these land facts in a simple, convenient form for use. This job requires the combined judgment of people trained in plant science, soils and engineering, as well as the experience of farmers and other users of the land. Lands having similar suitability for use and similar management requirements are placed in the same land capability class.

THE LAND-CAPABILITY CLASSIFICATION

Land Facts Are Organized for Convenient Use

The land-capability classification is a systematic arrangement of the different kinds of land according to those properties that determine its ability to produce permanently. Experience has shown that for practical purposes all land can be placed in eight broad land-capability classes. The eight classes range from the best, most easily farmed land (Class I) to land which has no value for cultivation, grazing or forestry use but may be suitable for wild life, recreation, or protection of water supplies (Class VIII).

The eight land-capability classes are *briefly* defined.

Land Suited for Cultivation

Class I. Very good cultivable land.

Class II. Good cultivable land with minor limitations in use.

Class III. Moderately good cultivable land with major limitations in use.

Class IV. Fairly good land suited only for limited or occasional cultivation.

Land Not Suited for Cultivation

Class V. Very well suited for grazing or forestry.

Class VI. Well suited for grazing or forestry with minor limitations in use.

Class VII. Fairly well suited for grazing or forestry with major limitations in use.

Class VIII. Land not suited for cultivation, grazing or forestry. It may be used for wild life, recreation, or protection of water supplies.

The kind of problems or limitations of the land included in any one of the capability classes (except Class I) may vary considerably from place to place. For example, one piece of land may be in Class II because of a drainage problem, while another may be in Class II because of slope that brings about an erosion problem. Since drainage problems require corrective practices that are distinctly different from erosion-control practices, it is helpful to divide the land-capability classes into subclasses based on the kind of limitations. The four most commonly recognized subclasses are briefly defined:

e—Land limited in use by erosion or slope or both.

w—Land limited in use by excessive water in the soil, or by flooding.

s—Land limited in use by unfavorable soil conditions such as shallowness, coarse texture, alkalinity or salinity.

c—Land limited in use by adverse climatic conditions, such as very low rainfall where water for irrigation is not expected in the foreseeable future.

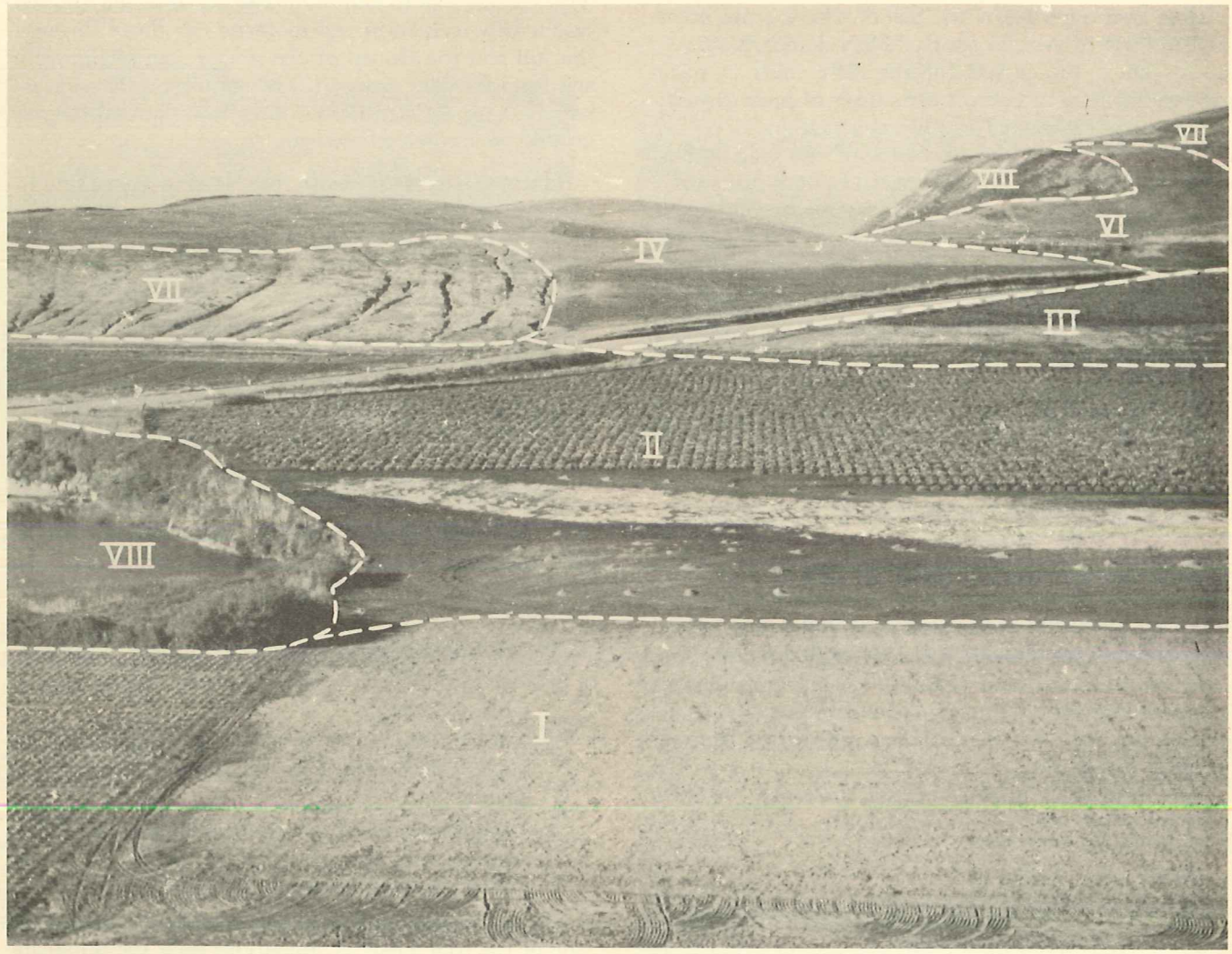
When a single piece of land is affected by more than one of the four kinds of limitations only the dominant one is indicated.

A further segregation of land limitations within a given subclass into capability units is sometimes desirable. The capability unit indicates the specific kind of limitation. In the case of subclass "w" for excess water, for example, land affected by high water table may be separated from land subject to flooding.

Briefly summarizing, the land-capability classification, like other classification systems, has different levels or categories of information. The four categories of the capability classification ranging from the most general to the most specific, are:

1. Two land-capability *divisions* showing land suitable for cultivation and land not suitable for cultivation.
2. Eight land-capability *classes* based on *intensity of limitation.*
3. Four land-capability *subclasses* based on *kind of limitation.*
4. Land-capability *units* as needed to show *specific kind of condition.*

Landscape showing capability classes in San Mateo County



LAND-CAPABILITY DEFINITIONS

LAND SUITABLE FOR CULTIVATION				LAND NOT SUITABLE FOR CULTIVATION			
VERY GOOD LAND with no limitations	GOOD LAND with minor limitations	MODERATELY GOOD LAND with major limitations	FAIRLY GOOD LAND with occasional cultivation and major limitations	SUITABLE FOR RANGE AND WOODLAND with no limitations	with minor limitations	with major limitations	SUITABLE FOR WILDLIFE AND WATERSHED
DEGREE OF PERMANENT LIMITATIONS →							
CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V	CLASS VI	CLASS VII	CLASS VIII

Choosing Practices to Fit the Land

Each land-capability unit has distinctive crop adaptations, production potentialities, or treatment needs. Recommendations for the good use and conservation of the land in each unit are brought together and summarized in a technical guide for soil conservation. This job, like the one of land-capability classification, calls for combined judgment of many people. Training in soil science, plant science, and engineering must be utilized, along with the experience of practical farmers. The recommendations are based on farmers' experience, field observations, and research findings. They are revised from time to time as new facts are discovered. Detailed recommendations for the use and conservation of each kind of land are prepared in convenient tabular form. Copies are available for reference at offices of soil conservation districts throughout the State. A very general table on page 20 shows the nature of some of the most common recommendations, and how they are organized.

Land-capability Surveys in California

The job of inventorying, classifying and preparing recommendations for use and conservation of land can be carried out in detail or on a general reconnaissance basis depending on the objective. The objective of the detailed land-capability surveys in soil conservation districts is to collect land information in sufficient detail for individual farm and ranch plans. The completed detailed capability surveys are available for reference at soil conservation district offices.

The reconnaissance land-capability survey made of every county in California was part of a state-wide land and water inventory. This job involved a study of all available information from soil surveys, detailed soil conservation surveys, flood control reports, vegetative type surveys and other sources of information. After accumulation of all available information on soils and related land conditions, about two weeks were spent in the field in each county completing and checking the capability classification. At the time of this field review, a data sheet (similar to Table 1) showing land-capability and land use for each area drawn on the county maps was completed. The land-capability classification shown on the maps only indicates the dominant land-capability for an area, while the data sheets were used to record estimates of actual land-capability and land use. The acreage data presented in this publication on land-capability and land use were obtained by summarizing the data sheets for each capability area (and watershed portion thereof) into county totals. The county totals were summarized to give the state total. The portions of watersheds in counties were totaled for 97 minor watersheds and these in turn were summarized to eight major watersheds or basins which are discussed later.

LAND RESOURCES IN CALIFORNIA

The results of this survey for the whole State are summarized in Table 1. Since there are just over a hundred million acres in the State (100,353,920 acres), the acreage figures can readily be converted to approximate percentages by pointing off six places. This relationship is helpful in analyzing these results.

TABLE 1

LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE, STATE OF CALIFORNIA

Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	1,633,160		1,633,160	1,580,590	52,270	300	
II	5,076,950	e	1,935,240	1,377,710	549,660	7,870	
		w	1,272,500	1,099,860	172,030	610	
		s	1,869,210	1,477,780	389,790	1,640	
III	5,647,250	e	2,258,870	1,223,450	964,660	70,760	
		w	1,393,020	1,014,980	374,880	3,160	
		s	1,995,360	1,321,260	652,780	21,320	
IV	4,241,020	e	2,236,360	679,260	1,380,870	176,230	
		w	412,330	142,550	268,740	1,040	
		s	1,527,040	443,940	1,043,950	39,150	
		c	65,290	5,660	59,630		
V	250,650	w	250,650	9,390	241,260		
VI	16,353,230	e	11,831,820	176,530	7,163,480	4,491,810	
		w	251,080	2,640	243,030	5,410	
		s	2,020,330	19,640	1,645,490	355,200	
		c	2,250,000		1,578,390	671,610	
VII	30,549,860	e	20,290,380	3,850	6,484,490	13,802,490	
		w	187,090		164,220	22,870	
		s	6,882,060		3,025,480	3,856,580	
		c	3,189,880		2,043,570	1,146,310	
VIII	32,906,260	e	1,554,420		15,670	542,250	996,500
		w	386,790		3,170	15,710	367,910
		s	24,928,870		38,350	10,770,910	14,119,610
		c	6,036,180			138,000	5,898,180
Unclassified	3,695,540						*3,695,540
Totals	100,353,920		96,658,380	10,579,090	28,555,860	36,141,230	25,077,740

*Cities and towns—1,332,790; roads and railroads—1,354,650; other—1,008,100.

The data given in Table 1 on land-capability and present land use is graphically presented in the bar graph shown in Figure 1. It shows the relationship between actual land use and potentialities for use. The present use is shown by the hachures on the bars and the potentialities for use by the capability classification.

A brief analysis of the results given in Table 1 reveals some interesting facts. For example:

1. Of the 100,353,920 acres in the State only about 10.5 percent is now being cropped, 28.5 percent is used dominantly for grazing and 36 percent for forestry and watershed purposes. The remaining 25 percent is in desert waste, barren mountain tops, cities, towns and roads.
2. Over 3 million acres of land suitable for *regular* cultivation (Capability Classes I, II and III) and 2¾ million acres of land suitable for *limited* cultivation in rotation with improved pastures (Class IV land) are now being grazed.
3. The crop and improved pasture lands of the State could therefore be increased by about 6 million acres if all the suitable land were developed to its full capability.
4. About 1 million acres of land in Classes IV and VI is being regularly cultivated and planted to erosion-inducing crops. Use of this land should be limited to close-growing forage and pasture crops.
5. There are several million acres of range and brush land in capability Class VI that could be greatly improved by fertilization, brush clearing and seeding to improved grass species.

The adjustments and expansion in cropland will not be fully realized for many years because most of the suitable land occurs in small acreages on individual farms and ranches scattered over the State. Also an ever-increasing acreage of good land is being used for urban development, highways and other nonagricultural uses. Because of the scattered occurrence of this land it can best be located and fully developed by detailed land-capability surveys and conservation plans on individual farms and ranches similar to those being made in soil conservation districts. The development of these small areas of under-utilized land offers part of the solution to the soil erosion problem on many farms and ranches. For the State as a whole the land capable of more intensive production far exceeds the acreage that is too intensively used to permit erosion control by known practical soil conservation practices. There are, however, some areas of erodible soils in the State, particularly in the central and southern coastal sections, where individual operating units do not have sufficient land capable of development to offset their critically eroding land. In these areas, a reduction in the acreage of cropland by a shift in enterprise from cash crops to livestock may be the best solution from a conservation point of view.

TABLE 2

SUMMARY OF SUBCLASSES IN CALIFORNIA

Subclass		Land suitable for cultivation	Land not suitable for cultivation	Total acres
Symbol	Dominant limitation or hazard	Acres	Acres	
e	Erosion and/or slope	6,430,470	33,677,070	40,107,540
w	Wetness or overflow	3,077,850	1,075,610	4,153,460
s	Soil depth, texture or alkali	5,391,610	33,831,260	39,222,870
c	Climate—lack of moisture	65,290	11,476,060	11,541,350
	None (Class I)	1,633,160		1,633,160
	Total	16,598,380	80,060,000	96,658,380
			Unclassified	3,695,540
			Total acres in state	100,353,920

Development and permanent maintenance of the available land to its full capacity will require the installation and maintenance of a large number of erosion-control, conservation irrigation, drainage, flood control, range and woodland management practices. The acreage of land needing different types of practices is obtained by summarizing the subclasses given in Table 1. This information is presented in Table 2.

These results show that:

1. Actual or potential erosion is the dominant hazard on 40 percent of the land in California if the land is not properly used and protected by soil conservation practices.
2. Over 4 percent of the State needs drainage improvement and flood protection, or maintenance of these practices where they are already installed.
3. The dominant problem in the use of 39 percent of California lands is due to soil limitations such as shallowness, unfavorable surface texture, lack of fertility and accumulation of toxic amounts of salts.
4. Lack of moisture is the dominant factor limiting use of 11½ percent of the land in California. This land occurs primarily in the desert areas where water for irrigation is not expected to be made available. Land that is in need of irrigation but for which water is being, or is expected to be developed in the foreseeable future, was classified on the basis of its capability when irrigated.

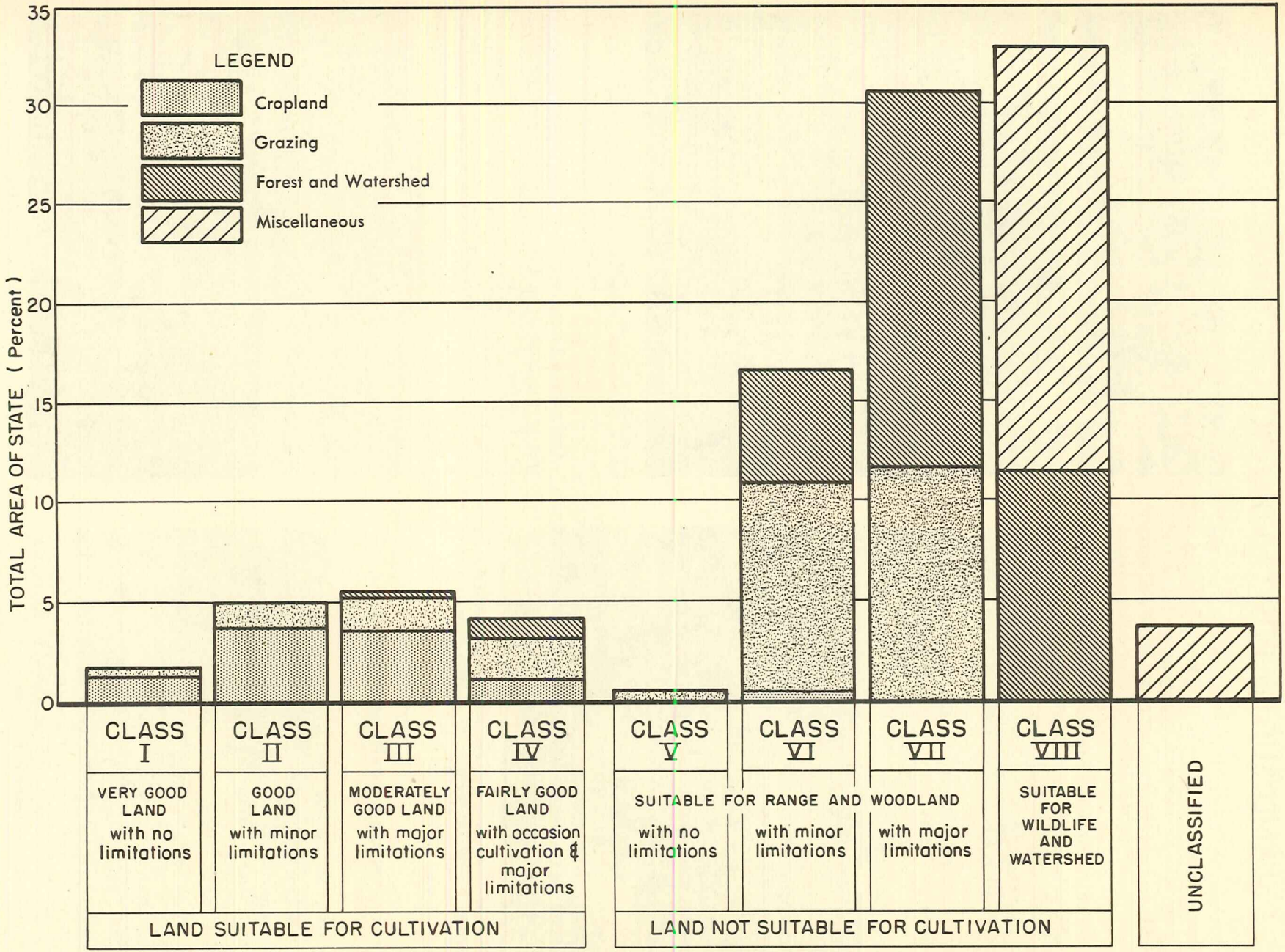
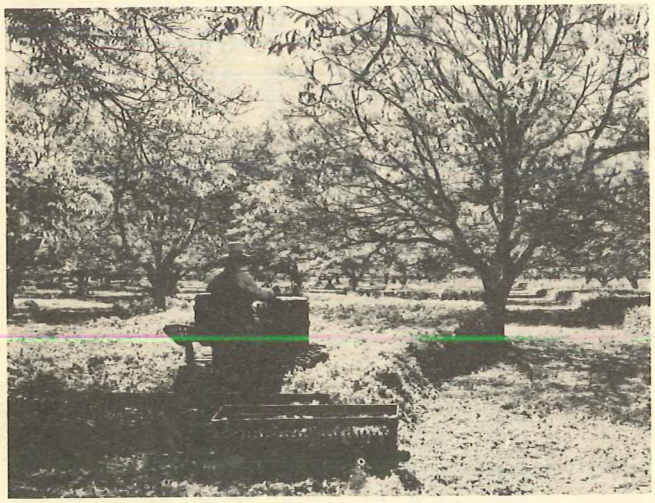


Figure 1. Bar Graph Showing Land Use by Land Capability

LAND SUITED FOR CULTIVATION IN CALIFORNIA

Land-capability Classes I, II, III and IV include the land that is suitable for cultivation. The range in capability from I to IV indicates increasing problems and limitations in using the land. There are 16,598,380 acres of land in California that are suitable for cultivation, of which 10,367,040 are now being cultivated.

Class I (light green on map) is very good cultivable land. The soil is deep, easily worked and well adapted to a wide variety of crops. It is nearly level and has little or no erosion problem. Drainage is good and the soil has a good capacity for supply moisture and nutrients for plant growth. This is usually the best land for deep-rooted tree crops. Although Class I land does not have any special problems or limitations in use, it does require good farming practices to maintain soil fertility and soil structure.

