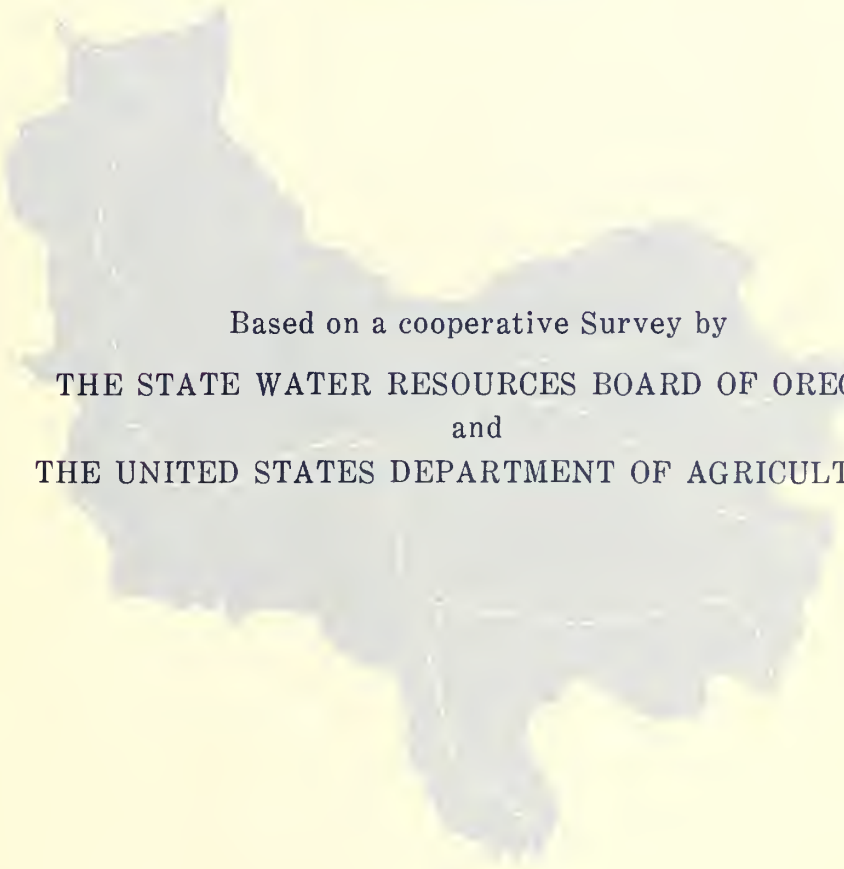
USDA Report on
WATER and RELATED LAND RESOURCES

JOHN DAY RIVER BASIN
OREGON



Based on a cooperative Survey by

THE STATE WATER RESOURCES BOARD OF OREGON

and

THE UNITED STATES DEPARTMENT OF AGRICULTURE

Prepared by · · ECONOMIC RESEARCH SERVICE · · FOREST SERVICE · ·
SOIL CONSERVATION SERVICE SEPTEMBER 1961

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cc: Beattie

CONTENTS

INTRODUCTION

This report presents information concerning the water and related land resources of the John Day River basin, the result of a cooperative study by the U. S. Department of Agriculture and the State Water Resources Board of Oregon.

The State Water Resources Board of Oregon is making a survey and investigation of the John Day River Basin to develop information needed for planning the coordinated development of the basin's water resources. The information needed for its study includes: (1) the kind and location of desirable water resource developments; (2) the amounts of water required; (3) the physical opportunities for installation of development to meet water needs; and (4) the broad economic aspects of possible development. The State will use this information to formulate and implement plans and programs to secure the most beneficial use and control of the basin's water resources. The State's programs are intended, by legislative decree, to be dynamic in nature, with provision for changes as new information is available, and as the physical or economic situation changes. The current survey is only the beginning of the State's work in this basin.

Upon request of the State Water Resources Board, the U. S. Department of Agriculture cooporated in this survey under the provisions of section 6 of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, as amended).

The broad objective of the cooperative survey was to gather data and information pertinent to the use and control of water for agriculture in the basin, as well as data concerning such water-related problems as erosion, flood prevention, and drainage. Data of this kind are necessary for appraisal of present and future use of water by agriculture in relation to other water uses and for planning, evaluation, development, and operation of the various agricultural programs of Federal, State, and local agencies. Data presented herein should be of use to anyone interested in the basin's land and water resources.

The survey was not a detailed one. It was intended to gather broad basic data, highlight major problems, and outline a general program for water and related land-resource management to be used as a background for future detailed study and planning in the basin. No final solutions are intended, for it is felt that watershed planning must be a dynamic, continuing process, requiring further cooperative work by all groups concerned.

Basic data used as a foundation for statistical information presented in this report are in the files of the USDA Field Party. Because of time limitations, it was not possible to obtain detailed data on several items.

Several agencies and organizations provided helpful assistance in the preparation of this report. Of particular value was information, data, and consultation received for the County Extension Service, the U. S. Bureau of the Census, and the Pacific Northwest Forest and Range

Experiment Station. The various field offices of the U. S. Forest Service and the Soil Conservation Service compiled much of the basic data used in this report. In accordance with the cooperative agreement, the State Water Resources Board developed and furnished information and data concerning existing water rights, major resources and their use and other pertinent information, in addition to furnishing hearing reports and numerous maps.

USDA REPORT ON WATER AND RELATED LAND RESOURCES

JOHN DAY RIVER BASIN, OREGON

SUMMARY

General Description of the Basin

The John Day River Basin, in north central Oregon encompasses an area of 8,000 square miles, 8.2 percent of the area of the State of Oregon. It includes portions of the Deschutes-Umatilla Plateau and the Blue Mountains, with elevations varying from about 150 feet at the river's mouth to more than 9,000 feet at the summit of the highest mountains. The climate is generally semi-arid; it is characterized by low annual precipitation, very dry summers, and low winter and high summer temperatures. The average annual precipitation varies from less than 10 inches along the lower river to more than 40 inches in the high mountains. The growing season in the major agricultural areas varies from 120 to 170 days. Highest summer temperatures are above 110; lowest winter temperatures are around -50 in the mountain areas.

Settlement of the basin, beginning in 1862, was on the basis of mining and domestic livestock production. Dryland grain farming, irrigation, and lumbering developed later, while mining became relatively insignificant. The population of the basin, which is predominantly rural in nature, is now about 15,000 persons.

Forty-four percent of the basin is forested land, 44 percent is open rangeland, 11 percent is cropland, and 1 percent is devoted to other uses. Sixty-three percent of the basin is privately owned; 37 percent is publicly owned.

Forestry

Use of the timber, water, forage, wildlife, and recreational resources of the forest land in the basin has been greatly intensified in the last 30 years. The 2 million acres of commercial forest land have an estimated annual sustained timber production of 170 to 200 million board feet; but an average of 290 million board feet was harvested from this land annually during the last 5 years, more than half of it from private land. Most forest land also produces forage for summer grazing by big game and domestic livestock. Forested areas attract many recreational visitors. For instance, nearly 140,000 visits were made to the national forests in 1960. Hunting and fishing, camping and picnicking, and sightseeing are the most popular recreational activities. Greatly increased recreational use is expected in the future. Except for some of the more heavily grazed areas, forested watersheds are in generally good condition, and because of their location and natural characteristics, they furnish a large portion of the basin's streamflow during the growing season.

Consumptive uses of water on forest land include requirements for plant growth, residents of forest areas, recreational visitors, domestic livestock, wildlife, and other purposes. Present annual consumptive uses, other than plant growth needs, total about 350 acre-feet, and are expected to increase by about 50 percent in the next 40 years. Present nonconsumptive uses include environmental requirements for fish life and recreation and limited use for hydraulic mining and hydroelectric power production.

Agriculture

Agriculture is the chief source of income in the basin. The dominant agricultural activities are production of beef and dryland grain. Ranches and farms require extensive use of resources in order to be successful. The 776 ranches (farms) in the basin average about 4,000 acres in size and represent investments of about $100,000 per farm. Farm numbers have decreased by 50 percent while average farm acreage has increased by 4 times in the last 40 years. Investment in land and buildings has also increased greatly. Production of crops and beef has increased since 1939, while sheep production has decreased.

Grazing of domestic livestock is the predominant use of land in the basin. Grasslands at a low elevation and hay grown on valley croplands supply winter and spring forage. Pine forests and mountain meadows supply most of the summer forage. In 1960, the livestock population included 105,000 cattle, 38,500 sheep, and 9,000 other livestock. Much of the grazing land is in depleted condition, and there is great opportunity for more production from this resource.

Eleven percent of the basin is cropland, most of which is in the dryland wheat-producing area of subbasin 3. Wheat is produced under an alternate crop fallow operation. Most of the cropland in subbasins 1 and 2 is used for irrigated pasture and hay.

The major agricultural uses for water in the basin are for production of forage, grain, and livestock. Some water is stored in tanks or small reservoirs at strategic locations for dry-season use by livestock. With optimum range conditions, an estimated 1,257 acre-feet of water would be consumed by livestock in harvesting the forage crop, about twice the amount presently required.

An estimated 49,000 acres are irrigated, primarily to increase the yield of hay and improve pasture. Most irrigated land is in the valleys, adjacent to streams. Irrigation is usually provided on an individual farm basis by means of direct gravity diversion of water from streams. Flooding is the most common method of applying water, although sprinkler systems have become more important in recent years. An estimated additional 17,000 acres of land could be irrigated, but increased late season water supplies are needed. Opportunities and need for irrigation development exist, but development will be governed by economic factors.