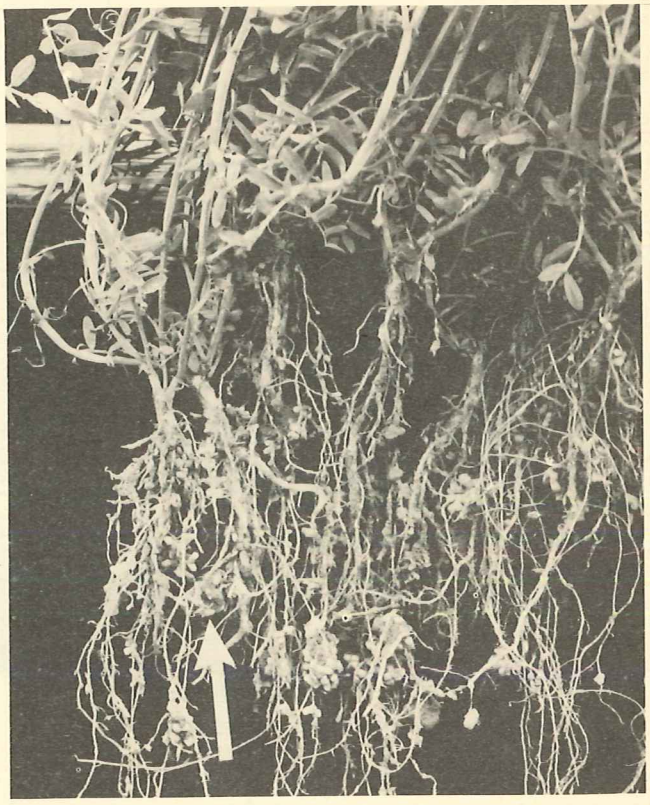


Class I land where a cover crop planted early and fertilized is the principal practice required. Ten or twelve tons of green manure are added to each acre when the crop is worked down.

Some of the common good farming practices are:

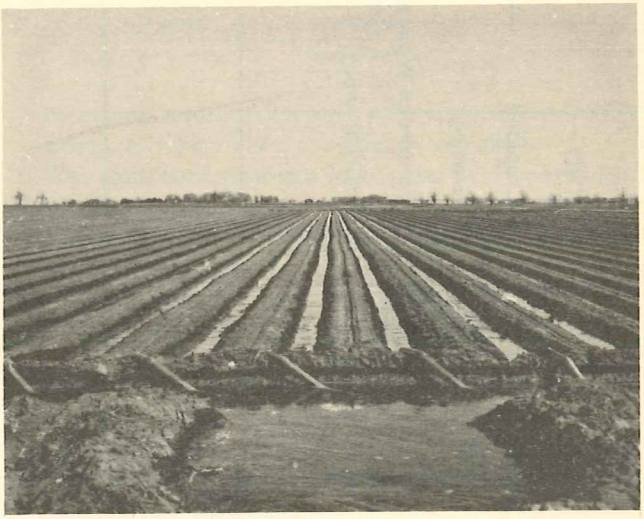
1. Rotate crops; use soil-building legumes in the rotation.
2. Grow green-manure crops; include legumes like vetch and clover.
3. Use stubble-mulch cultivation; returning all crop residues such as straw and stubble to the surface of the soil.
4. Use best irrigation practices to avoid waste of water, loss of soil, and loss of plant food.
5. Use fertilizer and manure to maintain productivity.

Some leveling may be required on Class I land to make most efficient use of irrigation water. The frequency and amount of irrigation should be adjusted to the soil and crop requirements.



The nodules on the roots of legumes take nitrogen from the air. When these legumes are turned under this nitrogen becomes available for use by other crops.

Only about 1.6 percent (1,633,160 acres) of the total area of the State is in Class I land. All except about 50,000 acres of this very good land is cultivated and used in the production of agricultural crops. The main bodies are scattered throughout the Sacramento and San Joaquin Valleys. Smaller areas are found in the coastal valleys of the central and southern part of the State.



Conservation irrigation saves water, soil and plant food

Class II (yellow on map) is good cultivable land. It has minor limitations such as moderately deep soil, gentle slopes, slight alkali or drainage problems. These limitations influence the manner of farming and selection of crops. Easily applied soil conservation measures to protect and improve Class II land are required for safe and maximum production. A total of 5,076,950 acres, or about 5 percent of the total area of the State, is in this land class. The three different kinds of Class II land are shown by subclasses.

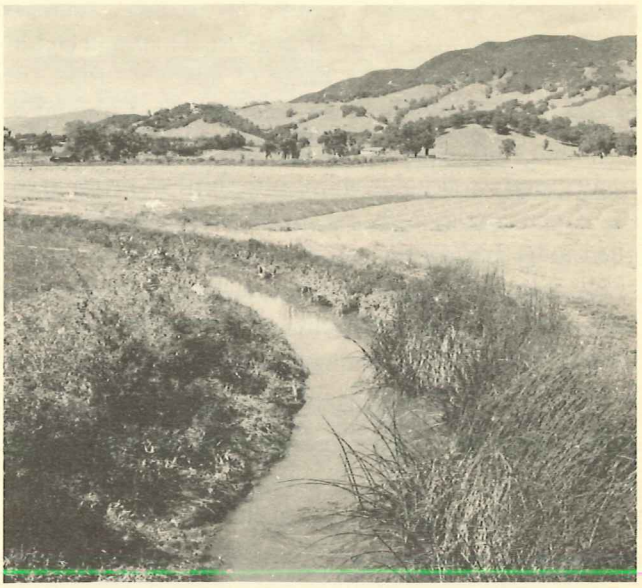
Contour subsoiling on Subclass IIe land helps to save water and soil. The soil is opened up to permit more rapid penetration of rainfall.

Subclass IIe is limited in use by erosion or slope problems. The slope of the land varies from about 2 to 8 percent. If slope is not considered in the selection of cropping systems and manner of cultivation, loss of soil by erosion is likely to occur. Part of the IIe land is flat sandy land subject to wind erosion. In addition to the good farming practices listed above for Class I, such additional practices as winter cover crops, contour farming, and control of runoff water may be needed to prevent soil loss.

Strip cropping helps to prevent wind and water erosion in the Antelope Valley Soil Conservation District. The straight strips in the background control wind erosion while the contour strips in the foreground are for water erosion control.

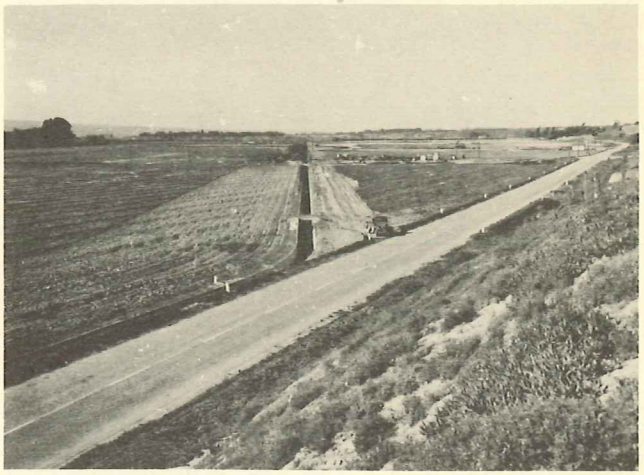
Strip cropping and careful attention to stubble-mulch tillage may be needed on sandy land subject to wind erosion. Wind strips should be laid out at right angles to the general direction of the wind.

Subclass IIe land occupies about 1.9 percent (1,935,240 acres) of the total area in the State. It is made up mostly of gently sloping land in the central and coastal valleys.



An open drainage ditch in the foreground and vegetative waterway in the background help regulate the water table on this Subclass IIw land in Lake County.

Subclass IIw has minor limitations in use due to poor drainage, water ponding, or flooding. A water-logged soil is poorly aerated and not well suited for most crops. Tile or open ditch drainage systems are needed to lower the water table, improve soil aeration and increase the variety of crops that can be grown. Land that is subject to overflow is not well adapted to crops that need to be cultivated during the flood season.

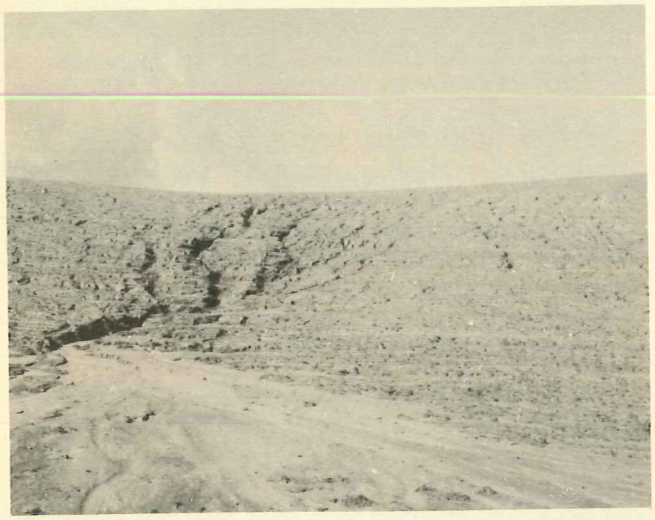


Adapted truck crops and other summer growing crops are well suited to this kind of overflow land. To prevent flooding it is often necessary to improve existing channels to dispose of excess water.

IIw land occupies about 1.3 percent (1,272,500 acres) of the total area in the State. Drainage systems have already been installed on much of this area. These systems, however, must be maintained for continued successful operation.

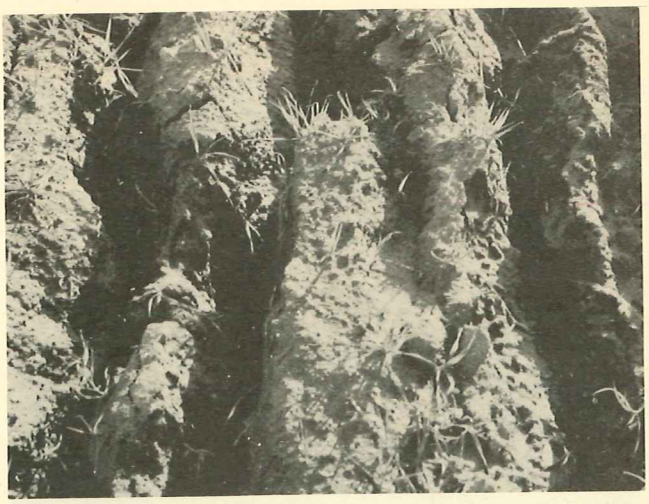
Subclass IIs land has minor problems caused by unfavorable soil conditions such as shallowness, sandy or very heavy clay surface texture, or excessive amounts of salts that are toxic to plant growth. These soil conditions tend to restrict the range of adapted crops, the timing of cultivation, and the frequency and amount of irrigation water that can be applied efficiently. For example, sandy soil holds about one-third as much available water as clay soils. Irrigation water should be applied more frequently and in smaller quantities on the sandy soils. Saline lands may be improved by leaching with water, the turning under of green-manure crops, the addition of barnyard manure, and by other methods.

Extensive areas of IIs land are found in the San Joaquin Valley with smaller acreages in other valleys of the State. A total of 1,869,210 acres, or about 1.8 percent, of the total area in the State is in this subclass.



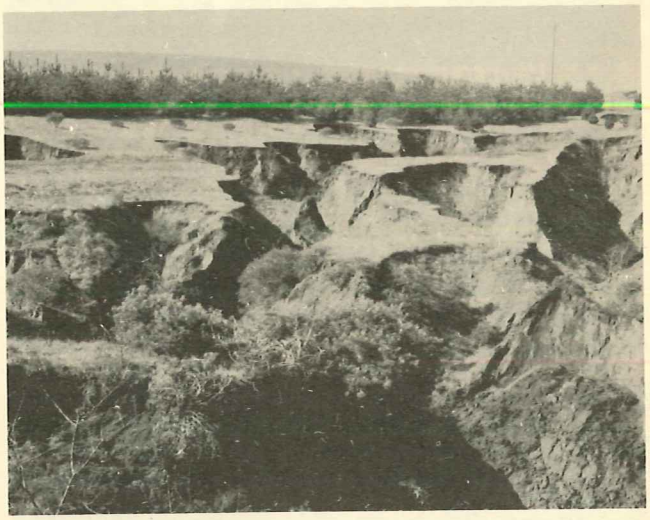
Clean cultivation of steeply sloping land leads to sheet and rill erosion. Soil washed from hillsides is deposited on better land below.

Class III (red on map) is moderately good cultivable land. It has major limitations in use because of slope, erosion problems, shallowness of soil, water-logging, or other hazards. More intensive application of erosion control, drainage, flood protection and other practices are needed than on Class II land. The number of crops that can be grown safely on Class III is less than on Class II land. A total of 5,647,250 acres, about 5.6 percent of the total area of the State, is in this land class. The three different kinds of Class III land are shown by subclasses.



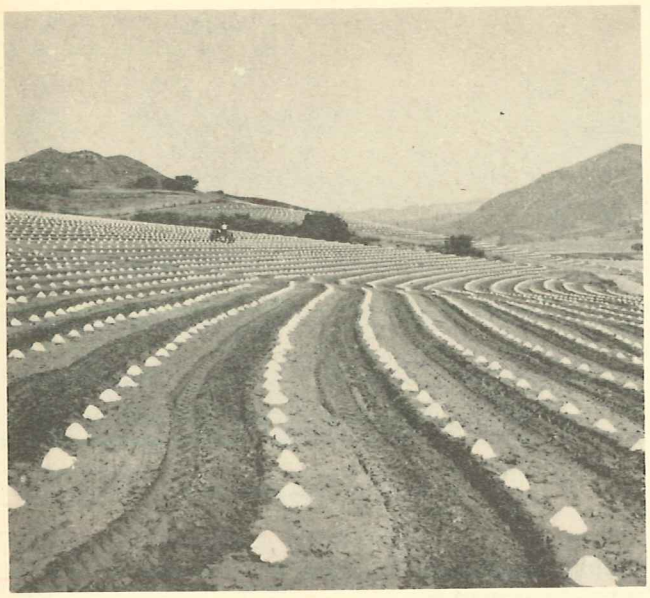
Close-up of severe rill erosion caused by up and down hill cultivation

Subclass IIIe is primarily limited in use by erosion or slope problems. Slopes vary chiefly from about 8 to 15 percent. Land on such slopes should be used for close-growing soil-building crops at least 50 percent of the time. A proper system of cropping needs to be supported by locally adapted erosion-control practices such as contour cultivation, contour planting, diversion terraces and stubble-mulch tillage.



Improper use and management on the upper portions of a watershed may cause severe gully erosion on the lower-lying valley land.

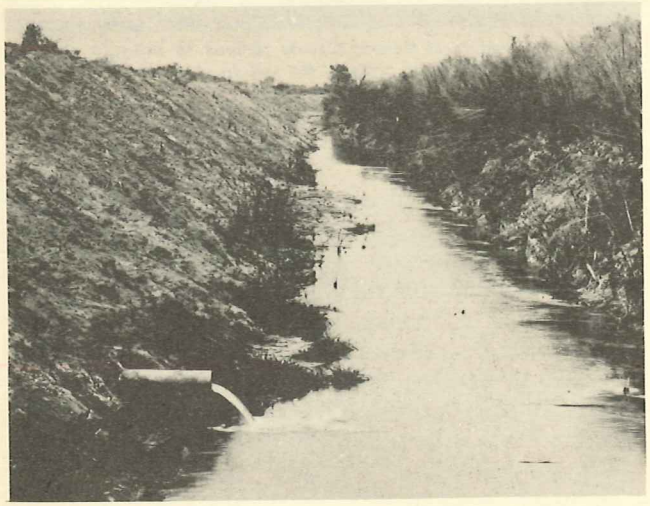
Some of the IIIe land has gentle slopes but is subject to severe damage by wind erosion because of the sandy nature of the soil. A combination of strip-cropping and stubble-mulch tillage is needed in addition to the good farming practices given for Class I land. Subclass IIIe occupies 2,258,870 acres, or about 2.3 percent of the total area of the State. The main areas of this kind of land are found in the central and southern coastal sections of the State. A large area of IIIe land subject to wind erosion occurs in the southern part of the San Joaquin Valley.



This field of young tomatoes is properly cultivated and planted on the contour to hold soil and water. Contours are on irrigation grade. The white caps are to protect the young tomato plants from frost damage.

Subclass IIIw has major limitations in use due to poor drainage and flooding. The soil is generally heavy-textured, making it rather difficult to remove the excess water. Toxic amounts of salts may accumulate in the soil because of the poor soil drainage. These salts are of a type that can be removed by drainage. Shallow-rooted vegetable and pasture crops and moisture-loving crops such as rice do best on this land. Improvement of drainage by open ditch drainage systems is usually necessary before adapted crops can be successfully grown. Drainage ditches lower the water table, help remove excess salts, and improve soil aeration.

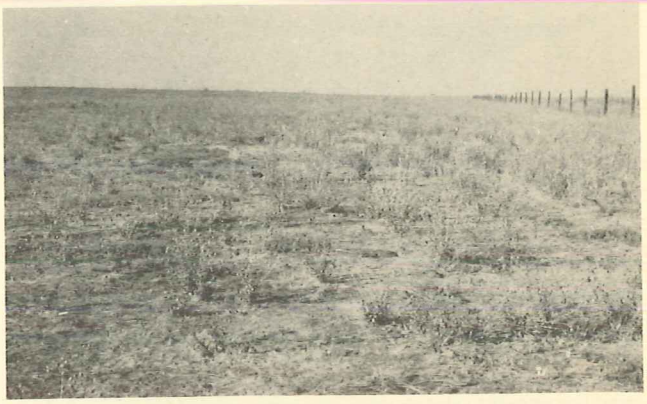
About 15 percent of the IIIw land occurs along streams and is subject to damage by flooding and overflow. Land of this type requires protection from flood by dikes and levees.



Excess soil water is removed from adjacent fields by tile drains and emptied into large open ditch drains

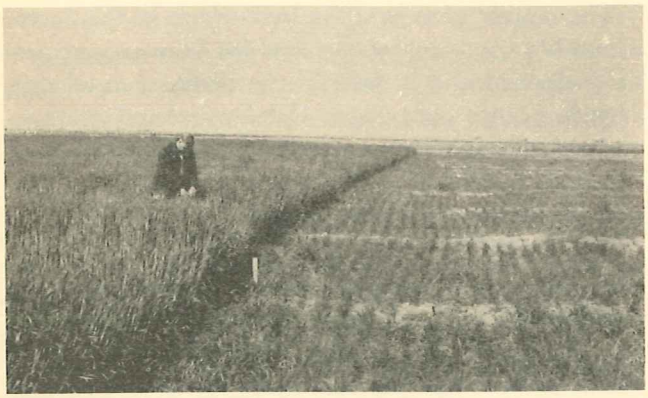
The largest areas of IIIw land occur in the Sacramento Valley. Much of this land has been at least partially drained and is used in the production of rice, vegetable crops and pasture. Maintenance and improvement of drainage will be a continuing need on much of this land. A total of 1,393,020 acres, or about 1.4 percent of the State, is in this subclass.

Subclass IIIs has major problems caused by unfavorable inherent soil conditions such as shallowness, sandy or heavy clay surface texture, or presence of alkali salts that are toxic to plant growth. Extensive areas of gently rolling shallow hardpan land along the eastern edge of the Sacramento and San Joaquin Valleys are in this subclass. This land is best adapted to shallow-rooted grain and pasture crops. The alkali lands classified as IIIs are chiefly located in the San Joaquin Valley. The salts are such that intensive corrective measures are needed to remove them and to improve the land for cultivation. Usually a combination of improved drainage, leveling, irrigation, leaching, addition of manure and gypsum or sulphur is necessary before this kind of land is suitable for crop production. The type of crop is then limited to cotton, beets, alfalfa and irrigated pastures that can tolerate some salts. Subclass IIIs occupies 1,995,360 acres, or about 2 percent of the total area of the State.



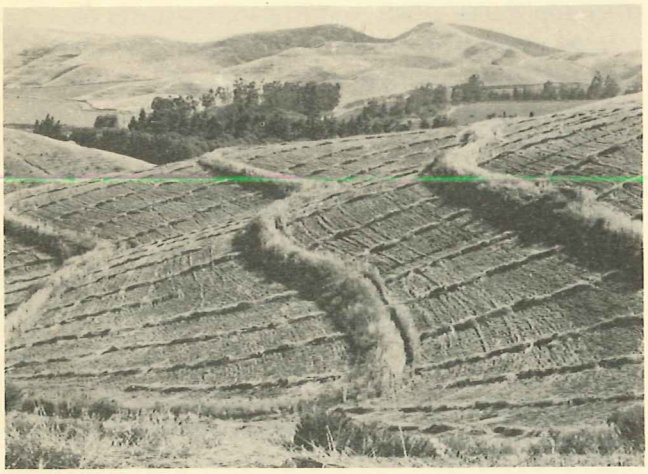
Subclass IIIs land before improvement. Sparse alkali-tolerant plants.

Land leveled and prepared for treatment. Gypsum has been added, then water applied and allowed to leach through the soil.



Treatment of three tons per acre of gypsum, with leaching and drainage. (LEFT) Cover crop of barley and vetch. (RIGHT) First year of pasture establishment using a mixture of tall fescue and birdsfoot trefoil.