Water Related Problems

Major water related problems in the basin include those of water supply, irrigation system improvement and water management, drainage, flooding, sedimentation, and erosion. Although the annual water yield is large, water is generally insufficient during the late summer for irrigation, fish habitat, and other uses. Some irrigation systems are inefficient because of poor water control and inadequate land preparation. Only an estimated 4 percent of the arable land is subject to excessive wetness. However, this includes 43 percent of the presently irrigated area. Floods resulting from winter and spring runoff and summer cloudbursts cause extensive floodwater damage to agricultural land and other property. Sediment production is low to moderate, but is locally serious with damage to fish habitat, stock ponds, irrigation systems, and drainage ditches. Gully and sheet erosion is a problem wherever the vegetative cover has been seriously disturbed. Lands adjacent to major streams are subject to streambank and scour erosion.

Needs and Opportunities for Improved Management of Water and Related Land Resources

There is need for continuing maintenance and improvement of watershed conditions in the basin. Land use in all watersheds is an important aspect of water management because if affects flooding, sedimentation, erosion, and water yield. Forest and rangelands should be managed for optimum sustained yield of all resources. Major needs on agricultural land are better cropping systems, improved irrigation systems and methods, drainage of wetlands, streambank protection, and protection of land from wind and water erosion.

Additional water development is needed to insure uniform forage utilization by livestock and to provide additional late-summer water flows for irrigation and other uses. Ground water supplies, seeps, and springs need to be developed as a source of livestock water. Waterspreading of early-season runoff from some small drainages to adjacent rangeland could materially increase forage production. There are potential water storage sites throughout the basin where reservoirs could be developed for multipurpose use.

A limited survey indicates that only a few of the water and related land resource problems of the basin could be feasibly solved under the provisions of the Watershed Protection and Flood Prevention Act. The types of situations most likely to be suitable are those involving reorganization of group irrigation systems, or those involving multipurpose tributary watershed improvement. Six watersheds, having a total area of about 1 million acres, have problems and needs that might be met under the act; however, there have been no applications to date.

Coordinated action by all agencies, organizations, and individuals concerned will facilitate the best use of the basin's land and water resources.

GENERAL DESCRIPTION OF THE BASIN

LOCATION AND SIZE

The John Day River Basin is located in north central Oregon (fig. 1). The Blue Mountains and its spurs form the northern, eastern, and southern boundaries of the basin, and the divide between the lower Deschutes River and the John Day River forms the western boundary. It is about 130 miles wide at its widest point and narrows to 25 miles along the Columbia River. The longest north-south distance is 90 miles. The basin encompasses an area of about 8,000 square miles and includes major portions of Wheeler, Gilliam, Grant, and Sherman Counties and minor portions of Umatilla, Morrow, Jefferson, Wasco, Crook, Harney, and Union Counties.

The main stem of the John Day River extends 284 miles from its source in the Blue Mountains to its confluence with the Columbia River. Major tributaries include the North, Middle and South Forks. The John Day River with its tributaries drains about 8.2 percent of the area of the State of Oregon.

For the purpose of this report the basin is divided into 3 subbasins. Subbasin 1, the North Fork John Day Subbasin, includes the drainages of the North Fork and Middle Fork. Subbasin 2, the Upper John Day Subbasin, includes the South Fork drainage and the drainage of the main John Day River above its junction with the North Fork. Subbasin 3, the Lower John Day Subbasin, includes the drainage of the John Day River below its junction with the North Fork.

PHYSICAL ASPECTS

Topography

The John Day Basin is situated within two distinct physiographic areas. These are the Deschutes-Umatilla Plateau on the north and the Blue Mountain area to the south. The approximate boundary between the two areas is the county line between Gilliam and Wheeler Counties.

The lower portion of the basin, within the plateau area, slopes gently toward the Columbia River. Elevations range from 147 feet at the river mouth to nearly 4,000 feet along the south Gilliam County Line. The John Day River and tributaries are entrenched in the lava plateau with relatively narrow and flat bottomlands at scattered locations. The lands on the plateau are generally smooth and rolling, but the drainage pattern is characterized by steep swales and narrow canyons with abrupt sides.

The middle and upper portions of the basin, within the Blue Mountains, have highly variable relief. Elevations range from 1,830 feet along the river to 9,052 feet atop Strawberry Mountain. The land forms include narrow flat alluvial plains along the rivers and some broad rolling elevated valleys, all bounded by hilly and mountainous terrain.