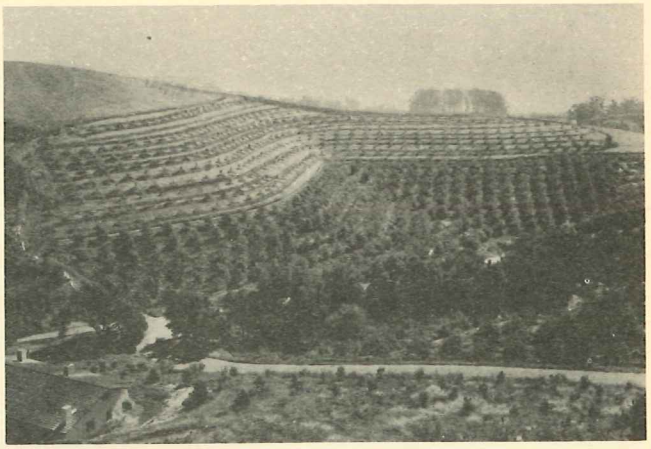
Class IV land (blue on map) is fairly good land that is suited to occasional or limited cultivation. Its use is limited by steep slopes, shallow soils, poor drainage, alkali, and other adverse conditions. It is best suited for hay and pasture or for orchard or vineyards that are protected by cover crops. There are 4,241,020 acres, or about 4.2 percent of the total area of the State, in this land class.



Subclass IVe land once used for beans is planted to close-growing alfalfa. The diversion terraces move any excess rainfall off the land slowly, thus preventing soil loss.

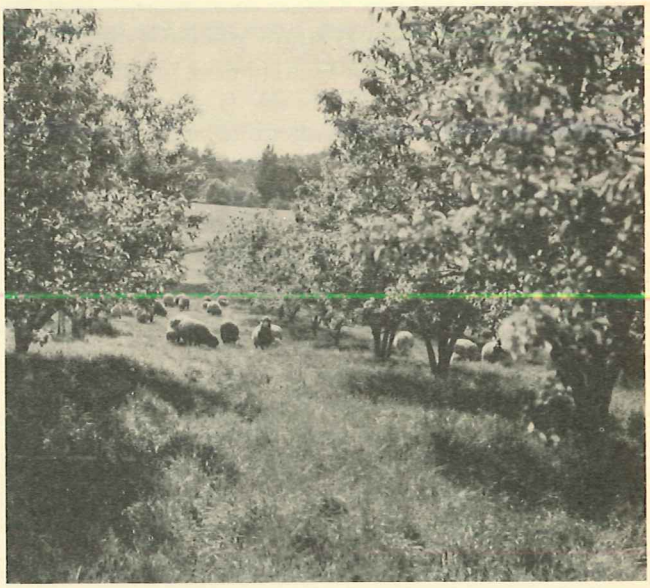
Subclass IVe is primarily limited in use by erosion or slope problems. The slope of this land ranges from about 15 to 25 percent. Erosion is an actual or potential problem on all this land if not properly used and protected. A considerable acreage of this land in the central and southern coastal sections of California is used for grain, beans, and other regularly cultivated crops. Soil losses by water erosion are alarmingly high. Some progress has been made in converting these lands to perennial hay and pasture.

Many citrus and avocado orchards in Southern California are being successfully grown on this land using contour bench terraces with permanently vegetated terrace risers.



Subclass IVe land in San Diego County that has been bench-terraced on the contour and planted to lemons

Erosion is very effectively controlled on hillside deciduous orchards by using a permanent cover and sprinkler irrigation.



Subclass IVe land in El Dorado County planted to pears. A sprinkler-irrigated permanent cover protects the soil from erosion and provides forage for sheep.

A total of 2,236,360 acres, or about 2.2 percent of the State, is in Subclass IVe.

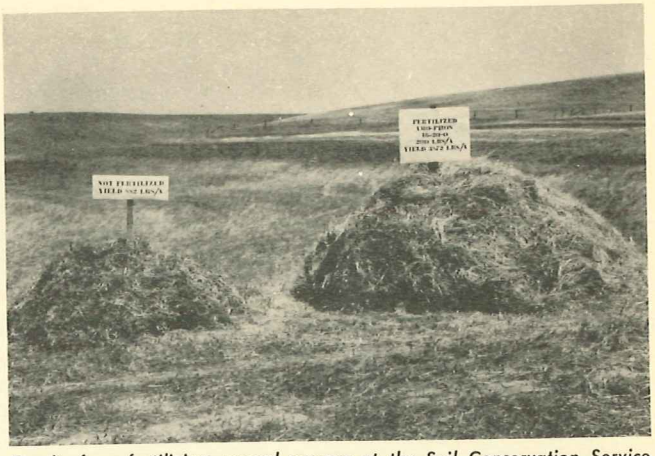
Subclass IVw land can be used for the most part only for pasture or special summer crops because of very poor drainage and danger of overflow. Most of this land is so flat and the soil so heavy that only limited improvement of drainage is feasible. Land in the Sacramento River bypass system is included in this subclass as it may be flooded any time during the rainy season. The use of much of this land is limited to summer crops. There is always the possibility that late spring or early fall floods may occur.

A total of 412,330 acres, or about 0.4 percent of the State, is in Subclass IVw.

Subclass IVw land. A part of the Sacramento River bypass system. At any time during the rainy season the bypass may be under water, hence the area is limited to summer crops.

Subclass IVs land is suited primarily for pasture and hay use because of shallow soils or rather poor soils in combination with large amounts of alkali salts. Shallow-rooted and alkali-tolerant plants are best adapted. A considerable area of this land has recently been developed to irrigated pasture in the San Joaquin Valley. This has been accomplished by development of water for irrigation, careful land leveling, drainage improvement, use of soil amendments and fertilizers, and selection of locally adapted pasture plants.

Of the 1,527,040 acres of Subclass IVs land in the State, about 444,000 acres are now used primarily for irrigated pasture and hay production. The remainder is used for limited grazing but is capable of considerable improvement as irrigated or dry perennial pastures.



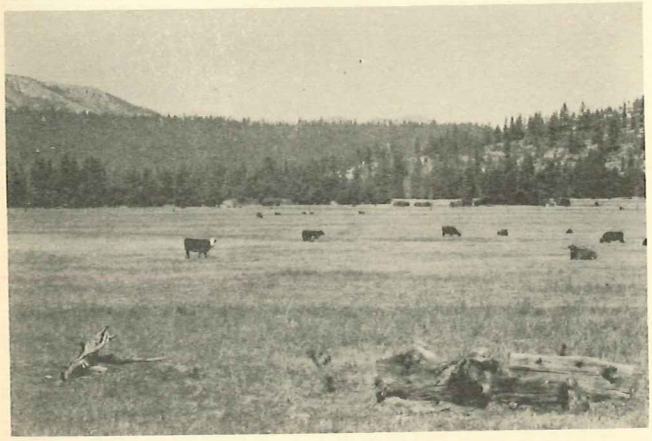
Results from fertilizing annual grasses at the Soil Conservation Service Sunol Nursery (1949) on Subclass IVs land. An increase from 882 pounds per acre (left, unfertilized pile) to 3,872 pounds per acre (right, fertilized pile) was obtained from the addition of 200 pounds of ammonium phosphate.

Subclass IVc is limited to an occasional crop of grain or hay because of low rainfall. During years of high rainfall fairly good crops may be produced, though crop failures are common. Cropping of any kind always involves a gamble with the weather. Water for irrigation is not expected to be made available in the foreseeable future. If and when water does become available, this land will be capable of much higher production and will be given a higher classification.

A total of 65,290 acres of this kind of land was found in the State. Only 5,660 acres were in cultivated crops or fallow at the time of this survey.

LAND NOT SUITED FOR CULTIVATION IN CALIFORNIA

Land-capability Classes V, VI and VII are not suited for cultivation but are suited for grazing and forestry use. The range in capability from V to VII indicates increasing need for care and protection even in grazing or forestry use.



Typical Subclass Vw meadow land in the high Sierras

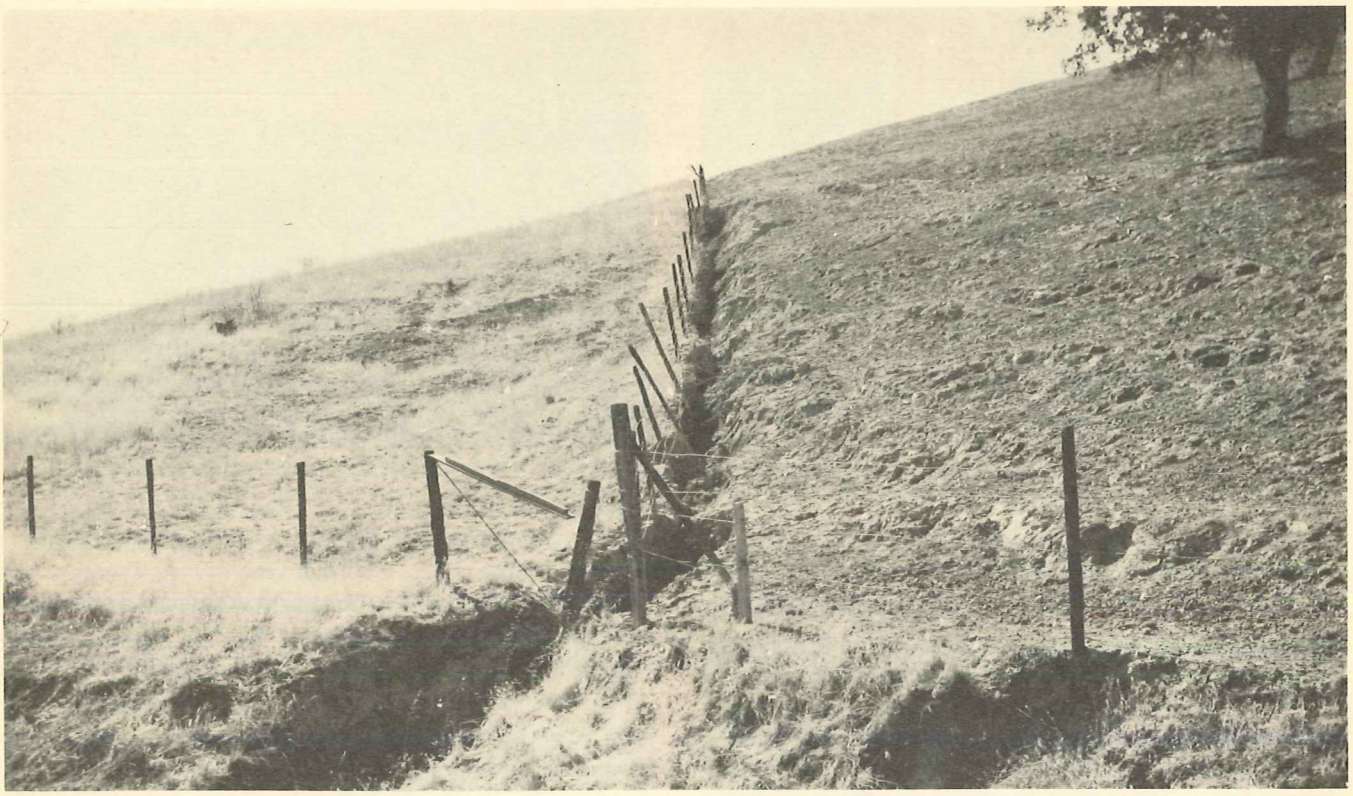
Class V land (dark green on map) is very well suited for grazing use and needs only good grazing management to keep it permanently productive. It is nearly level and not subject to erosion.

Subclass Vw is limited to mountain meadows where natural wetness and a short growing season make the land unsuitable for cultivated crops. The soil is fertile and the moisture supply is good. These areas are very productive of native meadow grasses.

Only 250,650 acres of Subclass Vw were found in the State.

Class VI land (colored light brown on map) is well suited for grazing or forestry use. It is not suited for cultivation because of steep slopes, susceptibility to erosion, shallow soils, poor drainage, climate or other unfavorable conditions. The four distinctively different kinds of Class VI land are shown by subclasses. There are 16,353,230 acres, or about 16.4 percent of the total area of the State, in Class VI.

Subclass VIe land is moderately limited in use for grazing or forestry because of erosion or slope prob-

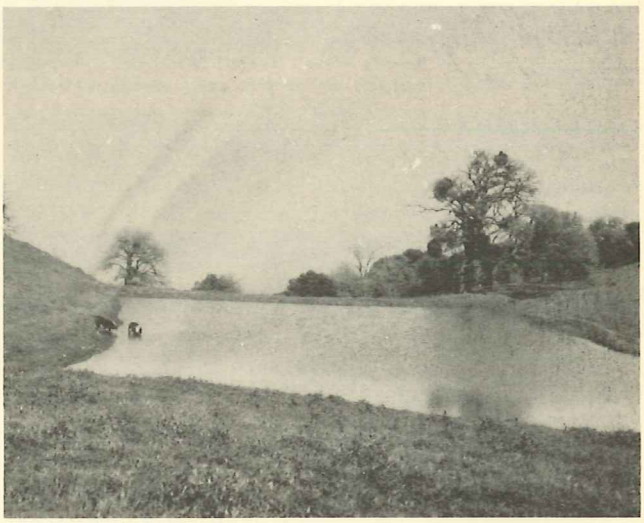


Subclass VIe land. The gully along the fence has been caused by over-grazing on the area to the right of the fence.

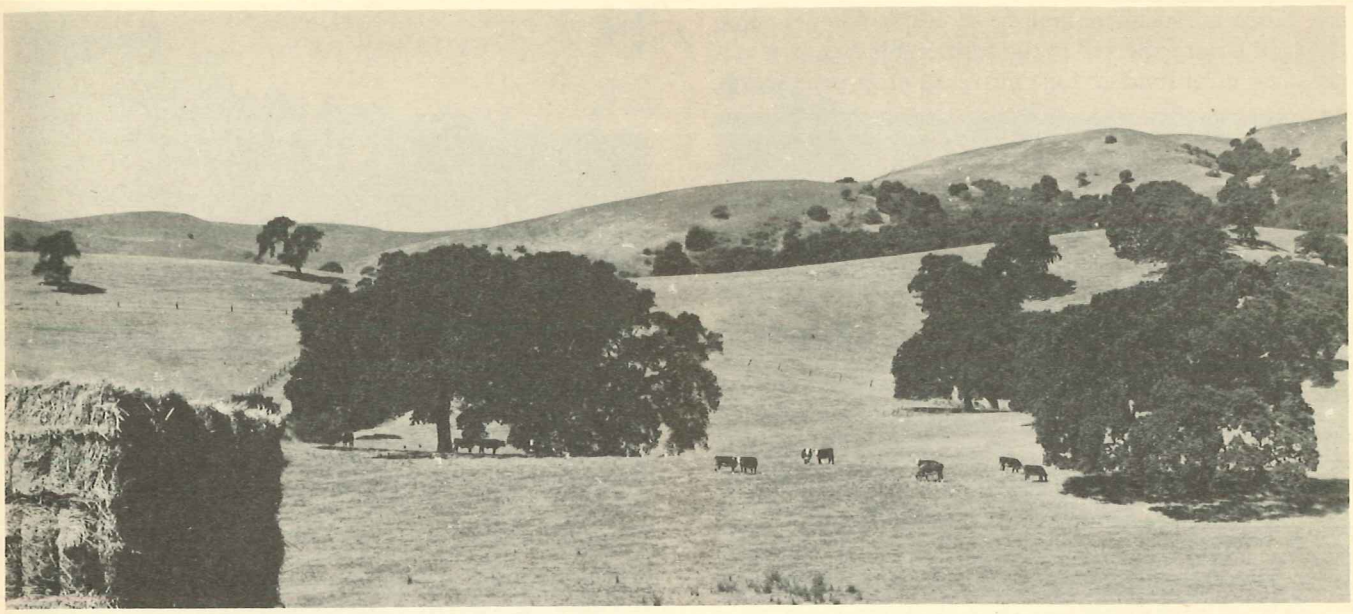
lems. The slope of this land varies from about 25 to 50 percent. If the cover is destroyed by cultivation, overgrazing, uncontrolled burning, or poor logging practices, loss of soil by water erosion is likely to occur.

The productive capacity of this kind of land can be maintained and improved by well-known range and woodland management practices. On Subclass VIe grassland, stock water development, cross-fencing and proper salting help to get good distribution of cattle and even utilization of range grasses. The use of supplemental feed and development of irrigated pasture makes it possible to leave enough plant residue on the range to favor desirable plants and protect the soil from erosion. A considerable part of Subclass VIe land now in brush could be greatly improved by brush removal and seeding to adapted grass species.

Very serious erosion on Subclass VIe land caused by clean cultivation of steep land. This land is best suited for growing grass and trees. Note the deposition of the eroded material on the bottom land in the foreground.



Stock water ponds may be constructed and located to secure better distribution of stock over the range



Subclass VIe land used for range with forage in good condition, as shown by patchiness of residues without weediness

The forested land in Subclass VIe needs fire protection and good forest management practices to keep it permanently productive.

There is a total of 11,831,820 acres of Subclass VIe land in California; 176,530 acres are cultivated, 7,163,480 acres are used for grazing, and 4,491,810 acres are used primarily for forestry.

Selective cutting of a stand of timber on Subclass VIe land

Subclass VIw land is limited to grazing use primarily because of poor drainage and winter flooding. Some salts are usually associated with the high water table, tending to reduce the quality and variety of forage grasses. Drainage and protection of this land from flooding is not considered feasible.

Only 251,080 acres of this land was found in the State. The main areas occur along the San Joaquin River and are used almost entirely for grazing.

Subclass VIs is limited to grazing or forestry use because of unfavorable soil conditions. Shallowness is the primary soil limitation of this subclass. Soils strongly affected by black alkali are also included. This land is flat to moderately sloping and has little or no erosion problem. The main areas of the shallow VIs land are located in the Sierra foothills. The lower elevations are in grass while the higher elevations are forested. The flat alkali areas are found in the San Joaquin Valley. A total of 2,029,330 acres of Subclass VIs land was found in the State.

Subclass VIs land limited by strong alkali. This land is best suited for early spring grazing.

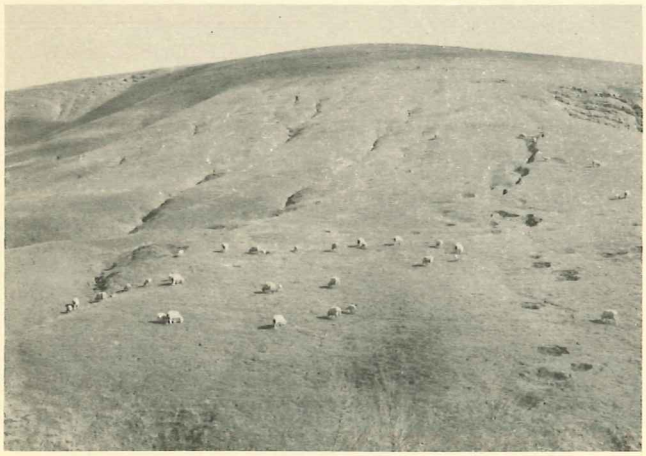
Subclass VIc is limited to grazing use primarily because of low rainfall. Although the soils are highly variable, many of them are good and occur on gentle slopes. Wind erosion is a problem on the sandier types, particularly if the vegetation becomes depleted during a dry cycle or by overgrazing. With irrigation water much of this land would be capable of cultivated

use. Since an adequate supply of water for irrigating this land is not expected in the foreseeable future, it was classified as unsuitable for cultivated crop production.

Subclass VIc land showing typical vegetation, consisting of annual grasses and desert shrubs

A total of 2,250,000 acres of Subclass VIc was found in the State. Most of this acreage is located in the southern San Joaquin Valley and the Mojave Desert.

Class VII land (colored dark brown on map) is fairly well suited for grazing or forestry. It has major hazards or limitations for use because of very steep slopes, shallow or sandy soils, very low rainfall, excessive erosion or severe alkali conditions. Very careful management is required for most productive safe use. There are 30,549,860 acres, or about 30.5 percent of the total area of the State, in this class.



Subclass VIIe range land that has been too heavily grazed by sheep. Note the evidence of gully erosion.

Subclass VIIe is limited in use by erosion or very steep slopes. Because the slope of the land is in excess of 50 percent, careful grazing and logging practices are necessary to avoid loss of soil by water erosion. Very careful application of the management practices given for Subclass VIe land is needed to maintain this land in

A view of typical Subclass VIIe forest land in California

maximum production. These areas are not well suited for clearing, reseeding, or fertilization.

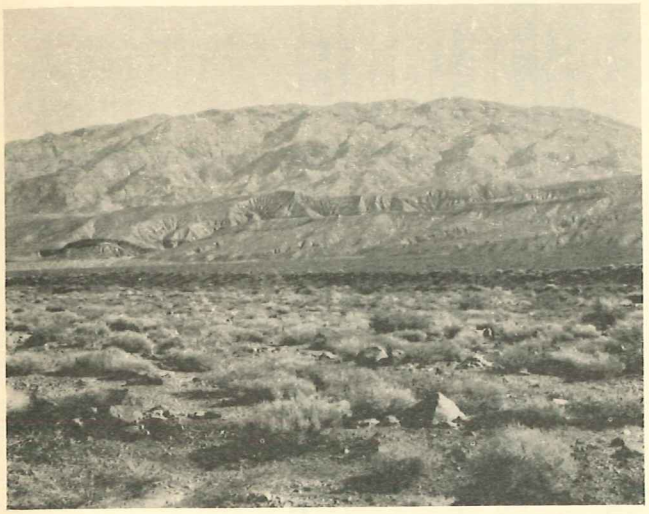
Approximately 20.3 percent of the State is in Subclass VIIe land. About one-third is used primarily for grazing and the rest primarily for forestry.