Soils and Geology

Geologic formations in the John Day Drainage Basin include the Quaternary, Tertiary, Cretaceous, Jurassic, Triassic, and Permian periods. The largest part of the basin, however, is covered by volcanic materials of the Tertiary period. These volcanic materials include agglomerates, breccias, tuffs, and ashes. The most common lava flows are basalt, rhyolite, and andesite. Older rocks include quartzdiorite, serpentine, graywacke, and shale. The valleys consist of young and old alluvium.

A thin loess mantle covers the northern portion of the basin. The silty soils developed in the loess are on the average 2 to 5 feet deep. Most of these soils are used for dryland wheat under a summer fallow system of farming. On the very steep northerly exposures, the soils are derived from loess, and they are commonly deep, but rock outcrops and topography limit these soils to range use. The soils on steep and very steep southerly exposures are generally very stony and shallow; these soils are also limited to range use.

The ridgetops and northerly exposures in the northern portion of the Blue and Ochoco Mountains are covered by a 1 to 3 foot mantle of volcanic ash, which presumably originated from the eruption of Mt. Mazama (Crater Lake) some 7,000 years ago. This ash fall buried the then-existing soils, so that the soils on northerly exposures are commonly 3 to 6 feet deep. Presumably the southerly exposures were also covered by this ash mantle, but they are hotter and drier and consequently have less soil-protecting vegetation, so most of the ash has been eroded away. Thus, the soils on southerly exposures are generally shallow, very stony, and derived from basalt. Other extensive soils in the mountain area south of the main John Day are derived from graywacke, shale, tuffs, and breccias and are typically shallow. Most of these mountain soils are forested, although the north slopes generally have a much denser stand of conifers and understory vegetation than the southerly slopes.

The upland soils developed under bunchgrasses are derived from a large variety of parent materials. The soils on northerly exposures are commonly moderately deep to deep, whereas those on southerly exposures are typically shallow and stony or very stony.

Most of the soils on the flood plains are medium to moderately fine textured and moderately deep to very deep. Although some of these soils are excessively wet and some contain alkali, most of the acreage consists of deep, well-drained soils. Nearly all of these soils are irrigated. Most of the low terrace and alluvial fan soils adjacent to the flood plains are somewhat finer textured than the flood plain soils. Many of these soils are irrigated.

The Soil Conservation Service has a practical way of grouping soils called "Land Capability Classification". Soil characteristics such as permeability, waterholding capacity, depth, inherent fertility, texture, structure, wetness, acidity or alkalinity, overflow hazards, slope and also climatic conditions as they influence use, management,