Subclass VIIw is suited for only limited grazing and woodland use because of very wet or severe flooding conditions. This type of land is limited in extent and occurs as scattered areas along streams and along the ocean.

Subclass VIIs is suitable for only limited grazing and woodland use primarily because of very shallow or rocky soils. Only limited annual growth of forage and trees can be expected because of the low moisture-holding capacity of these gravelly and rocky soils. About 650,000 acres of land, mostly in the San Joaquin Valley, are included in this subclass because of very strong black alkali. The cover on this land is limited to alkali-tolerant plants, of some value for spring grazing.

Subclass VIIs land severely affected by alkali. Note bare areas and sparse vegetation. This land affords very limited grazing.

Subclass VIIc is suitable for only limited grazing and woodland use because of low rainfall. This land is found in the desert areas of the State where rainfall is generally less than 10 inches. Grazing use is limited to the winter and early spring months.



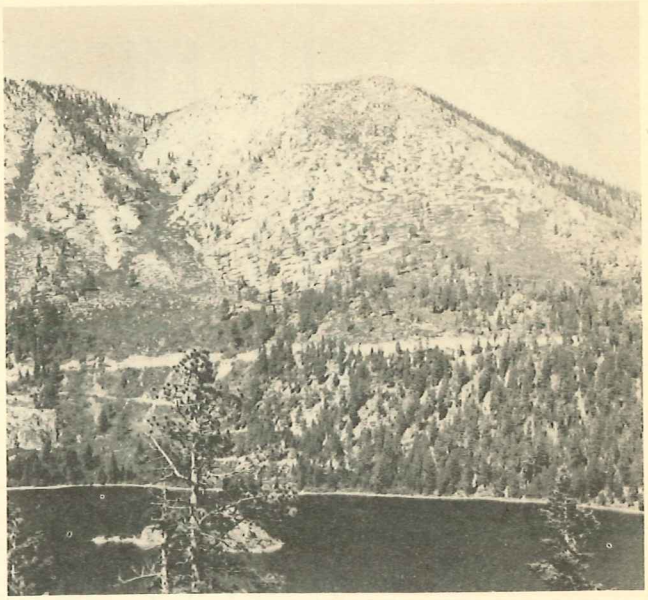
Subclass VIIc land showing typical desert cover and stony surface condition.

Class VIII land (colored purple on map) is not suited for cultivation, grazing or forestry use. It has value for wildlife, recreation or protection of water supplies. This land class includes mountain tops with little or no soil mantle, very steep brush-covered areas with shallow soils, gravelly river channels, gullies, essentially barren desert, swamps, and beaches. The different kinds of Class VIII land are shown on the map by subclasses. There are 32,906,260 acres, or 32.9 percent of the total area of the State, in this class.

Subclass VIIIe land consists chiefly of highly erodible steep formations, sand dunes, and gullied areas. These areas are the sources of sediments that cause damage to property, streams, reservoirs and land. A maximum growth of vegetation should be established and maintained on these areas for soil stabilization. Check dams and other structural measures to stabilize gullies may be justified where land and property values are high.

Subclass VIIIw is very limited in extent and includes tidal lands, stream channels, and marsh areas where improvement is not considered feasible. Some of these areas have very high value for wildlife and recreational purposes.

Subclass VIIIs consists of extensive areas of steep mountainous land having little or no soil mantle. It includes the recently glaciated crests of the Sierras, the Trinity Alps, other mountain areas with very shallow soils, and the barren mountain ranges of the desert portions of the State. The soil is so thin that essentially no harvestable vegetation is produced on this land. The present cover should be protected from fire. The value



Subclass VIIIs land in background. This is a typical view of the glaciated crest of the Sierra Nevada.

of this land is for watershed protection, wild life and recreational purposes.

The areas of the State that have been left unproductive by gold dredging are also included in this subclass.

Subclass VIIIs land, formed as a result of gold dredging operations. Twenty miles east of Sacramento.

Subclass VIIIc is confined to the hot desert valley lands in the southeastern part of the State. The rainfall is so low that little or no usable vegetation is produced. A portion of this area has fairly good soil on gentle slopes. With irrigation water it could be used for crop production. Since water for irrigation is not expected to become available in the foreseeable future it was classified as VIIIc land.

A general summary of the land conditions and conservation practices for the land-capability classes is given in Table 3.

TABLE 3

GENERAL TYPES OF CONSERVATION PRACTICES AND USES RECOMMENDED FOR LAND-CAPABILITY CLASSES

LAND SUITABLE FOR CULTIVATION

Land Capability Class	Subclass (Dominant kind of land)	Suitable For (Only the most intensive safe use is mentioned)	Special Needs or Precautions
I (light green on map). Very good cultivable land.	Deep, nearly level productive valley land.	Intensive cultivation to all climatically adapted crops.	No special difficulty in farming. Usual good farming practices to maintain soil fertility and conserve water.
II (yellow on map). Good cultivable land.	IIe —Good soil on gentle slopes subject to water erosion, or wind erosion on sandy soils.	Cultivation with precaution.	Protection from erosion. Use conservation irrigation methods.
	IIw —Good soil, slightly wet or subject to overflow.	Cultivation with management of excess water and selection of crops adapted to wet conditions.	Drainage improvement or flood protection.
	IIs —Soil with minor soil problems such as clay or sandy texture, moderate depth, or slight alkali.	Cultivation with selection of crops adapted to soil limitations.	Treatments to offset soil limitations, and to conserve irrigation water.
III (red on map). Moderately good cultivable land.	IIIe —Good soil on moderate slopes subject to water erosion, or sandy soil subject to wind erosion.	Cultivation with precaution against permanent land damage.	Special attention to erosion control and conservation irrigation.
	IIIw —Good soil, moderately wet or subject to overflow.	Cultivation with careful management of excess water and selection of crops adapted to wet conditions.	Intensive drainage improvement or protection from flooding.
	IIIs —Soil with moderate problems due to moderate depth, gravels, or alkali.	Cultivation with careful selection of crops adapted to soil limitations.	Intensive treatment to offset or overcome soil limitations and conserve irrigation water.
IV (blue on map). Fairly good land. Suited for occasional or limited cultivation.	IVe —Moderately steep land subject to serious water erosion, or sandy soils subject to wind erosion.	Occasional cultivation in rotation with hay or pasture, or orchards protected by permanent cover crops.	Intensive erosion control when in cultivation.
	IVw —Bottom land that is very wet or subject to severe overflow.	Cultivation to special summer crops, hazard of crop failure is always present.	Intensive drainage. Special attention to seeding and harvest dates to minimize crop failures on overflow land.
	IVs —Fairly good land with limitations due to shallowness, gravel, stone, or strong alkali.	Occasional cultivation in rotation with hay or pasture.	Very intensive treatment to overcome soil limitations. Careful selection of crops.
	IVc —Good soil with just enough rainfall for crops in favorable years.	Cultivation during wet years, frequent crop failure. Better in permanent vegetation.	Conserve all rainfall—develop water for irrigation or convert to pasture or grazing use.

TABLE 3—Continued

GENERAL TYPES OF CONSERVATION PRACTICES AND USES RECOMMENDED FOR LAND-CAPABILITY CLASSES

LAND NOT SUITABLE FOR CULTIVATION

Land Capability Class	Subclass (Dominant kind of land)	Suitable For (Only the most intensive safe use is mentioned)	Special Needs or Precautions
V (dark green on map). Very well suited for grazing. Not arable.	Vw —Good productive mountain meadows that are wet and have short growing season.	Grazing and production of wild hay.	Proper season of use and rate of stocking, protect from gullying.
VI (light brown on map). Well suited for grazing or forestry. Not arable.	VIe —Steep land subject to erosion if cover is depleted.	Grazing or forestry or both.	Manage grazing and logging to maintain sufficient residue and litter on the soil for soil and moisture conservation. Fire protection.
	VIw —Flat land, occasionally with saline salts. Permanently wet or subject to overflow.	Grazing.	Manage grazing to prevent soil puddling, and to favor desirable forage plants.
	VIs —Flat to gently sloping shallow, stony, gravelly, or alkali land.	Grazing or forestry or both.	Good range and forestry management practices. Fire protection.
	VIc —Good or fairly good soil, not enough moisture for cultivation.	Grazing primarily, some forestry. Could be cultivated if water were available.	Good range and forestry management practices. Fire protection.
VII (brown on map). Fairly well suited for grazing or forestry. Not arable.	VIIe —Very steep land subject to erosion if cover is depleted.	Grazing or forestry or both.	Carefully manage grazing and logging to maintain enough plant litter for soil and moisture conservation. Fire protection.
	VIIw —Flat, permanently wet or overflow land along streams, or tidal marsh areas.	Limited grazing.	Range grazing to favor desirable plants.
	VIIs —Very shallow, stony, or strong alkali land.	Grazing or forestry or both.	Good range and forestry management. Fire protection.
	VIIc —Fairly good soil, not enough moisture for cultivation.	Grazing or forestry or both.	Good range and forestry management. Fire protection.
VIII (purple on map). Suited only for wild life, recreation and protection of water supplies.	VIIIe —Highly erodible—gullies, badlands, and sand dunes.	Watershed and wild life.	Maintain maximum cover for erosion control.
	VIIIw—Tidal land, stream channels and swamps.	Wild life, recreation, and water spreading.	Improve for wild life and recreation.
	VIIIs —Barren mountain tops, little or no soil mantle.	Recreation and watershed.	Improve for wild life and recreation.
	VIIIc —Fair soil in desert areas with very low rainfall.	Recreation.	Water, check your canteen and radiator.

THE WATERSHED APPROACH

Civilizations are built on a combination of land, water and people. Our success in making the best use of our land and water resources depends on how we handle our forests and grass lands; on the way we farm, and on the skill and foresight with which we manage our streams. Watersheds are the natural units to use in approaching these conservation problems because all parts are related to each other by the flow of water. Each watershed presents interrelated problems and must be considered as a unit in planning for its use and treatment. Conservation work must be planned and carried out with an eye to the needs of the land downstream. This approach is essential, as the process of soil erosion has no respect for man-made boundary lines. Gullies don't stop at fence lines, farm lines, or even county or state lines. Neither do dust storms or floods. The amount of moisture stored in the soil for plant growth, the flow and quality of water in streams, the destructiveness of floods, reservoir storage, erosion and sedimentation are all interrelated and influenced by man's use of the land on each individual watershed.

Watersheds are the natural units for collection, analysis and interpretation of data related to land and water resources. This is particularly true in an area like California, where the maximum use of the land for agricultural production is directly dependent on the development and use of water for irrigation. Water that falls on the mountain watersheds is used chiefly for agricultural and industrial development in our valleys. Floods that cause damage to valley land and property originate largely from precipitation falling on mountain watersheds. For full control of floods we must develop watershed lands to retard runoff.

It has been the usual practice in the past to collect and present water resources data by watersheds. Land information, however, has usually been compiled on a county or state basis. Because of the close interrelation between the use of our land and water resources, the data on land-capability presented in this report are organized on both a state and watershed basis. Although the data for the individual counties recognized 97 watersheds, only eight of the major drainage basins are used in presenting the data in this report. They are listed below and outlined on the included relief map of the State.

Name of watershed	*Symbols on state capability map*
Northern California Coastal	1–2a–2b
Upper Sacramento River (above Shasta Dam)	3a
Central Valley	3b–4a–4b
San Francisco Bay Area	5
Central California Coastal	6
Southern California Coastal	7
Northern Great Basin	8–9
Central Great Basin and Lower Colorado River	10–11

The land-capability data for the individual counties and the 97 minor watersheds are not included in this report, but are available for reference at the State Office of the Soil Conservation Service, United States Department of Agriculture, at Berkeley.

NORTHERN CALIFORNIA COASTAL WATERSHED

Physical Conditions

The Northern California Coastal Watershed includes the California portions of the Klamath and Rogue River drainages, and the watersheds of the Smith, Mad, Eel, and Russian Rivers, along with a number of minor coastal drainages (State Capability Map areas 1, 2a, 2b). The eastern portion of the watershed extends into the Modoc lava formation. This upland lava plateau is characterized by low hills from local lava flows and cone-shaped peaks formed by volcanic eruptions. The soils are shallow and contain considerable lava rock. The rainfall varies from 10 to 20 inches. The vegetal cover ranges from sagebrush in the dry areas to coniferous forest on the higher, more humid mountain slopes. These areas are used primarily for grazing and forestry purposes.

The northwestern portion of the watershed is characterized by high rainfall and steep, timber-covered slopes where lumbering is the chief industry. It also includes the extremely rugged Trinity Alps area. Here the glaciated mountain peaks have little or no soil mantle or vegetal cover. The southwestern portion of the watershed consists of: (a) a narrow coastal strip of gently sloping marine terrace; (b) steeply sloping, round-topped mountains (Coast Range) which rise abruptly from the coastal terrace, and (c) narrow alluvial valleys along the main streams. This coastal area is characterized by extremely high rainfall ranging from about 30 inches at Santa Rosa to about 100 inches at Monumental near the Oregon line. The cover throughout the coastal fog belt consists of redwoods in the canyons and woodland-grass on the rounded mountain tops. Fir, woodland-grass, or brush cover is generally found on the interior slopes. Medium-textured, moderately deep soils from sandstones and shales occur extensively on the hills and mountains. These soils are moderately erodible and tend to wash where the cover is destroyed.

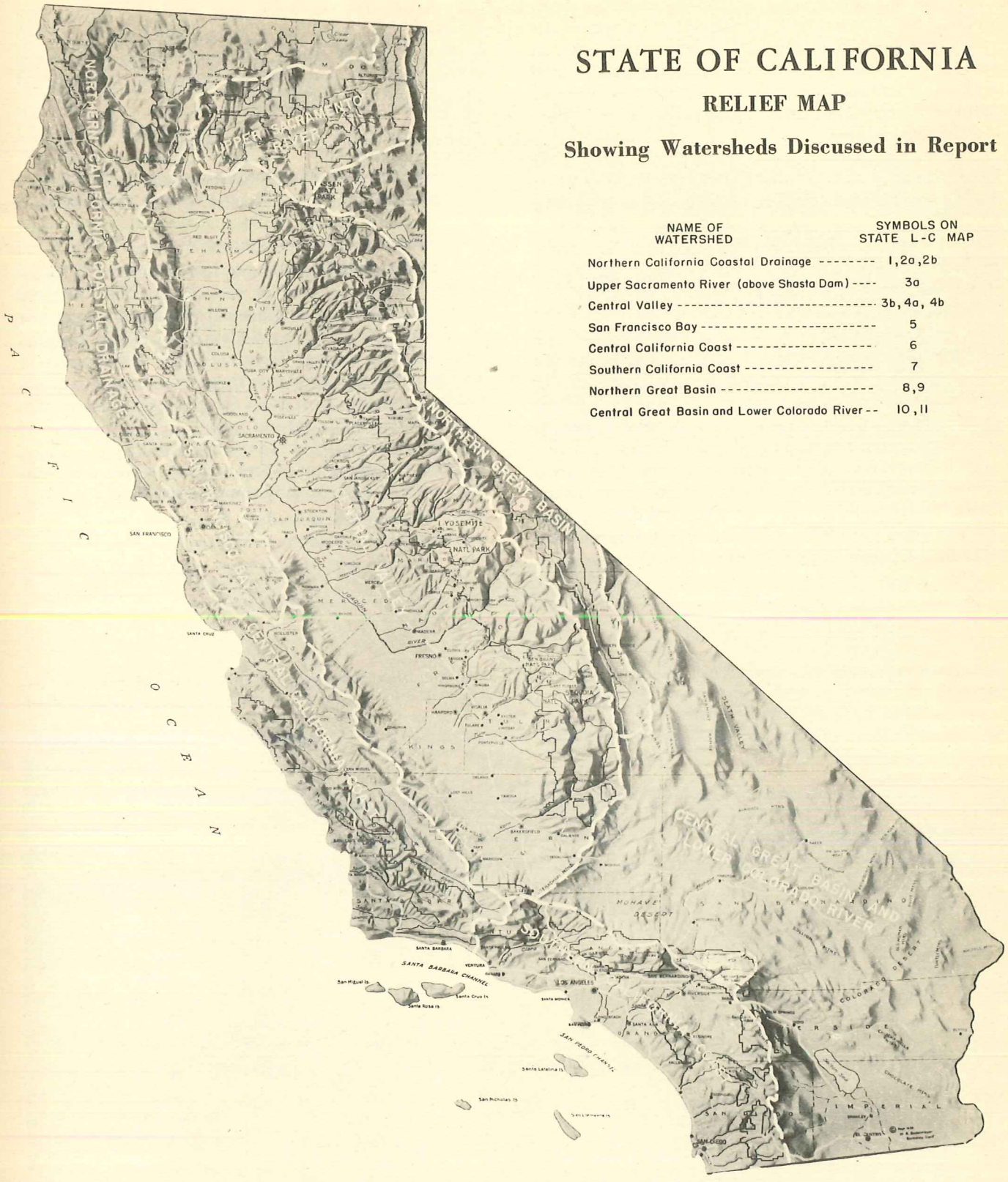


Figure 2. Watershed Map of California

Deep, medium-textured alluvial soils are common in the valley areas. The terrace lands around the edges of the valley and along the coastal plain have heavy claypan subsoils which absorb water slowly. Soil losses are high on land under cultivation if it is not protected by some form of vegetation or other conservation practice during the rainy season.

The main agricultural areas are in Butte Valley, Tule Lake, Shasta Valley, Scotts Valley, the Russian River Valley around Santa Rosa and Ukiah, and near Willits, Covelo, Eureka and Point Arena.

Table 4 gives a summary of the land-capability classes by present land use in the Northern California Coastal Watershed. It is significant to note that of the 945,000 acres of land that is suitable for cultivation (Classes I to IV), only about half is now being cultivated. Of the land in cultivation, there are about 21,000 acres that are not suitable for such use (Classes V to VII) and should be planted to grasses or trees. Most of the land that is capable of more intense use occurs in small scattered areas throughout the watershed and will require drainage, clearing, and erosion-control practices. These areas can best be selected by a detailed farm-by-farm inventory of land conditions. Improvement and development of these areas can be most efficiently accomplished by individual farmers joining together in small community groups to carry out a soil and moisture conservation program. Of the land now in cultivation about 218,000 acres is in need of erosion-control measures and 108,000 acres would be benefited by improved drainage and protection from flooding.

Soil and Water Conservation Needs

A soil and water conservation program for this watershed must be flexible to fit the different types of agriculture and variations in physical land conditions. The major conservation needs consist of:

1. Using Land According to Its Capability. This includes developing land of suitable capability classes, about 500,000 acres of Classes II, III, and IV land, for cultivated crops, improved dry pastures, or irrigated pastures. This acreage far exceeds the 21,000 acres of land now in cultivation that should be planted to close-growing grass and tree crops for greater soil protection. The forage produced on these additional acres if brought into improved use would permit lighter use on the steeply sloping range areas where erosion is a problem, without a decrease in the number of animals.

2. Water Development. At present only about 131,000 of the 463,000 acres of cropland is under irrigation. Development of irrigation water supplies to irri-

TABLE 4

LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE—NORTHERN CALIFORNIA COASTAL WATERSHED

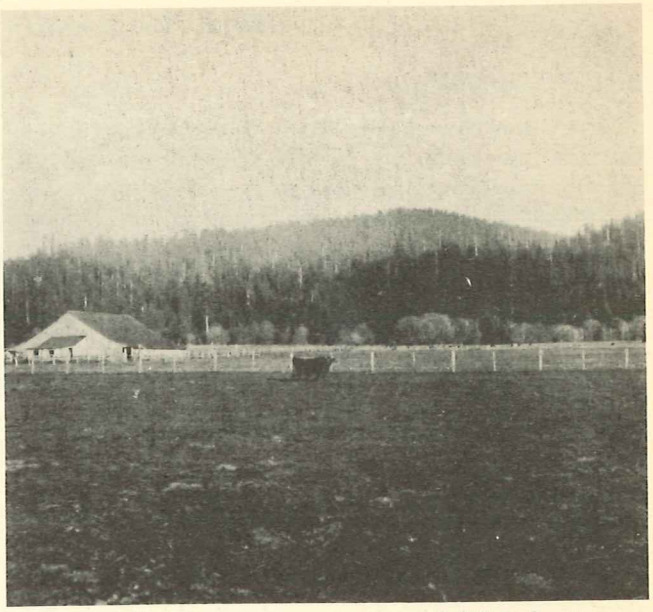
Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	31,720		31,720	31,420		300	
II	248,600	e	109,050	75,270	32,740	1,040	
		w	101,660	72,950	28,610	100	
		s	37,890	27,980	9,210	700	
III	351,230	e	199,980	96,420	81,290	22,270	
		w	67,760	35,700	31,410	650	
		s	83,490	43,270	38,870	1,350	
IV	313,690	e	257,870	46,320	148,440	63,110	
		w	6,180	10	6,170		
		s	49,640	13,040	32,430	4,170	
V	55,520	w	55,520	2,400	53,120		
VI	2,407,520	e	2,368,330	18,090	893,080	1,457,160	
		s	39,190	70	35,340	3,780	
VII	6,728,220	e	5,356,710	380	1,187,010	4,169,320	
		w	950		950		
		s	1,370,560		422,740	947,820	
VIII	2,128,190	e	46,890			32,650	14,240
		w	28,410			300	28,110
		s	2,052,890			1,284,490	768,400
Unclassified	276,080						*276,080
Totals	12,540,770		12,264,690	463,320	3,001,410	7,989,210	1,086,830

*Cities and towns—25,890; roads and railroads—174,020; other—76,170.

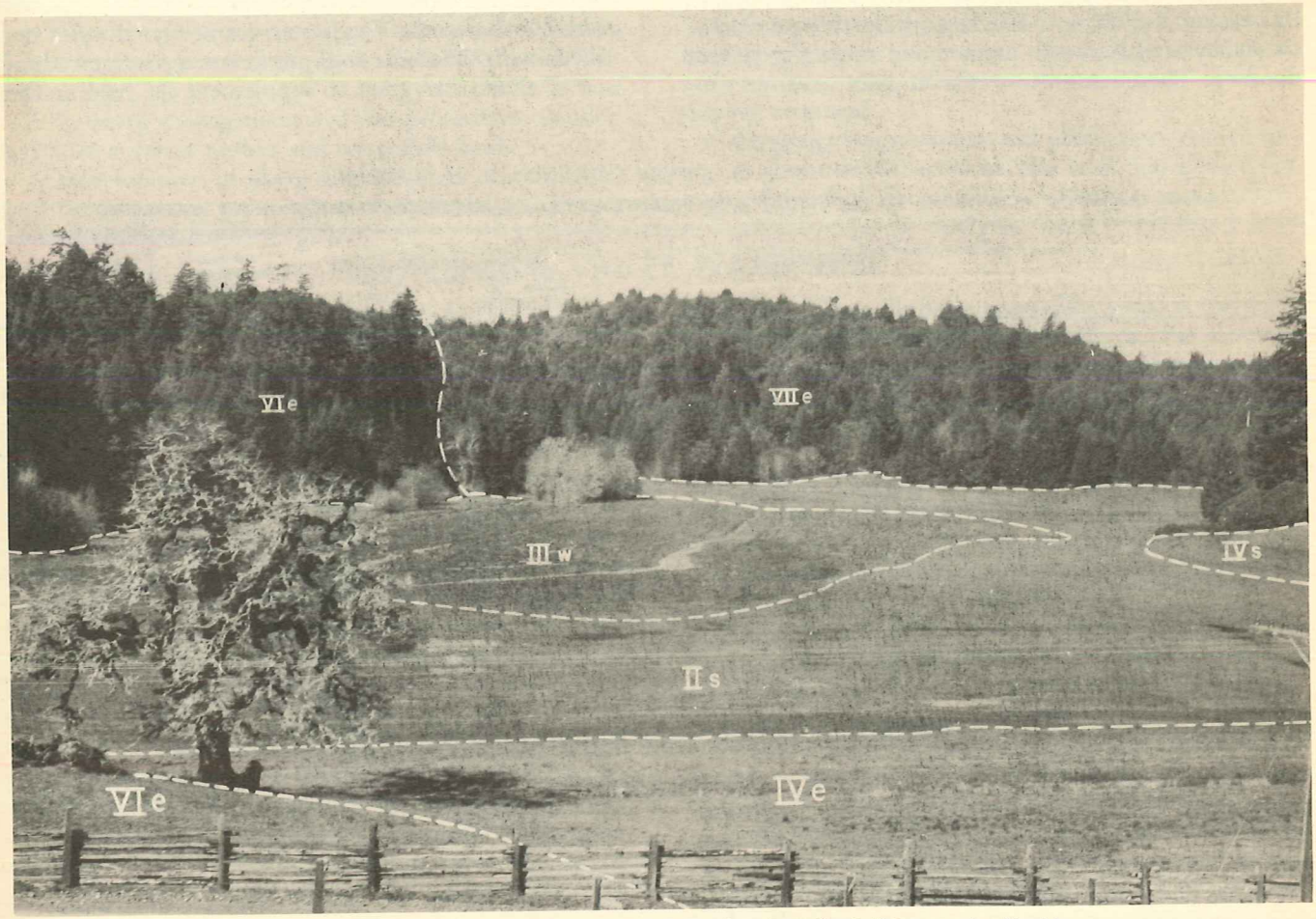
gate additional land would require construction of reservoirs, development of springs, and sinking of wells. Stockponds would allow better distribution of range livestock. Rehabilitation of existing farm irrigation systems and improvement of irrigation practices would afford greater efficiency in the use of water.

3. Erosion-control Practices. Contour-cultivation, crop-rotation, mulch-tillage, fertilization, and diversion terraces on cropland needing protection from erosion. Leaving adequate residue on range land when grazed to insure good moisture penetration and prevention of soil loss. Fire protection and good logging practices on the forested land.

4. Improvement of Farm-drainage Systems, Flood Control, and Streambank Protection on Nearly 175,000 Acres of Wet Land or Land Subject to Overflow. Work along minor streams such as stabilization, channel clearing and alignment to protect valuable bottom land from destruction by bank cutting and damage from flooding. Major flood control programs on the main streams usually are sponsored by a group or community. Approved programs are carried out cooperatively by various state and federal agencies. Such programs deal with upstream control of water, major structural improvements, watershed management, channel improvement, etc., all of which need to be planned and integrated for all the lands of the watershed.



A sprinkler-irrigated permanent pasture in Del Norte County



A landscape showing how capability classes fit the land in the Willits Soil Conservation District

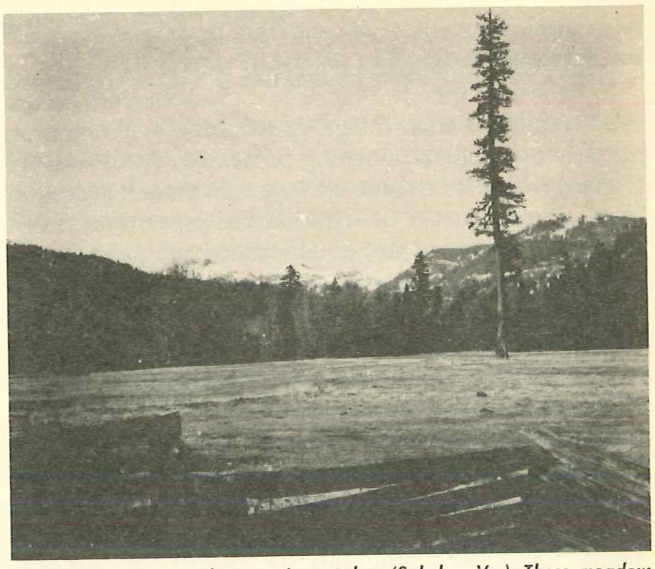
UPPER SACRAMENTO RIVER WATERSHED

Physical Conditions

The Upper Sacramento River Watershed includes all the drainage of the Pit and McCloud Rivers and the Sacramento River above Shasta Dam (See 3a on State Capability Map). The western part of the watershed is predominantly mountainous and supports a forest or chaparral cover. Mount Shasta, reaching an elevation of 14,162 feet, and Mount Lassen at 10,453 feet, are snow-capped throughout the year. The precipitation in this portion of the watershed ranges from 40 to 80 inches, much of which comes in the form of snow. The soils are typically shallow, medium-textured types containing considerable stone and rock.

The eastern part of the watershed is characterized by (1) steep mountain ranges, of which the Warner Range on the east divide of the watershed is the most prominent, (2) broad, moderately sloping, upland lava plateaus with low, cone-shaped volcanic peaks, and (3) narrow mountain valleys along the main streams, notably the Pit River.

Cattle raising, the main agricultural activity, is centered in the mountain valleys primarily around Alturas, Bieber, and Fall River Mills. A considerable portion of the valley land is poorly drained and subject to winter flooding. These naturally wet mountain meadows produce valuable green forage which is cut for hay, or grazed by livestock. The better-drained portions of the valleys with favorable soils are devoted to the production of alfalfa and grain to supplement the feed on the



A typical grass-covered mountain meadow (Subclass Vw). These meadow areas provide valuable summer feed for livestock.

TABLE 5

LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE—UPPER SACRAMENTO RIVER WATERSHED

Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	6,900		6,900	6,900			
II	47,110	e	15,250	13,420	1,830		
		w	27,860	22,310	5,550		
		s	4,000	4,000			
III	151,360	e	59,040	17,400	33,240	8,400	
		w	49,820	23,660	26,160		
		s	42,500	18,140	18,360	6,000	
IV	166,730	e	52,720	6,520	25,890	20,310	
		w	8,900	2,400	6,500		
		s	97,610	9,890	73,720	14,000	
		c	7,500	120	7,380		
V	33,510	w	33,510	1,210	32,300		
VI	1,132,030	e	816,560	400	325,150	491,010	
		w	9,950		9,950		
		s	282,720		184,920	97,800	
		c	22,800		22,800		
VII	2,330,720	e	1,635,180		387,640	1,247,540	
		s	695,540		236,720	458,820	
VIII	528,980	e	39,000			34,700	4,300
		s	489,980			286,150	203,830
Unclassified	130,340						*130,340
Totals	4,527,680		4,397,340	126,370	1,398,110	2,664,730	338,470

*Cities and towns—1,500; roads and railroads—92,480; other—36,360.

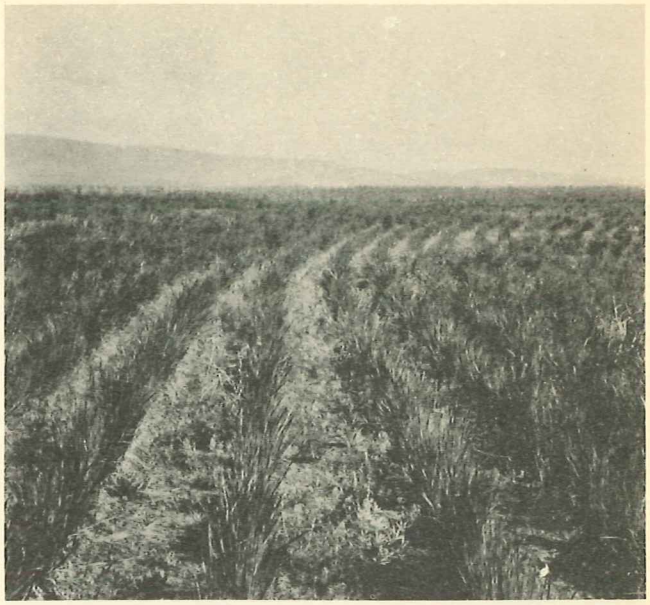
range. The use of forage produced in the valley areas is inseparably tied in with grazing on the surrounding range land and in the national forests. Grazing in the forests is limited to the summer months.

Table 5 gives an acreage summary of the land-capability classes by present land use for this watershed. At present 126,000 acres, or less than 3 percent of the acreage in the watershed, is cropped. It is estimated that about 100,000 acres of Classes II to IV now in range use could be greatly improved by clearing, drainage, irrigation, and planting to grasses and legumes. The remaining acreage of cultivable land that has not been developed is so scattered in small parcels that improvement is not considered feasible in the foreseeable future.

Soil and Water Conservation Needs

A soil conservation program for this watershed should consist of the following major practices:

1. Good grazing management on the 1,400,000 acres of land used primarily for grazing. This should include proper stocking in relation to the amount of forage produced, distribution of cattle by salting, water development and fencing to get even utilization of the forage, and proper season of use based on the type of vegetation and weather conditions. The objective is to get maximum forage from the range and to maintain sufficient vegetal growth and plant residue for watershed protection.
2. Forestry management and fire protection on over 2,650,000 acres of timber and watershed land.
3. Development of about 100,000 acres of cultivable land for cropping, primarily to cereals, hay, dry and irrigated pastures. This acreage would provide a dependable supplement to the forage produced on the range.
4. Erosion-control practices consisting of crop rotation, fertilization, contour or cross-slope cultivation, and stubble-mulch tillage on about 37,000 acres of sloping cropland.
5. Drainage improvement and protection from flooding on about 48,000 acres of wet land that is used for crop production.



A good stand of wheatgrass on Class III land in the Pit Soil Conservation District

CENTRAL VALLEY WATERSHED

Physical Conditions

This watershed, comprising the great Central Valley of California, contains over 33 million acres and includes all drainages into the Sacramento and San Joaquin Rivers except that portion of the Sacramento River above Shasta Dam. The central feature of this watershed is the 400-mile long, and 50-mile wide, gently sloping area of the confluent valleys of the Sacramento and San Joaquin Rivers, lying between the Coast Range on the west and the Sierra Nevada on the east. The Central Valley is terminated on the north by the convergence of these ranges near Redding, and on the south by the Tehachapi Mountains near Bakersfield. The northern portion (3b on the State Capability Map) is traversed by the south-flowing Sacramento River, a perennial waterway. The Feather and American Rivers, which are fed by melting snow of the Sierras, are the main tributaries from the east. The westside streams are comparatively small. Although their flow may reach destructive flood stages during wet winters, they are normally dry by late summer. The southern portion of the valley (4b on the State Capability Map) is traversed by the north-flowing San Joaquin River, also a perennial waterway. There are no streams of any consequence from the west side. The main tributaries from the east are the Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, and Madera Rivers, all originating in the high Sierras. The extreme southern portion of this watershed (4a on the State Capability Map) has no major streams flowing into the San Joaquin River; the east side drainages of the Kings, Kaweah, Tule and Kern Rivers dissipate on the valley floor.

The elevation ranges from sea level or below in the Delta area west of Stockton to the highest point in continental United States, Mount Whitney, 14,496 feet. The rainfall has similar extremes, from less than 10 inches over a large portion of the southern San Joaquin Valley to about 100 inches above Mineral in Tehama County.

There are over 10,500,000 acres of land in crops in the State, of which 6,600,000 acres are located in this Central Valley area. Of the 6,100,000 acres of irrigated land in the State, 4,200,000 are found here. Table 6 gives

A ladino cover crop in a pear orchard in the Placer County Soil Conservation District. The cover crop protects and improves the soil and provides forage for grazing.

a summary of the land-capability classes by present land use in the Central Valley Watershed.

Most of the 6,600,000 acres of cropland in the watershed are concentrated in the Sacramento and San Joaquin Valleys. The crops grown vary widely, with certain areas being recognized as producers of one or another specialty crop. Some of the more important specialty crops in the northern portion include peaches around Marysville, almonds in the vicinity of Chico, rice at Biggs, navel oranges at Orland and Oroville, olives at Corning, Tokay grapes at Lodi, and asparagus and other truck crops in the Delta area. In the southern portion cotton is grown over most of the Fresno-Bakersfield area, potatoes near Shafter, olives in the Visalia area, oranges near Porterville, and grapes in many localities. Irrigated agriculture is now common on the valley floor, while the bordering bench land around the valley floor is dry farmed to grain or used for grazing.

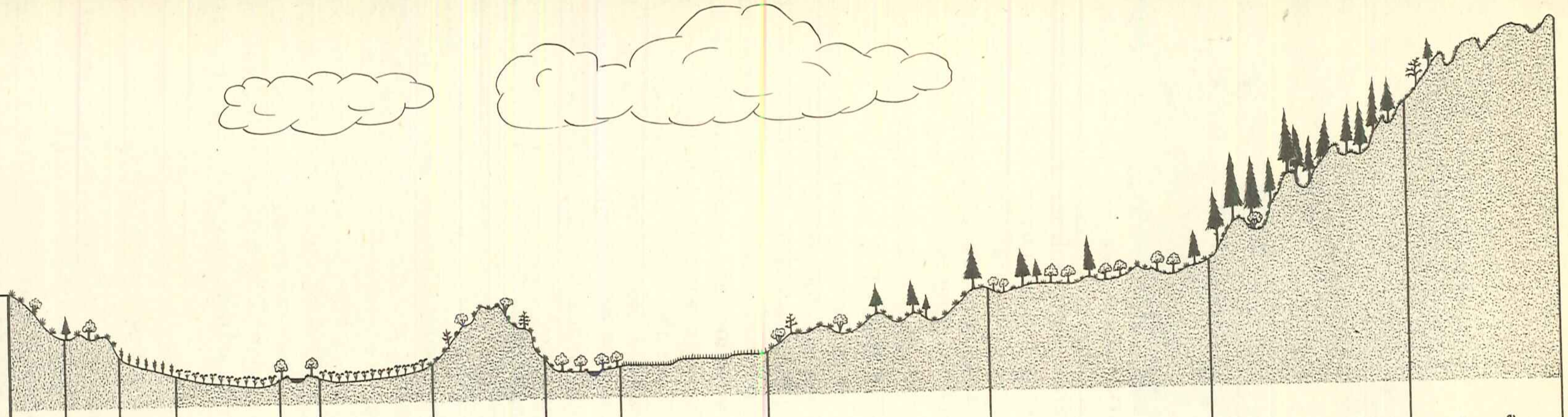
The soils of the northern portion of the valley floor are dominantly deep, medium to heavy-textured types, laid down by the Sacramento River and its tributaries; in the southern portion, light to medium-textured soils laid down by the San Joaquin River and its tributaries. Of the approximately 1,630,000 acres of Class I land in the State, over 1,160,000, or 71 percent, are found in

TABLE 6

LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE—CENTRAL VALLEY WATERSHED

Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	1,163,970		1,163,970	1,133,970	30,000		
II	3,088,690	e	770,750	593,520	172,750	4,480	
		w	729,540	643,600	85,430	510	
		s	1,588,400	1,256,690	330,770	940	
III	3,113,090	e	828,460	502,130	295,440	30,890	
		w	746,390	573,950	171,850	590	
		s	1,538,240	1,085,430	442,250	10,560	
IV	2,442,040	e	944,800	257,280	612,590	74,930	
		w	344,300	130,020	213,790	490	
		s	1,152,650	353,750	783,140	15,760	
		c	290	70	220		
V	106,660	w	106,660	5,780	100,880		
VI	7,531,110	e	5,616,870	51,350	3,421,020	2,144,500	
		w	90,950	2,640	83,450	4,860	
		s	1,430,500	18,650	1,185,720	226,130	
		c	392,790		392,790		
VII	9,916,600	e	7,661,140		1,526,910	6,134,230	
		w	46,170		41,850	4,320	
		s	2,109,760		1,028,760	1,081,000	
		c	99,530		99,530		
VIII	4,752,930	e	563,620		3,570	311,430	248,620
		w	72,180		350	1,010	70,820
		s	4,117,130		8,000	1,220,210	2,888,920
Unclassified	1,252,740						*1,252,740
Totals	33,367,830		32,115,090	6,608,830	11,031,060	11,266,840	4,461,100

*Cities and towns—289,830; roads and railroads—634,340; other—328,570.



PHYSIOGRAPHY	DOMINANT LAND CAPABILITY	USE OR ADAPTION	LIMITATION	CONSERVATION PRACTICES
Steep Hills Coast Range	VII e	Range	Shallow, Erosion	Range Management
Rolling Hills	IV e	Occasional Cultivation	Shallow, Erosion	Rotation with Grass Crops, Contour Cultivation
Alluvial Fan	II s	Cultivated	Shallow, Coarse Textured, Erosion	Rotation, Contour Cultivation
Basin	III w	Rice	Poor Drainage, Heavy Textured	Drainage and Irrigation
Sacramento River	I	Orchard	None	Good Management
Basin	III w	Rice	Poor Drainage, Heavy Textured	Drainage and Irrigation
Marysville Buttes	VI e	Range	Shallow, Erosion	Range Management
Feather River	I	Orchard	None	Good Management
Terraces	III s - IV s	Irrigated Pasture	Shallow to Hardpan	Conservation Irrigation, Seeding
Rolling to Steep Sierra Foothills	VI e - VI s	Range	Shallow, Erosion	Range Management
Lower Sierra Nevada	III e - IV e	Orchard	Shallow, Erosion	Cover Crops, Contour Cultivation, Irrigation Management
Steep Sierra Nevada	VI e - VII e	Forestry	Shallow, Erosion	Forest Management and Fire Protection
Very Steep Mountains above Timber Line	VIII s	Watershed and Recreation	Very Shallow Very Steep	

Figure 3. General Relationship Between Topography, Land Capability Classes, Crops, Cover, and Soil Conservation Practices From West to East Across the Sacramento Valley in the Vicinity of Marysville

the Central Valley area, dominantly on these deep alluvial soils.