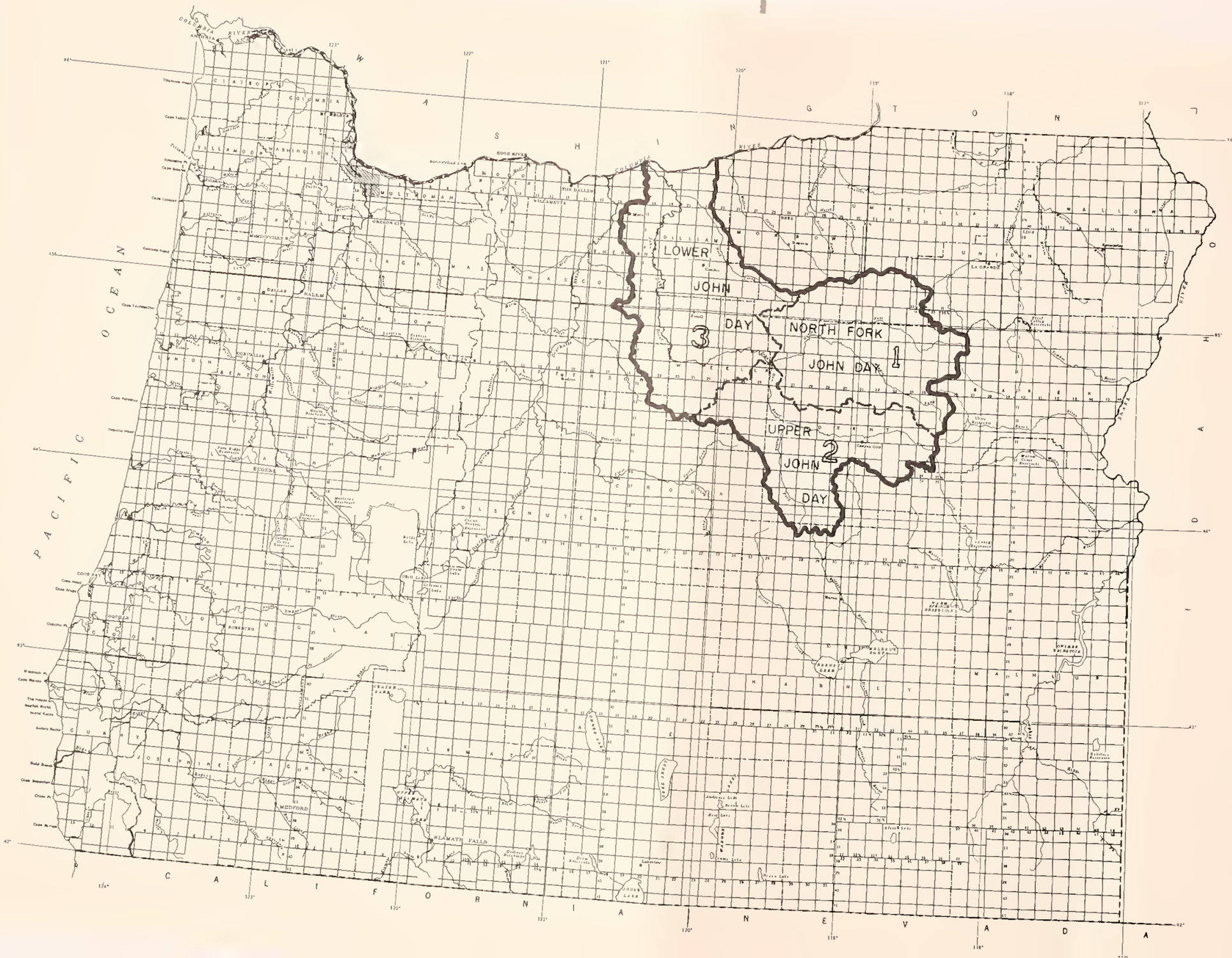


FIGURE 1

LOCATION MAP

JOHN DAY RIVER BASIN

OREGON

AUGUST 1961

and production of land were taken into consideration in grouping soils into eight land capability classes. These eight classes are designated by Roman numerals as indicated on the "Generalized Land Capability Map", figure 2. The hazards and limitations of use of the groups increase as the class number increases. Class I land has few hazards or limitations, whereas class VIII land is so limited that it is unfit for any safe or economical cultivation, grazing, or forestry.

Generally speaking, the classification can be broken into two divisions: (1) land in capability classes I through IV is suited for cultivation and other uses, and (2) land in capability classes V through VIII is best suited for range, forestry, and wildlife because of its own limitations. Land capability classes are sometimes broken down into subclasses to indicate the dominating limitation or hazard. The subclasses are: "e" for wind or water erosion, "w" for wetness or frequent inundation from overflow, "s" for soil limitation, and "c" for climatic limitations.

An estimate of the amounts of land in each subbasin has been made for each land capability class and subclass. These data were developed from the Conservation Needs Inventories from those counties within the boundaries of the John Day River Basin and are summarized in table 1. The general location of the major groups within the basin is shown in figure 2.

Climate

The climate of the John Day River Basin is generally semi-arid, characterized by low annual precipitation, low winter temperatures and high summer temperatures. Torrential rainstorms occur occasionally in spring and summer, causing severe soil erosion and flood damage and adding little to the soil moisture. Strong winds, generally from the west and southwest, may occur at any time of the year, drifting snow in winter and causing soil movement and excessive evaporation in other seasons.

Average annual precipitation varies from 50 inches in the upper reaches of the basin near Strawberry Mountain to 9 inches near the confluence of the John Day River with the Columbia River. Annual precipitation in most agricultural areas of the basin varies from 9 to 18 inches. Precipitation during the irrigation season, April 1 to September 30, averages less than 7 inches in most agricultural areas and is as low as 2 inches at Arlington.

Average annual snowfall varies from 190 inches in the Blue Mountains to 25 inches in the valley at Canyon City and 15 inches at Arlington. Mountain snowpacks are important sources of water for irrigation, fish and wildlife, domestic, and other uses.

Mean annual recorded temperature varies from 41 degrees at Austin, elevation 4,704 feet, to 54 degrees at Arlington, elevation 256 feet. Recorded temperature extremes have varied from -54 degrees Fahrenheit at Ukiah to 114 degrees Fahrenheit at Arlington.

Table 1 Estimated acreage of land by capability class and subclass, by subbasins, John Day River Basin, Oreg., 1961.