The Sierra foothills portion of the watershed rises gradually from the valley floor and extends up the west slope of the Sierras to about 2,500 feet elevation. The general topography consists of moderately sloping, rounded hills, dissected by steep canyons which drop abruptly to narrow winding valleys along the major stream channels. The cover is dominantly a woodland-grass type used primarily for grazing. Fairly extensive areas of brush occur on the shallower soils. Deciduous fruit growing is centered around Auburn, Placerville, and Grass Valley in the northern portion where irrigation water is available. To the south, with decreasing

Cattle grazing on irrigated pasture. An important land use in this watershed.

rainfall and less irrigation, the emphasis is more on dry-farmed grain and range use. Irrigated pastures are rapidly expanding as water for irrigation is developed. The main soil losses by erosion occur on newly cleared land or on fields that have been farmed to grain for many years. The upper part of the watershed, extending from about 2,500 feet up to the crest of the Sierras is timber covered except for the essentially barren glaciated peaks above the timber line. This part, though sparsely settled, is highly important to the economy of the whole valley as a source of water for irrigation and domestic uses, hydro-electric power, timber products and recreation.

The Coast Range Mountains which form the west boundary of the Central Valley present a distinctively different problem from the standpoint of soil and water conservation. The rainfall is comparatively low, ranging from 15 to 30 inches in the northern portion, and from 5 to 10 inches over most of the southern portion. The cover consists of grass, woodland-grass, and brushy types which are used primarily for grazing. Dry-farmed grain is produced on the deeper soils of the rolling foothill slopes. The soils are generally shallow to deep,

Active sheet and gully erosion on range land west of Corning

medium-textured, derived from sandstone and shale. They are inherently rather infertile and highly erodible. Active sheet and gully erosion are common on slopes farmed to grain, and on range land where the cover has been depleted by grazing and fire.

The results of this survey show that there are over 1,575,000 acres of Classes I, II, and III land now in range or woodland use in the watershed that are suitable for cultivation. These areas of suitable land are widely scattered, particularly around the edge of the valley basin and in the foothill area. Most of these acres will require careful crop selection, and erosion-control measures, irrigation or drainage, when developed for more intensive use. There are also about 1,400,000 acres of Class IV land that is now used for range that is capable of development to close-growing grass and legume crops. As water becomes available, much of this land will probably go into irrigated pasture. The forage-producing potential of these areas offers one of the best possibilities of maintaining or increasing livestock numbers without over-grazing the very steep land subject to sheet and gully erosion. There are also 72,000 acres of steep, erodible land now used chiefly for grain production that should be converted to forage grasses and legumes. There are about 500,000 acres of Subclasses VIc and VIIc land which under present conditions of aridity are not capable of producing cultivated crops, but do produce some forage. If water becomes available for use on these lands, they will have to be reclassified.

Soil and Water Conservation Needs

The major soil and water conservation needs of the Central Valley may be briefly summarized as:

1. Development of suitable land to its full potential so that the use on the poorer, erodible land can be reduced. Developing these areas for more productive use will require careful selection of crops to fit specific soil limitations, erosion-control, drainage improvement on

wet land, water development and conservation irrigation practices.

2. Maintenance or establishment of erosion-control measures on over 1,350,000 acres of sloping land now under cultivation. This will include wind erosion-control measures on some 250,000 acres of light-textured soils in the southern part of the watershed.

3. Maintenance or improvement of drainage and flood protection on over 1,350,000 acres of cropland that are subject to poor drainage and overflow. This includes about 250,000 acres of intensively used land in the Delta area where the principal problem is to maintain drainage on the islands which now average 10 feet below sea level.

4. Careful management and crop selection on almost 2,700,000 acres of land with soil problems such as shallow depth, extremely heavy or very light textures, or toxic amounts of salts.

5. Water development, land leveling, and conservation irrigation.

6. Grazing management practices on about 11 million acres of range land.

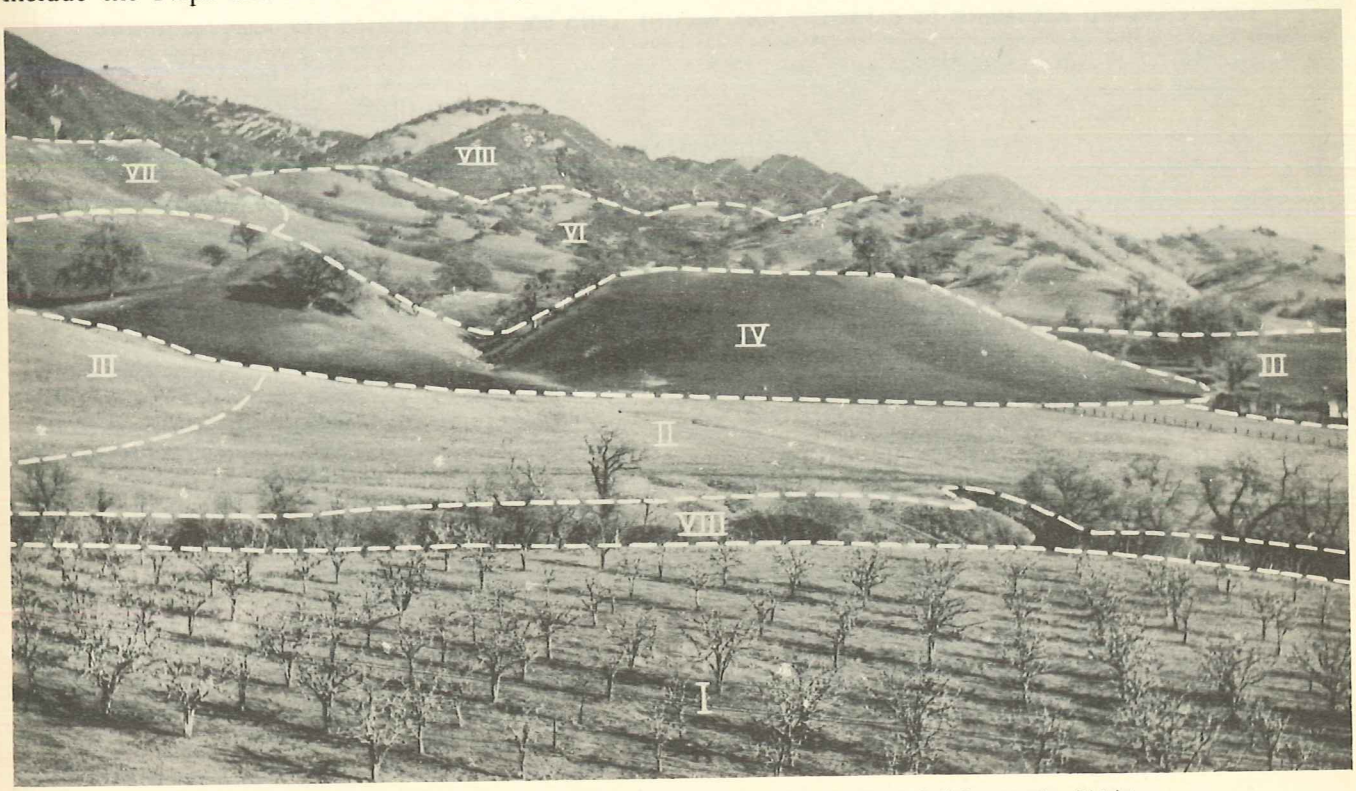
Heavy equipment is used to prepare the land for efficient irrigation

7. Forestry management and fire protection on over 14,500,000 acres of land used primarily for forestry, watershed and recreational purposes.

SAN FRANCISCO BAY AREA WATERSHED

Physical Conditions

The San Francisco Bay Area Watershed includes all the drainages into San Francisco Bay up to the confluence of the Sacramento and San Joaquin Rivers. These include the Napa and Santa Clara Rivers, Alameda Creek, and numerous minor tributaries to the bay. The watershed is made up of the round-topped Coast Range Mountains and the interlying valleys. The precipitation ranges from 20 to 30 inches, somewhat higher in the northwestern portion and lower in the south-central area around San Jose. The soils of the mountainous por-

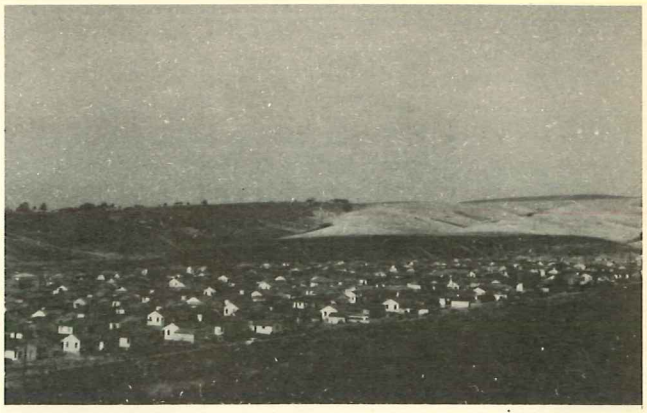


A landscape showing how capability classes fit the land in the Contra Costa Soil Conservation District

tion are medium-textured, moderately deep, and are derived from sedimentary sandstone and shale formations. The alluvial soils of the valleys are deep, medium- to heavy-textured.

Agriculture is varied. About one-third of the cropland is used for orchards and vineyards, one-third for small grain crops, and the balance is about evenly divided among row crops, hay and pasture, and fallow.

The deep alluvial valley soils are intensively utilized for tree crops: apricots and prunes in the Santa Clara Valley, walnuts near Walnut Creek, and prunes in the Napa Valley. Vineyards are important in the Napa, Sonoma, and Livermore Valleys. Table 7 gives an acreage summary of the land-capability classes by present land use for this watershed. At the time of the survey about 20 percent of the 2,201,220 acres in this watershed were cultivated. Sixteen percent of the area was unclassified, mostly urban areas. These include San Francisco and the peninsula cities, the San Jose area, the East Bay Metropolitan area, Vallejo, and Napa. In recent years there has been a rapid expansion of urban development, usually on the better agricultural lands, with a consequent reduction in the acreage of land suitable for intensive agriculture. In the past few years, over 10,000 acres of Class I and II land in Santa Clara County have been converted from agricultural to urban use. The same pattern is true for the Walnut Creek, Vallejo, and other areas in the watershed. As the urban areas expand on the better land there is less high quality land left. Intensive agriculture must move to the less productive and more hazardous land.



New housing on the best agricultural land in the valley bottoms (Class I), leaving the sloping hill land for agricultural use (Subclass IVe)

Of the 634,000 acres of land suitable for cultivation (Classes I to IV), 432,000 acres are used for crops. Of the remaining 200,000 acres suitable for cultivated use, only 20,000 acres are Class I or II land. There are about 13,500 acres of land in the watershed under cultivation that are not suited for such use and should be planted to grass or trees.

TABLE 7

LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE—SAN FRANCISCO BAY AREA WATERSHED

Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	79,910		79,910	79,780	130		
II	156,300	e	47,250	41,290	4,600	1,360	
		w	46,440	37,680	8,760		
		s	62,610	57,550	5,060		
III	168,200	e	56,830	46,570	10,260		
		w	65,150	46,190	18,960		
		s	46,220	38,610	7,610		
IV	230,010	e	171,670	70,330	99,980	1,360	
		w	30,810	5,520	25,290		
		s	27,530	8,730	18,800		
V							
VI	385,450	e	314,190	13,520	269,110	31,560	
		w	20,270		20,270		
		s	50,990		40,930	10,060	
VII	536,420	e	361,020		238,240	122,780	
		w	31,900		31,900		
		s	143,500		46,170	97,330	
VIII	292,730	e	3,760			1,700	2,060
		w	85,240				85,240
		s	203,730			152,660	51,070
Unclassified	352,200						*352,200
Totals	2,201,220		1,849,020	445,770	846,070	418,810	490,570

*Cities and towns—193,780; roads and railroads—125,530; other—32,890.

Soil and Water Conservation Needs

A soil and water conservation program for this watershed should consist of the following major practices:

1. Water Development. At present only 105,000 acres of the 445,000 acres of cropland are irrigated. Water shortages have been critical in the Santa Clara Valley. A program of water development would require the construction of reservoirs and stockponds, development of springs and wells, and the possible importation of water to the watershed.

2. Erosion-control Practices. Contour cultivation, crop rotation, mulch tillage, and diversion terraces on the 160,000 acres of cropland in need of protection from erosion, as well as on the 115,000 acres capable of being cultivated. Management on the 500,000 acres of range land to insure that adequate cover remains after use.

3. Flood control and drainage improvement on 140,000 acres of land with high water table or subject to flood or overflow.

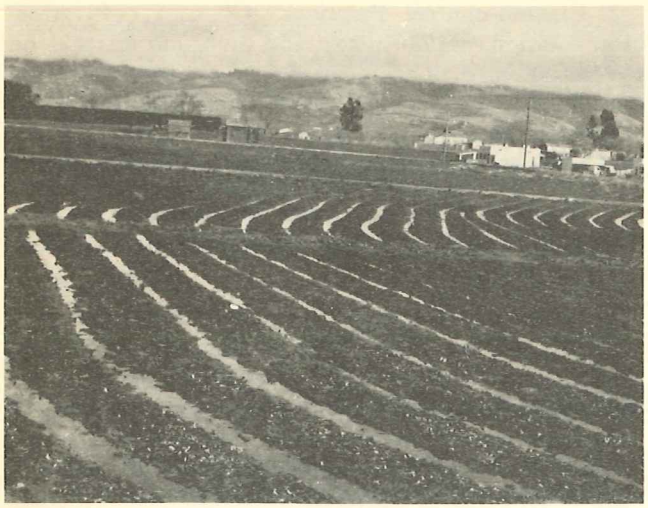
CENTRAL CALIFORNIA COASTAL WATERSHED

Physical Conditions

This watershed of over 7,500,000 acres includes all of the coastal drainage from the Golden Gate of San Francisco Bay on the north to the Santa Clara River in Ventura County on the south, and includes all or portions of San Mateo, Santa Cruz, San Benito, Monterey, San Luis Obispo, Santa Barbara and Ventura Counties. The principal features of the watershed are the steep, brush-covered Coast Range Mountains and the narrow alluvial valleys of the Pajaro, San Benito, Salinas, Santa Maria and Santa Ynez Rivers. These rivers are normally dry during the summer months, but their flows may reach destructive flood stages during the wet winters. Annual precipitation is quite variable, but over most of the watershed averages from 10 to 20 inches. Along the coast as well as in the upper portion of the Santa Ynez River in Santa Barbara and Ventura Counties the range is from 20 up to 60 inches. Almost all of the precipitation is in the form of rain.

The 1,100,000 acres of cropland in the watershed are concentrated in the alluvial valleys and their adjacent fans and terraces. The crops grown vary widely, and certain localities are known for specialty crops. The Pajaro Valley is known for apples and lettuce, the Lower Salinas Valley for lettuce and truck crops, the

A landscape showing how capability classes fit the land in the Santa Barbara Soil Conservation District



Contour-planted, contour-irrigated strawberries in Santa Cruz County

Upper Salinas Valley near Paso Robles for almonds. The Santa Maria and Lompoc areas are important truck crop producers, as is the coastal terrace strip near Santa Barbara. Artichoke production centers around the Half Moon Bay and Monterey Bay areas. Of the 1,100,000 acres of cropland about 280,000 acres are irrigated, chiefly the row crops and orchards.

The soils of the alluvial valleys are deep, vary in texture from light sands to heavy clays, and in some localities may have problems of high water table or overflow from the winter rains. About 450,000 acres of small grain are grown. Due to the low rainfall this is usually on an alternate grain-fallow basis. Large grain areas are located on the higher-lying alluvial fans and lower hill slopes around the valleys, and in the Carrizo Plains area. These dry-farmed sloping lands are subject to severe erosion losses.

There are over three million acres of grazing in this watershed. These include the grassland and the typical California coastal grass-woodland areas. The major areas of grassland occur in the western portion of San Benito County, southeastern Monterey, the eastern and western portions of San Luis Obispo, and in western Santa Barbara County. These grass and grass-woodland areas are typified by moderately deep, medium to heavy-textured soils derived from sandstones and shales.

Over 2,400,000 acres were classified as woodland in this watershed—the major portion being chaparral-covered watershed land. The southernmost stand of redwoods in the State lies in Monterey County. There is little other commercial timber in this watershed. Extensive areas of brush occupy the western portion of Monterey County, the south-central part of San Luis Obispo County, and most of the eastern half of Santa Barbara County. The soils of the brush covered areas are usually medium-textured, shallow and rocky, and occur on very steeply sloping mountainous land.

TABLE 8

LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE—CENTRAL CALIFORNIA COASTAL WATERSHED

Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	152,330		152,330	150,130	2,200		
II	345,920	e	210,990	165,210	45,210	570	
		w	32,420	25,700	6,720		
		s	101,880	86,580	15,300		
III	573,000	e	339,040	222,100	114,620	2,320	
		w	77,330	29,820	45,590	1,920	
		s	156,630	94,200	59,020	3,410	
IV	551,770	e	422,260	194,300	214,380	13,580	
		w	11,540	1,920	9,070	550	
		s	116,390	40,330	70,840	5,220	
		c	1,580	520	1,060		
V	4,500	w	4,500		4,500		
VI	1,358,770	e	1,278,430	79,880	1,056,990	141,560	
		w	6,620		6,070	550	
		s	73,720	920	58,670	14,130	
VII	2,350,440	e	1,645,350	3,470	984,190	657,690	
		w	54,940		44,990	9,950	
		s	650,150		413,100	237,050	
VIII	1,910,610	e	334,980		12,100	94,170	228,710
		w	63,390		2,820	14,400	46,170
		s	1,512,240			1,231,310	280,930
Unclassified	315,750						*315,750
Totals	7,562,460		7,246,710	1,095,080	3,167,440	2,428,380	871,560

*Cities and towns—76,270; roads and railroads—155,340; other—84,140.

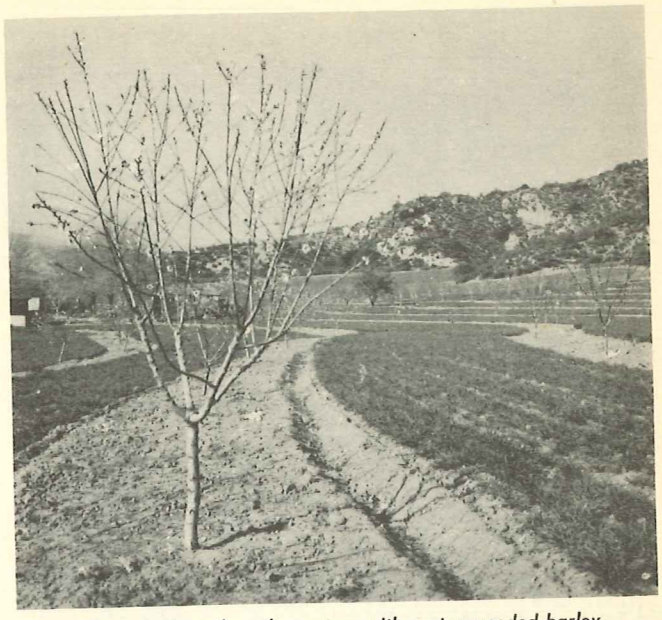
Table 8 gives a summary of the land-capability classes by present land use in the Central Coastal Watershed. This table indicates that there are about 300,000 acres of Classes II and III land now in grassland use that are suitable for cultivation. There are an additional 300,000 acres of Class IV land that is suitable for occasional cultivation or development to close-growing grass and legume crops. Most of the Class II and III land will require careful crop selection, erosion-control measures, drainage or irrigation, when developed for more intensive use. The development of these lands will permit less intensive grazing use of the steeper, more erodible land. There are about 80,000 acres of Classes VI and VII now used for grain and bean production, and some orchards, that should be retired from such use and converted to grass production.

Soil and Water Conservation Needs

The major soil and water conservation needs of the watershed may be briefly summarized:

1. Development of the more suitable lands to their full potential so that the use of the poorer, less suitable lands may be reduced. This development will require careful selection of crops to fit specific situations, erosion-control measures on sloping land, drainage improvement of wet lands, and conservation irrigation practices.

A sprinkler system is the most efficient way to apply irrigation water to this type of rolling land in permanent pasture



Almonds planted on the contour with contour-seeded barley cover crop between tree rows

2. Maintenance or establishment of erosion-control measures on the 580,000 acres of sloping land now being cultivated. This should include contour cultivation, crop rotation, mulch tillage, diversions, etc.

3. Maintenance or improvement of drainage and flood control on 57,000 acres of cropped land that is subject to poor drainage and overflow.

4. Good management on 220,000 acres of cropland that is limited in use by shallow soil depth or adverse soil texture.

5. Grazing management on over 3 million acres of range land.

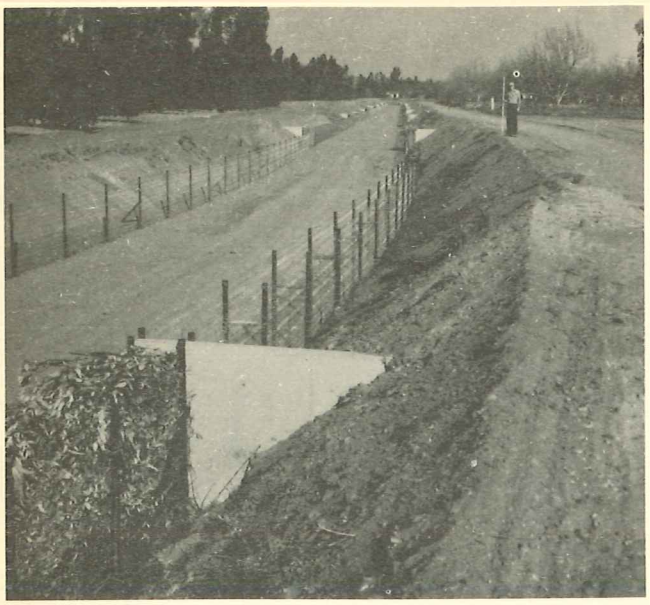
6. Fire protection on the 3,000,000 acres of watershed land dominantly brush covered.