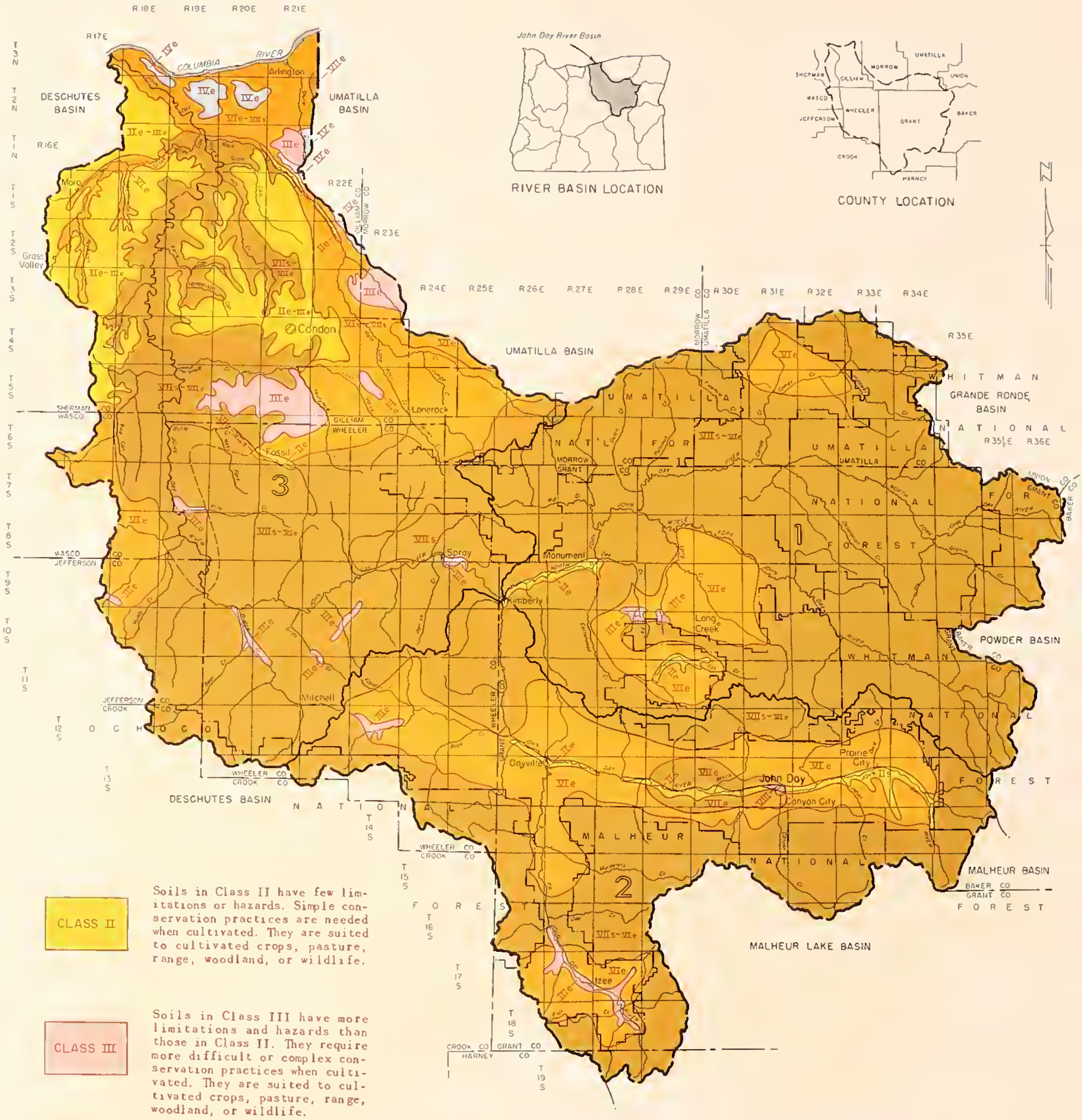
Land capability class	Subbasin 1 North Fork John Day	Subbasin 2 Upper John Day	Subbasin 3 Lower John Day	Total John Day Basin
	Acres	Acres	Acres	Acres
I	500	100	100	700
IIe	2,000	1,500	277,700	281,200
IIw	0	7,200	200	7,400
IIs	200	6,000	0	6,200
Total II	2,200	14,700	277,900	294,800
IIIe	13,300	5,100	161,500	179,900
IIIw	0	3,500	0	3,500
IIIs	1,500	0	0	1,500
IIIc	1,300	0	0	1,300
Total III	16,100	8,600	161,500	186,200
IVe	8,400	1,600	45,500	55,500
IVw	3,800	5,000	1,300	10,100
IVs	3,700	11,900	13,100	28,700
Total IV	15,900	18,500	59,900	94,300
VIe	797,800	414,800	609,000	1,821,600
VIs	65,800	173,400	107,800	347,000
VIc	0	0	3,000	3,000
Total VI	863,600	588,200	719,800	2,171,600
VIIe	183,600	75,000	219,700	478,300
VIIs	593,100	643,400	608,500	1,845,000
Total VII	776,700	718,400	828,200	2,323,300
VIII	5,000	8,500	35,600	49,100
Total	1,680,000	1,357,000	2,083,000	5,120,000

Source: Compiled by U. S. D. A. Soil Conservation Service.

The frost-free growing season varies from 50 days at higher elevations to more than 200 days along the Columbia River. In the valley around Dayville, the growing season is about 130 days, while on the plateaus in Sherman and Gilliam Counties, where dryland grain is raised, it varies from 120 to 170 days.

SETTLEMENT AND HISTORY

Settlement of the basin began with cattle ranching about 1860. Settlement of the upper part of the basin was accelerated in 1862 when gold was discovered in Grant County. The early gold operations were in lode and placer mines, most of which were played out by 1910.



CLASS II	Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.
CLASS III	Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.
CLASS IV	Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.
CLASS VI	Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland, or wildlife.
CLASS VII	Soils in Class VII have very severe limitations or hazards that make them generally unsuited for cultivation. They are suited to grazing, woodland, or wildlife.
CLASS VIII	Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range, or woodland. They may be used for recreation, wildlife, or water supply.

Areas shown with a single capability class and subclass indicate that about 85 percent of the area consists of that class and subclass. The remaining 15 percent includes a variety of other capability classes and subclasses. The double symbols are defined with the first percentage figure applying to the first listed class and subclass, and the second percentage figure applying to the second listed class and subclass as follows:

IIe-IIIe: 55-35 with 10 percent other capability classes and subclasses

VIe-VIIs: 50-40 with 10 percent other capability classes and subclasses

VIIs-VIe: 50-40 with 10 percent other capability classes and subclasses

VIIs-VIIe: 45-45 with 10 percent other capability classes and subclasses.

e - Erosion Problem

s - Soil Problem

w - Wet Problem

LEGEND

Natural Forest Boundaries

Subbasin Boundaries

Basin Boundary

SUBBASINS

1 NORTH FORK JOHN DAY

2 UPPER JOHN DAY

3 LOWER JOHN DAY

FIGURE 2

GENERALIZED LAND CAPABILITY CLASSES

JOHN DAY RIVER BASIN

OREGON

AUGUST 1961

5 0 5 10 15 SCALE IN MILES

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Dredge mining of alluvial deposits along major streams began about 1915 and continued until the 1940's. The mining industry has been dormant in recent years.

Grazing land was at first free to all and provided forage for cattle, horses, and sheep. Homesteading began in the 1880's. The level uplands and valley bottoms were plowed, and grain was planted. Gradually, livestock were forced to graze the poorer lands and winter feeding became necessary. Irrigation systems were established to provide water on the level land adjacent to streams, and alfalfa was introduced as a hay crop. Continuous overgrazing seriously depleted the forage supply and left grazing lands in a deteriorated condition from which they have never fully recovered.

The lumber industry was developed during the 1930's and now ranks second to agriculture in importance.