SOUTHERN CALIFORNIA COASTAL WATERSHED

Physical Conditions

The Southern California Coastal Watershed consists of the drainages of the Santa Clara and Santa Ana Rivers, and other minor coastal drainages covering all or parts of San Diego, Riverside, San Bernardino, Orange, Los Angeles and Ventura Counties, and occupies 7,019,750 acres. The principal features of this watershed are the flood plain of the Santa Ana River and the coastal plain area of San Diego County, which consists of marine terraces, narrow valleys, and low hills. These areas lie between the ocean on the west and steep brush-covered mountains rising to the watershed crest on the north and east.

The rainfall is low, averaging from 10 to 20 inches annually over most of the area, with the mountainous parts of Ventura and San Diego Counties receiving up to 40 inches. The temperature is moderate throughout the year, and the growing season ranges from year round at the coast to only slightly less at inland points.



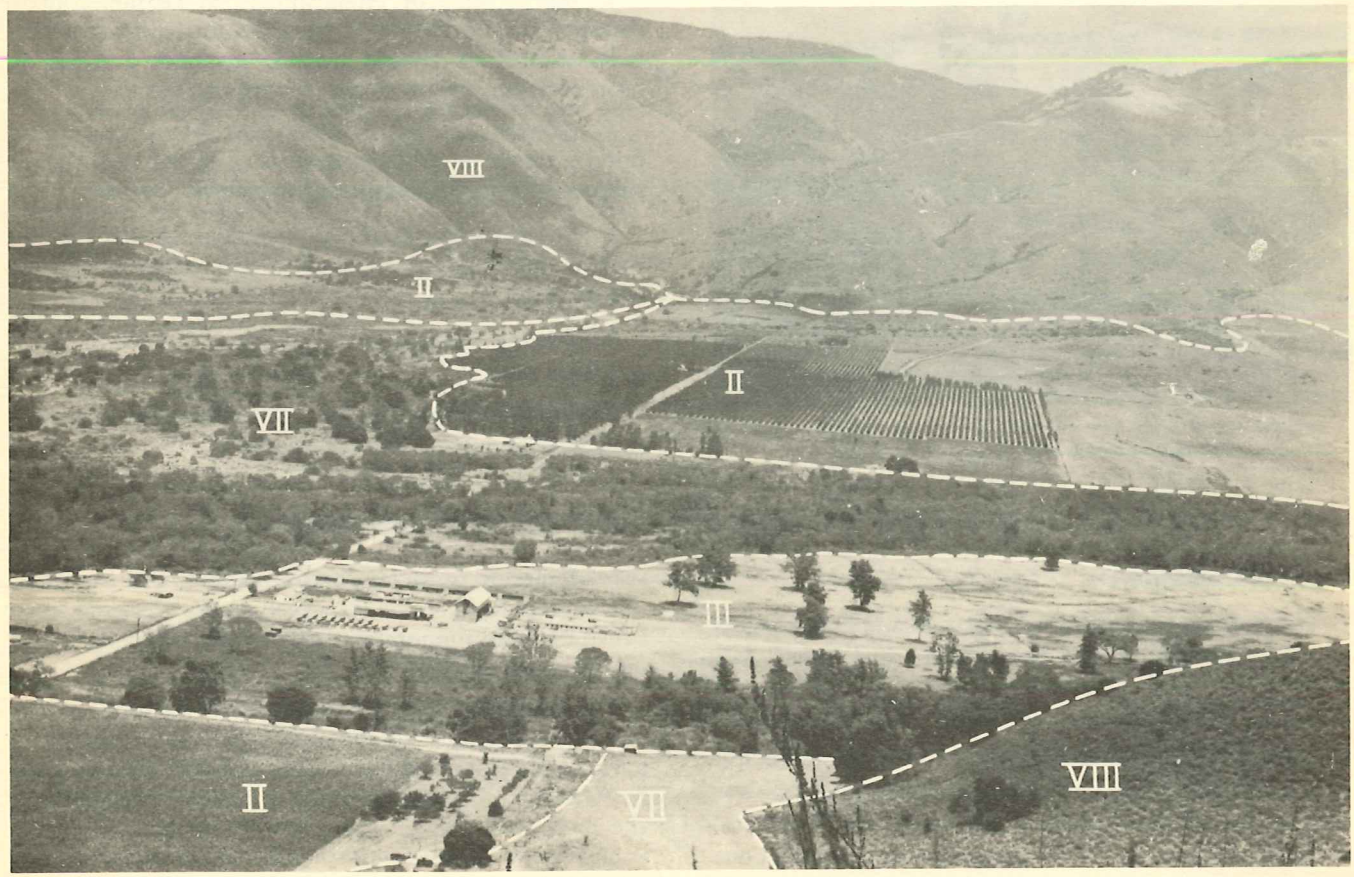
The San Fernando Valley Soil Conservation District coordinated the planning and installation of this properly designed flood control channel which safely handled the runoff waters from the January 1952 record storms

Irrigation is necessary for the more important crops. Of the 980,000 acres of cropland in this watershed, 600,000 are irrigated. The 380,000 acres of nonirrigated cropland consist mainly of the small grain crops, lima beans, fallow land, and vineyards.

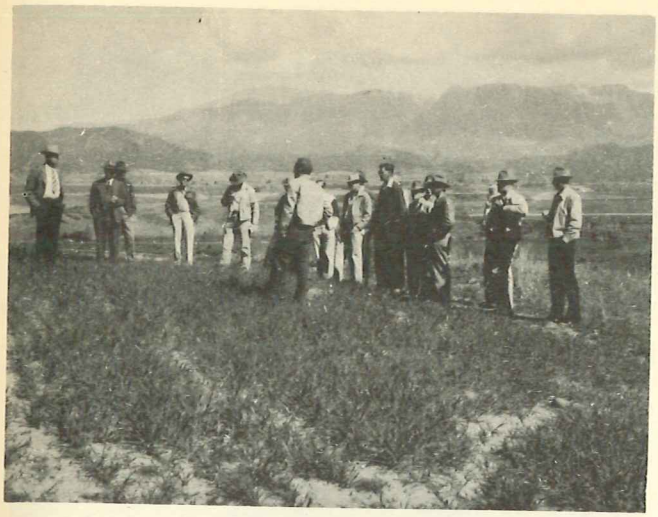
The soils of the marine terraces are usually light-textured, underlain by a dense claypan, and present a conservation problem. They are shallow and tend to erode rapidly unless very carefully managed. The valley soils are light to coarse-textured, gravelly, and much of the area is subject to flash floods and inundation. The mountain soils are mainly shallow, light-textured soils derived from granitic material and moderately susceptible to erosion. Under too intensive use, however, erosion damage is severe due to the high intensity of precipitation and the steep slopes on which these soils occur. An adequate cover of vegetation is the most important single conservation practice under local climatic conditions.

Partially due to the climatic desirability of this area, urban development has undergone a tremendous increase in the recent post-war years. At the time of this survey it was estimated there were 700,000 acres of urban area in this watershed; nearly equal to the area of cropland. This recent expansion has been mostly on the more accessible Class I and II lands, with the consequent loss of this good land for agricultural use and the subsequent development of the less desirable lands for intensive cropping.

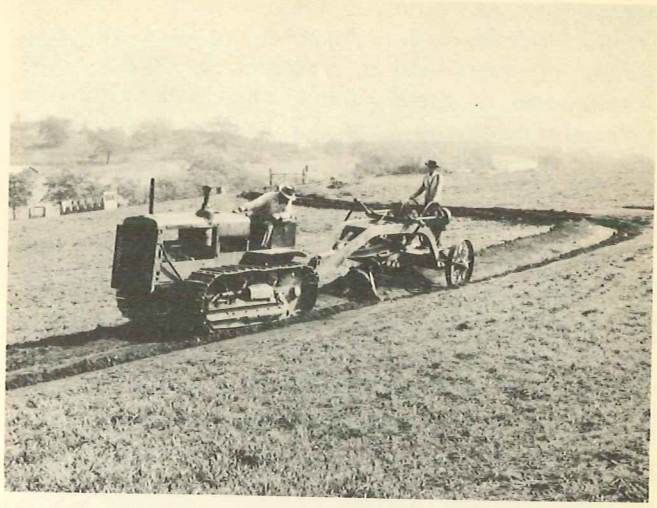
Table 9 gives a summary of the land-capability classes by present land use in the Southern California Coastal



A landscape showing how capability classes fit the land in San Diego County



A group of soil conservation district directors and farmers reviewing soil conservation problems in the field



Construction of a diversion contour ditch to remove excess runoff and prevent erosion. The diversions serve as guide lines for contour farming.

Watershed. Of the 980,000 acres of cropland in the watershed, 360,000 acres are used for orchard or vineyard, and over 200,000 acres are in row crops. Due to the temperate climate and irrigation methods of farming, many diversified crops are grown. Probably the most important single crop is citrus. Other important crops which have become specialized in local areas are avocados in the San Diego coastal strip; and beans, both green and lima, along the coastal terraces in the northern portion of the watershed.

The summary table shows that there are about 400,000 acres of Classes I, II and III land used for grazing that are suitable for more intensive agricultural use. The use of this land for agricultural production will require careful selection of crops to fit the limitations of the land, erosion-control measures on sloping areas, drain-

TABLE 9

LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE—SOUTHERN CALIFORNIA COASTAL WATERSHED

Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	189,580		189,580	169,640	19,940		
II	569,660	e	481,680	351,480	129,890	310	
		w	51,440	45,710	5,730		
		s	36,540	23,880	12,660		
III	501,070	e	425,800	219,530	200,320	5,950	
		w	40,520	32,410	8,110		
		s	34,750	18,800	15,950		
IV	343,590	e	305,950	92,880	211,590	1,480	
		w	10,600	2,680	7,920		
		s	24,530	10,010	14,520		
		c	2,510	440	2,070		
V	6,080	w	6,080		6,080		
VI	666,930	e	589,380	13,290	538,790	37,300	
		w	6,480		6,480		
		s	42,010		42,010		
		c	29,060		23,380	5,680	
VII	1,804,800	e	878,130		554,740	323,390	
		w	45,390		36,790	8,600	
		s	877,660		302,790	574,870	
		c	3,620		3,620		
VIII	2,053,050	e	50,280			24,000	26,280
		w	42,280				42,280
		s	1,960,490			1,430,520	529,970
Unclassified	884,990						*884,990
Totals	7,019,750		6,134,760	980,750	2,143,880	2,412,100	1,483,520

*Cities and towns—709,360; roads and railroads—95,320; other—80,310.

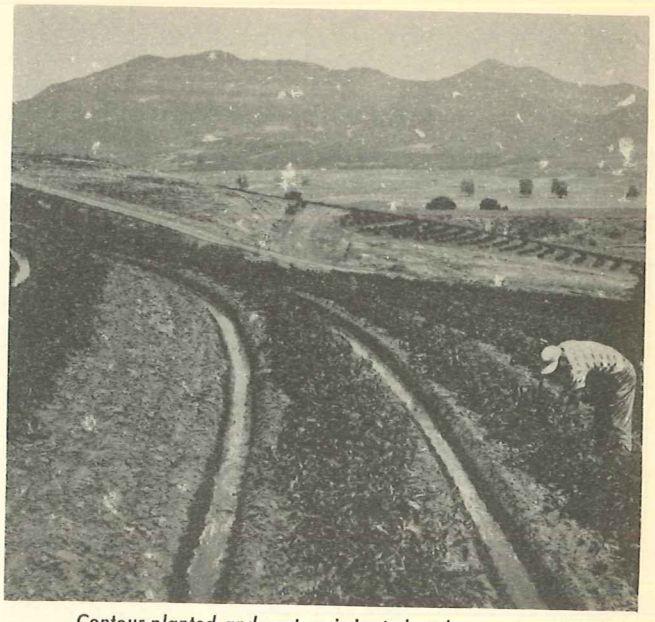
age and flood protection on wet and overflow areas, development of water for irrigation and intensive application of conservation irrigation practices. The development of these suitable lands will permit the currently cultivated Class VI land to be used for adapted trees and grasses.

Soil and Water Conservation Needs

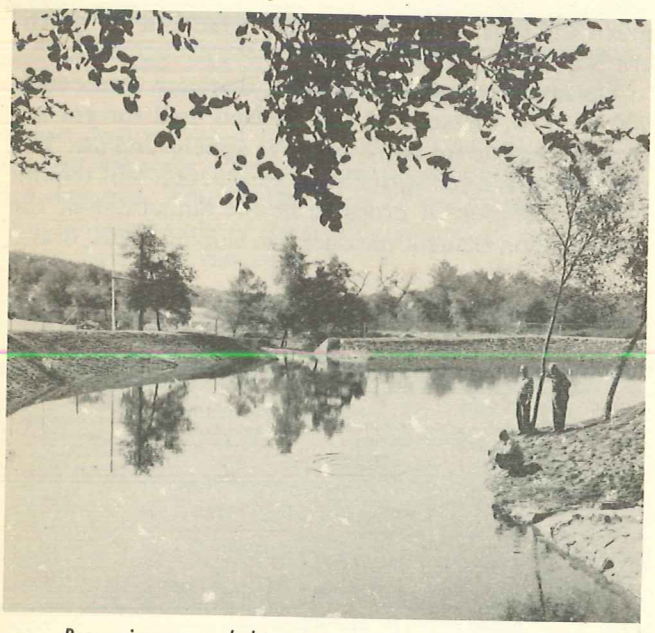
The essentials of a conservation program for this watershed include:

1. Careful management and full development of water resources along with intensive application of conservation irrigation methods. Water is perhaps the most important single factor in this watershed and measures must be taken to prevent its waste or misuse.

2. Maintenance or establishment of erosion-control measures on over 660,000 acres of sloping land now under cultivation. This will include contour cultivation, bench-terracing of orchards, winter cover-crops, crop rotation, stubble-mulch tillage, construction of diversions, etc.



Contour-planted and contour-irrigated early tomatoes in San Diego County



Reservoirs are needed to store winter runoff for summer use

3. Maintenance or establishment of drainage and flood control structures on the 80,000 acres of cropland subject to high water table or periodic flooding.

4. Conservation practices on the 52,000 acres of land now cultivated that has restrictions in use due to shallow soil depth, or to excessively light-textured soils.

5. Good range management on over 2 million acres of range land.

6. Fire protection on almost 3 million acres of land classified as woodland and miscellaneous. These lands are dominantly brush covered, steep mountainous areas with shallow soils. They are the lands which must be protected in order to obtain the maximum amount of usable water from the watershed.

NORTHERN GREAT BASIN WATERSHED

Physical Conditions

The Northern Great Basin Watershed is composed of 6,206,740 acres and includes areas 8 and 9 on the State Capability Map. Area 8 is the California portion of the Northern Great Basin. The average elevation is 4,000-6,000 feet, and some peaks rise to 8,000 feet. This area includes the relatively flat land around the Alkali Lakes, and the eastern slopes of the Warner Mountains. The average precipitation is 10 to 20 inches, some of which comes as snow in the winter, some as summer thunder showers. The alluvial soils surrounding Cowhead Lake, the Alkali Lakes, and in Surprise Valley are generally deep and medium-textured. The steep mountainous soils are medium-textured, shallow and rocky, and dominantly pine and fir covered. Sagebrush is the principal cover and small areas of cropland occur on the better soils. Grazing is the chief agricultural use.

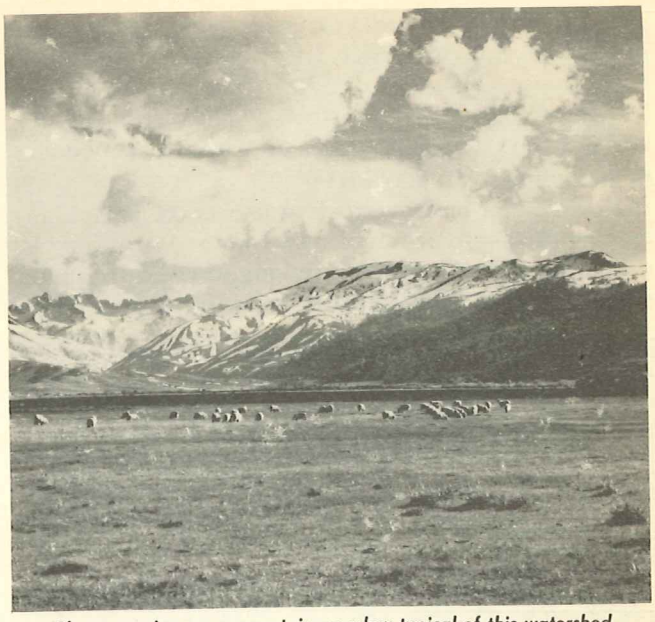
Area 9 includes the east slope of the Sierra Nevada from the Modoc County line on the north to Owens Lake in Inyo County on the south. The principal feature of this portion of the watershed is the steep, rugged eastern face of the Sierras, which drops abruptly from the watershed crest to the Great Basin area consisting of desert valleys and mountains to the east. This abrupt change in elevation from a maximum of 14,000 feet to

a low of 4,000 feet is reflected in similar rapid changes in precipitation and vegetation. The precipitation ranges from about 50 inches at the crest to a low of 10 inches in the desert. The highest glaciated peaks are above the timber line and are essentially barren. Various species of pine predominate in the timber zone. Pinon, juniper and sagebrush cover the lower and drier portion of the watershed. Wet meadow areas are found along some of the main streams. The Truckee and Walker Rivers are the principal drainages, both flowing northeast into Nevada.

The soils on the steep mountain slopes are generally shallow, light to medium-textured rocky types. Deep, light to medium-textured, gravelly alluvial soils are found extensively on the fans and in the valley bottoms. The soils of the meadow areas are dark colored, medium to heavy-textured, poorly drained types.

The agriculture centers around the raising of livestock. Cattle and sheep generally graze the open range during the summer months. In the winter periods they are fed around ranch headquarters on locally produced meadow hay, grain, and alfalfa.

Table 10 gives a summary of the land-capability classes by present land use in the Northern Great Basin Watershed. In this 6-million-acre watershed there are less than 100,000 acres of cropland, most of which is under irrigation.



Sheep grazing on a mountain meadow typical of this watershed

Soil and Water Conservation Needs

Since the growing of livestock is the most important industry of this area, the conservation program centers around the improvement of the forage-producing capacity of the ranch and grazing lands. The broad essentials of this program include:

TABLE 10

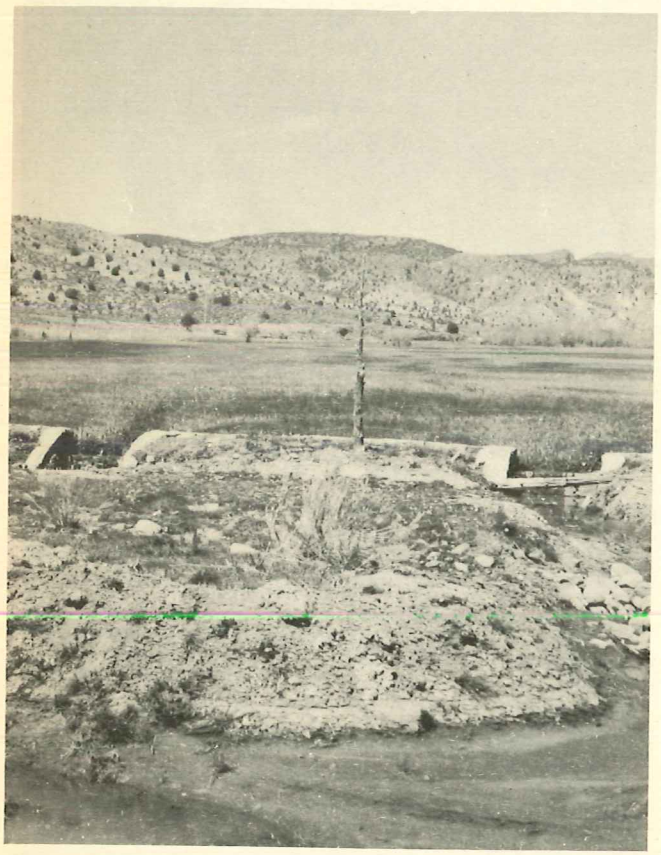
LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE—NORTHERN GREAT BASIN WATERSHED

Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	7,950		7,950	7,950			
II	86,310	e	35,910	21,980	13,930		
		w	22,000	9,250	12,750		
		s	28,400	20,100	8,300		
III	85,200	e	28,800	9,100	19,200	500	
		w	29,100	8,250	20,850		
		s	27,300	6,500	20,800		
IV	117,200	e	38,250		37,000	1,250	
		s	34,250	5,000	29,250		
		c	44,700	400	44,300		
V	43,340	w	43,340		43,340		
VI	1,435,740	e	692,860		509,090	183,770	
		w	116,500		116,500		
		s	101,200		97,900	3,300	
		c	525,180		519,980	5,200	
VII	2,546,600	e	2,078,910		1,409,170	669,740	
		s	254,490		203,440	51,050	
		c	213,200		211,700	1,500	
VIII	1,659,260	e	7,200			3,600	3,600
		s	1,652,060		4,000	856,070	791,990
Unclassified	225,140						*225,140
Totals	6,206,740		5,981,600	88,530	3,321,500	1,775,980	1,020,730

*Cities and towns—19,130; roads and railroads—41,140; other 164,870.

1. Clearing and development of about 150,000 acres of suitable land (Classes II, III, and IV) for cultivated hay crops and improved dry and irrigated pastures. The forage produced on these areas would permit lighter use on steep erodible grazing land while still producing more pounds of beef and wool.

2. Irrigation and livestock water development, including the construction of reservoirs and stock ponds, development of springs, and sinking of wells. Irrigation of suitable areas would greatly increase forage production. Stock water ponds would facilitate better distribution of range livestock and hence more uniform utilization of the range forage. Rehabilitation of farm irrigation systems and improvement of irrigation practices would result in greater efficiency in the use of water.



Flash-board check dams are sometimes needed to regulate spring runoff and prevent gullying in natural meadows

3. Drainage improvement and regulation of spring flooding on about 94,000 acres of wet land and overflow land. Much of this acreage is in native wet meadow where the quantity and quality of forage could be greatly improved by better regulation of water. Excessive amounts of water flood these meadows in the spring, keeping the soil too cold and waterlogged for plant growth. A system of drainage and irrigation ditches that can be regulated by flash boards makes it possible to control the water table a few feet below the surface of the soil. This enables the soil to warm up and aerate early in the spring, making conditions more favorable for the growth of native or introduced forage plants. Drainage and irrigation improvement is also necessary on cropland around Honey Lake for the control of alkali salts.

4. Erosion control on 30,000 acres of cropland; 2,000,000 acres of land used primarily for grazing, and 850,000 acres used primarily for forestry and watershed purposes. This will include crop rotation, contour cultivation and stubble-mulch tillage on the cropland; good range and forestry practices and fire protection on the rest of the watershed lands. The use, conservation, and improvement of these lands are all interrelated, as the ranchers with crop and meadow lands have grazing rights on the open range and forest lands. By developing adequate feed reserves on the home ranch it becomes possible to regulate the amount and time of use on the range for improvement in plant cover and conservation of soil and moisture.

CENTRAL GREAT BASIN AND LOWER COLORADO RIVER WATERSHED

Watershed Physical Conditions

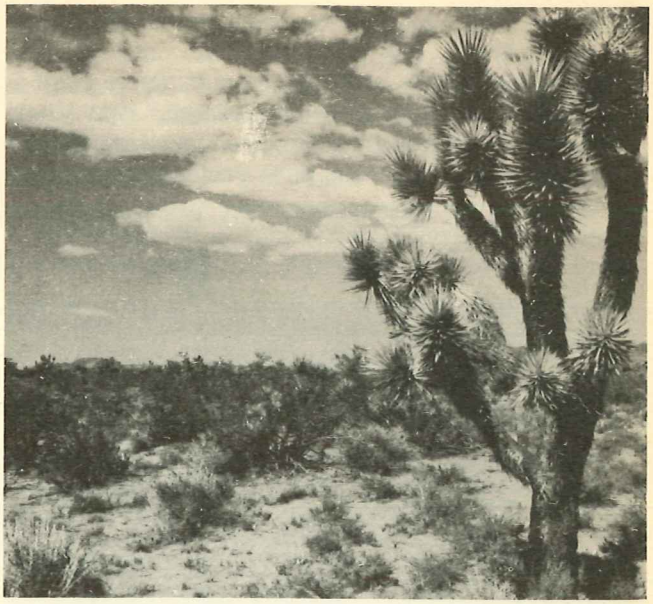
The Central Great Basin and Lower Colorado River Watershed in California is composed of 26,927,470 acres, and includes areas 10 and 11 shown on the State Capability Map. This watershed is characterized by extreme aridity and sparse vegetation. It includes practically all of the true desert in the State. Annual precipitation seldom reaches 10 inches, and in most places it is less than five inches. The rains are extremely variable. A storm of high intensity may occur in any month of the year and may be general or very localized. Summer temperatures are extremely high and dry winds are common. Widely spaced desert shrubs consisting primarily of species of yucca, creosote brush, atriplex, and cacti make up the natural vegetation. These plants are well adapted to the low rainfall but the scant vegetative growth and wide spacing make them of little value for grazing or for protecting the soil from erosion. Much of the soil has a well-developed "desert pavement" of rock and gravel. This pavement now helps to protect the soil from further wind and water erosion.

Physiographically the area consists of a series of almost bare mountain ridges surrounded by sloping allu-

vial outwash fans. The drainage pattern for the area is poorly defined, as many streams are self-contained and terminate in bare alkali flats. Elevations are chiefly from 1,000 to 2,000 feet above sea level. Some of the mountain crests rise to 10,000 feet, while two major depressions (Death Valley and Salton Sink) are nearly 300 feet below sea level.

The soils are typically sandy with considerable gravel and have a low moisture-holding capacity. They range in depth from essentially no soil mantle on the mountains to deep alluvial deposits on the fans and valleys. Under low rainfall the salts produced in the process of soil weathering tend to accumulate in the surface soil to the point of being toxic to plant growth. These salts are concentrated in the valley bottoms and sinks by the runoff water from surrounding areas, the deposits forming barren alkali playas.

Farming is limited to Antelope, Imperial, Coachella and Palo Verde Valleys, and to scattered areas along the Mojave River. Imperial Valley has become famous for its early truck crops of all kinds, while the Coachella Valley has the most extensive planting of dates in the United States. Alfalfa, grain, and pasture are common crops in these irrigated valleys. A fairly extensive area is used for the production of dry-farmed grain in the western part of Antelope Valley where rainfall ranges up to around 15 inches. Here low yields and crop failures occur during years of lower than average rainfall.



Desert vegetation and topography typical of this watershed

Table 11 gives a summary of the land-capability classes by present land use. The results of this survey show that of the 27 million acres included in this watershed, only 770,000 are cropped. Slightly over 90 percent of the cropland is irrigated. The remainder is dry-farmed, primarily to grain. There are about 4

TABLE 11

LAND CLASSIFIED ACCORDING TO CAPABILITY AND PRESENT LAND USE—CENTRAL GREAT BASIN AND LOWER COLORADO RIVER WATERSHED

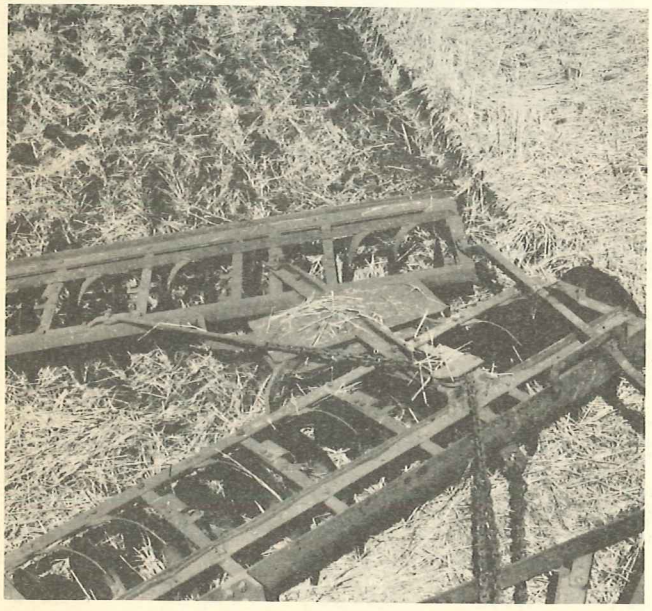
Land capability classification				Land in crops, fallow, hay and pasture	Dominantly grazing use	Dominantly forest and watershed use	Miscellaneous barren, desert, etc.
Class		Subclass					
Symbol	Acres	Symbol	Acres	Acres	Acres	Acres	Acres
I	800		800	800			
II	534,990	e	264,360	115,540	148,710	110	
		w	261,140	242,660	18,480		
		s	9,490	1,000	8,490		
III	704,100	e	320,920	110,200	210,290	430	
		w	316,950	265,000	51,950		
		s	66,230	16,310	49,920		
IV	75,990	e	42,840	11,630	31,000	210	
		s	24,440	3,190	21,250		
		c	8,710	4,110	4,600		
V	1,040	w	1,040		1,040		
VI	1,435,680	e	155,200		150,250	4,950	
		w	310		310		
		c	1,280,170		619,440	660,730	
VII	4,336,060	e	674,390		196,590	477,800	
		w	7,740		7,740		
		s	780,400		371,760	408,640	
		c	2,873,530		1,728,720	1,144,810	
VIII	19,580,510	e	508,690			40,000	468,690
		w	95,290				95,290
		s	12,940,350		26,350	4,309,500	8,604,500
		c	6,036,180			138,000	5,898,180
Unclassified	258,300						*258,300
Totals	26,927,470		26,669,170	770,440	3,646,890	7,185,180	15,324,960

*Cities and towns—17,030; roads and railroads—36,480; other—204,790.

million acres of land suitable for irrigation (Subclasses VIc and VIIc) if and when water becomes available. Drainage and salinity problems are common to the irrigated areas, particularly the Imperial and Palo Verde Valleys. Land leveling, water development and conservation irrigation are the most pressing problems in

Land that has been leveled and prepared for irrigation. Pre-irrigation before planting alfalfa for seed.

the Antelope and Coachella Valleys and along the Mojave River. Wind erosion is an ever-present problem in these desert areas where the soils are sandy and when clean tillage is practiced. After close-growing irrigated crops are established, wind erosion is usually controlled. When it becomes necessary to cultivate in connection with re-establishment of stands, crop residues should be left at the ground surface to prevent soil movement by wind.

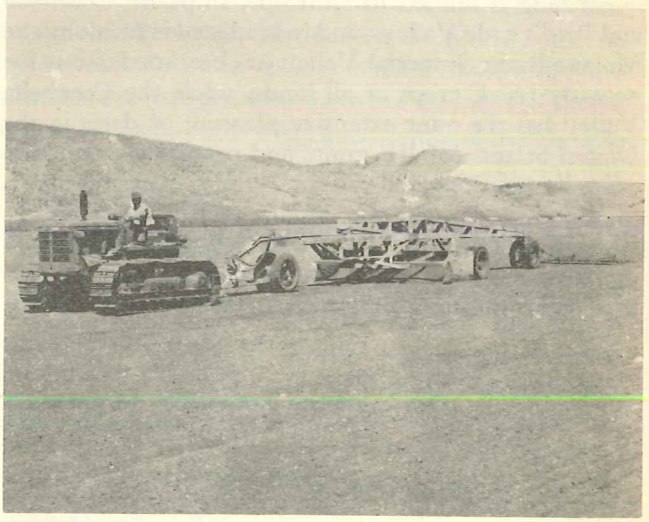


Stubble-mulch tillage. Straw was spread on this field after grain was harvested. The field is being cultivated to leave as much of the straw as possible on the surface.

Soil and Water Conservation Needs

The major soil and water conservation needs of this watershed consist of:

1. Irrigation water development and establishment of conservation irrigation methods on all irrigated land. Because of the very low rainfall, stream flow and underground water supplies are very limited. Water for irrigation must be brought to suitable areas from long distances by canals; or, where ground water supplies exist, they have to be lifted to the surface at a considerable pumping cost. The cost of water from either of these sources demands that irrigation be done with utmost care and efficiency. The land should be carefully selected as to its suitability for irrigation, and then carefully leveled and prepared to permit uniform water application. Farm irrigation systems should be laid out

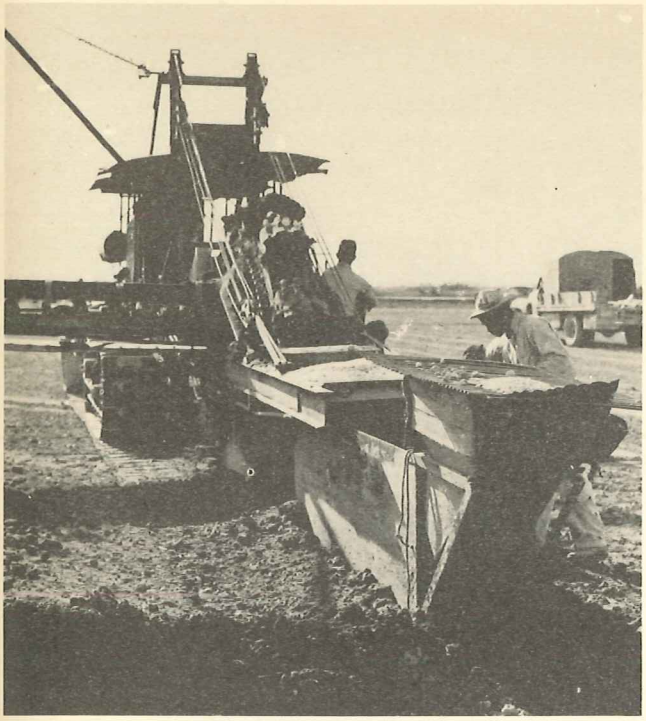


Land planes are commonly used to level the land for irrigation

to fit the type of soil and to meet the needs of the particular crops to be grown. Very careful regulation of the frequency and amount of irrigation water applied is necessary to prevent the creation or aggravation of drainage and salinity problems.

2. Maintenance or improvement of drainage on about 500,000 acres of cropland having waterlogged soils with accompanying salinity problems. Extensive open and tile drainage systems have already been installed in the Imperial Valley. These installations need to be maintained. Established systems need to be extended to areas not now adequately drained. Properly installed and managed irrigation and drainage systems not only increase crop yields but are the best insurance against the accumulation of toxic amounts of salts in the soil.

3. Soil-management practices to maintain tilth and fertility on 770,000 acres of cropland. Crop rotations and use of commercial fertilizers are now fairly common on much of this acreage. A favorable trend is the inclusion of green-manure crops and a period of pasture

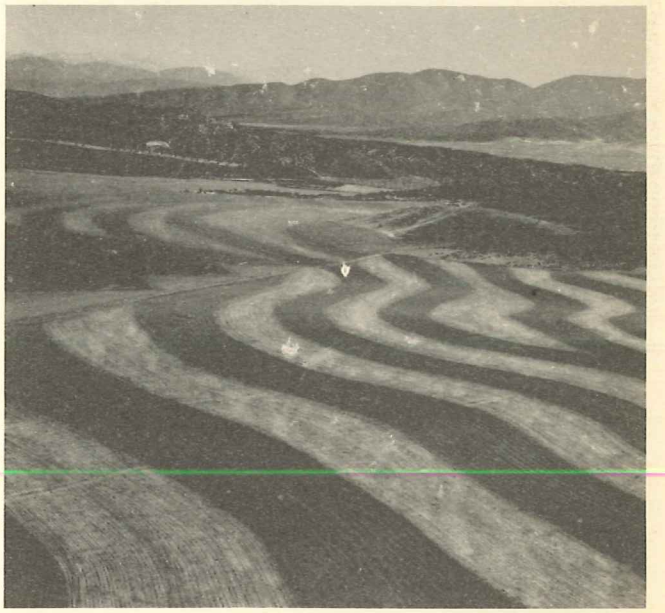


A rotary trencher installing tile drains in the Imperial Valley

in rotation with truck crops. The use of sesbania, a rank-growing tap-rooted legume, as a green-manure crop is proving very beneficial in maintaining soil fertility and soil structure. The tap-root system helps to open up the subsoil, thus permitting irrigation and drainage water to move more uniformly and rapidly through the soil profile. Maintaining the permeability of the soil so that about 10 percent of the irrigation water moves through the soil and out the drainage system is necessary to avoid the accumulation of toxic amounts of salts in these desert areas. All barnyard manure and crop residues should be returned to the surface soil to maintain or improve soil tilth and fertility.

4. Erosion-control practices on about 237,000 acres of cropland. Wind erosion is the primary problem on about 75 percent of this acreage. The greatest damage occurs on the sandy soils when the land is bare either during land leveling or seedbed preparation. Land of this type can best be protected by using it for close-growing crops where possible. Such practices as mulch-tillage, strip-cropping across the direction of the wind, leveling during periods of low wind velocity, and planting of windbreaks will reduce the land damage and human discomfort from wind erosion to a minimum.

Water erosion is confined to about 61,000 acres of dry-farmed grain land. This acreage is centered in the western end of the Antelope Valley and east of Tehachapi. Stubble-mulch tillage and contour strip-cropping have proven effective on these lands. About 10,000



Contour strip-cropping in the Antelope Valley Soil Conservation District. Alternate strips of cultivation and stubble are used to control water erosion on this sloping grain land.

acres of this grain land is in Subclass IVe due to steep slopes and erodible character of the soil and is only suitable for grain about one year in four in a long rotation with grass.

5. Range, woodland and watershed management practices on about 10 million acres of land used primarily for grazing, forestry or watershed.

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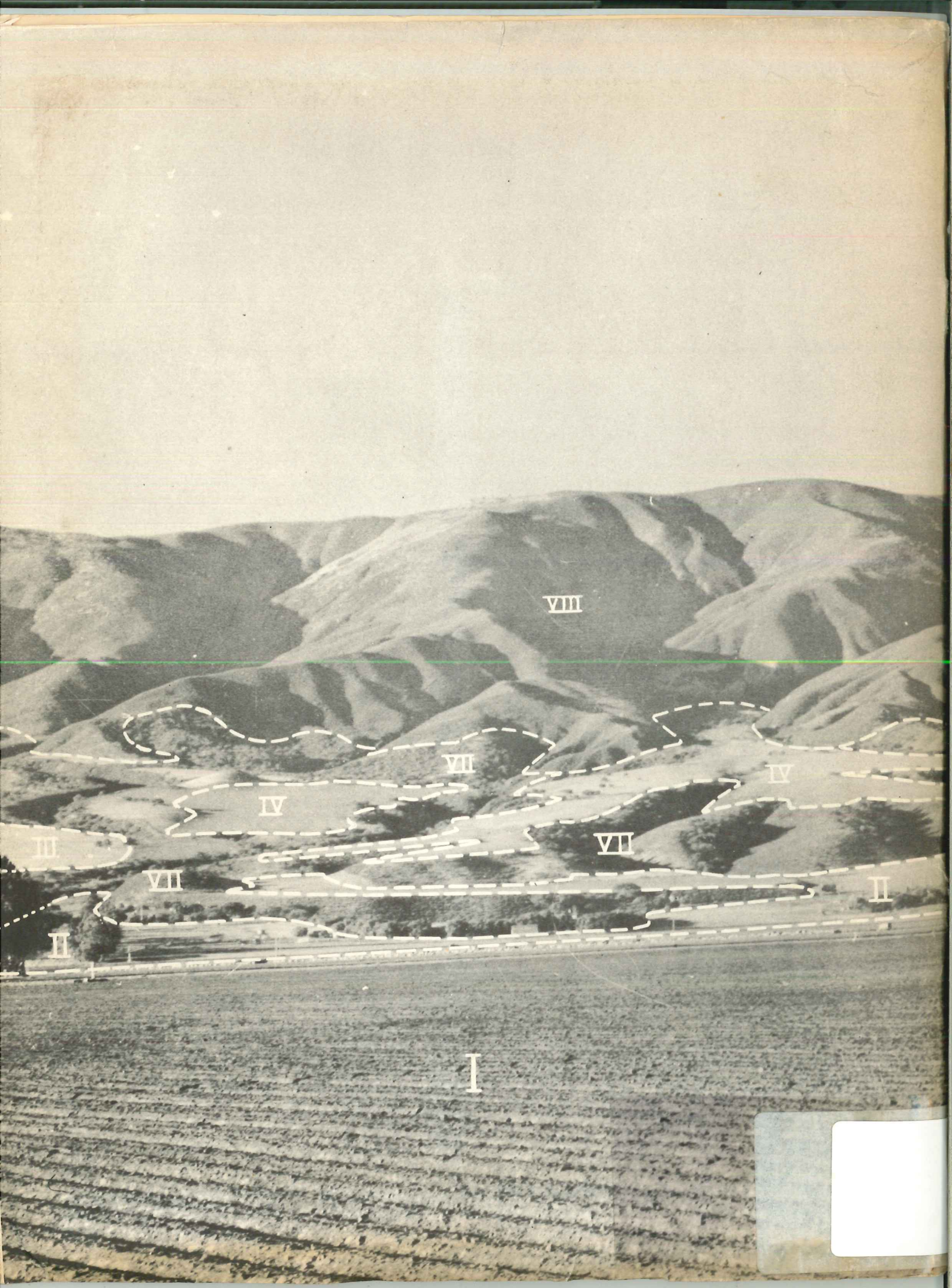
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