POPULATION

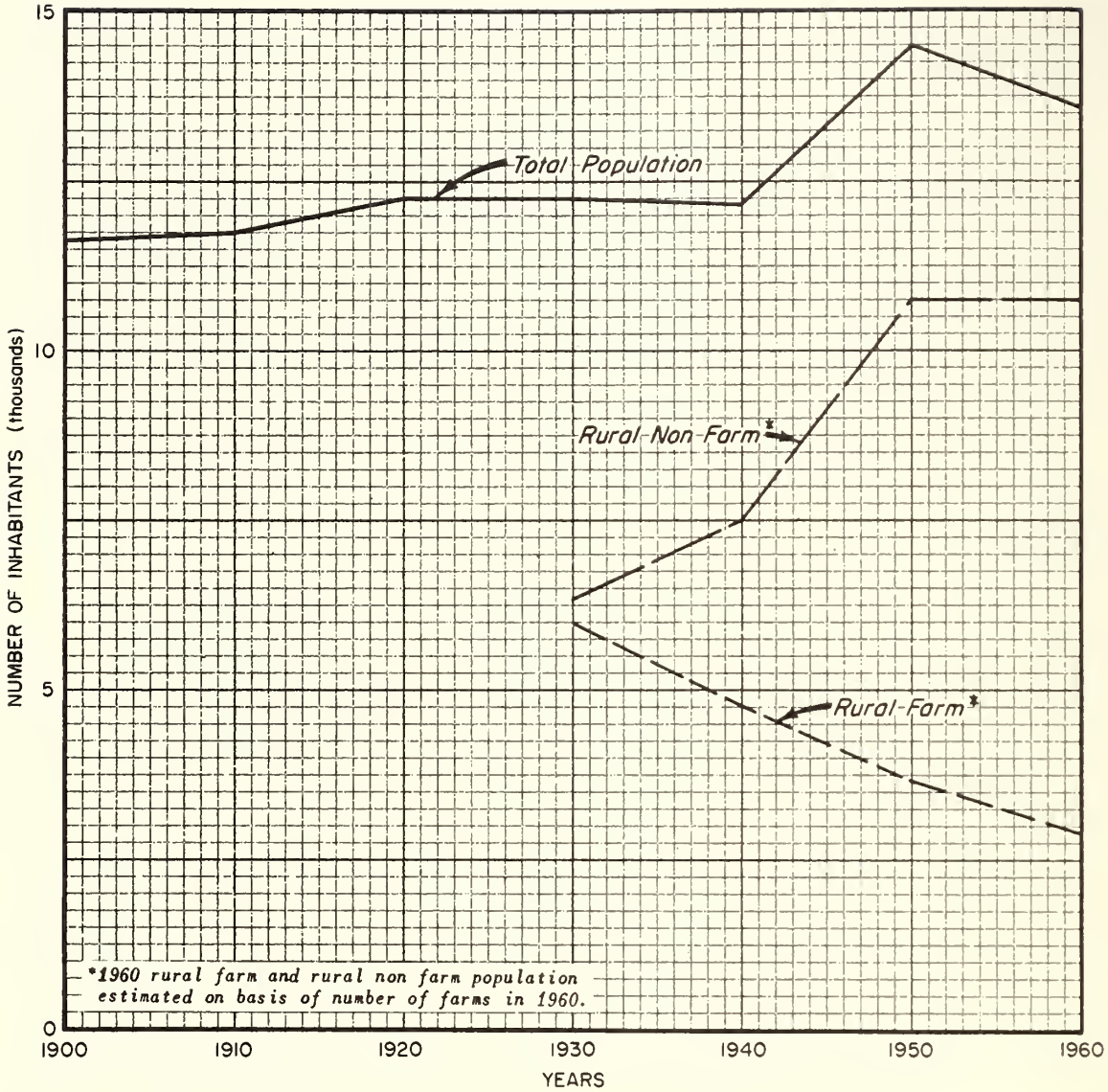
In 1960, the population of the John Day River Basin was about 15,000. The rural nature of the area is reflected by the fact that average population density is less than 2 persons per square mile. John Day is the largest incorporated city in the basin with a population of 1,520, followed by Condon 1,149, Prairie City 801, Fossil 672, Canyon City 654, Arlington 643, and Mount Vernon 502. All other communities have populations of less than 500 each.

It is estimated from census data that about 22 percent of the population lives on farms. Of the nonfarm population, about 60 percent derive their living from the lumber and wood products industry, about 24 percent from services and merchandising activities, and about 13 percent from local, state, and Federal government employment. About 17 percent of the farms are run on a part-time basis, and much of the employment in the lumber and wood products industries is of a seasonal nature. Total population and farm population estimates for each subbasin are shown in table 2.

Table 2 Total and farm population distribution by subbasins, John Day River Basin, Oreg., 1960

Subbasin	Population		Percentage farm population is of total population
	Total	Farm	
	Number	Number	Percent
1. North Fork John Day..	2,200	660	30
2. Upper John Day.....	5,700	670	12
3. Lower John Day.....	7,100	1,970	28
Total.....	15,000	3,300	22

Total population in the basin has remained fairly stable since 1900. Figure 3 shows the combined population of Gilliam, Grant, and



Source: U. S. Census of Population data for Gilliam, Grant, and Wheeler Counties.

FIGURE 3.– Population for Three Principal Counties in The John Day River Basin, Oregon, 1900 – 60.

Wheeler Counties during the last 60 years. The decline in rural farm population since 1930, a result of expanded farm size, has been offset by an increase in nonfarm population. The increase in technology and mechanization has permitted farm size to be expanded, and fewer people are now needed on farms.

TRANSPORTATION

The major highways traversing the John Day River Basin are Oregon 19, which runs the length of the basin from Arlington to Picture Gorge; U. S. 26, which runs from Prineville through John Day and on east through the Blue Mountains; and U. S. 395, which runs from Burns north to Pendleton, via John Day and Mt. Vernon. Other highways and roads link the population centers with each other and with the main highway system. Two branch railroads link the dryland grain area to main lines along the Columbia River. One runs from Biggs to Moro; another extends from Arlington to Condon. The only other railroad in the basin is a lumber railroad that extends from Condon to Kinzua.

Because of the lack of railroads in the area, most of the freight is handled by trucks. Regular bus service is available on U. S. Highways 26 and 395, and irregular passenger and freight service can be secured to nearly all points in the basin.

John Day and Condon have airports that are classified for public use by the State Board of Aeronautics, but no commercial airline service is available to any point in the basin. There are a number of other private and public airfields and landing strips in the basin.

LANDOWNERSHIP

Approximately two-thirds of the basin is privately owned. Most of this land is owned by farmers, ranchers, and a few large timber companies.

One-third of the basin is in Federal ownership. Eighty-four percent of this land is in national forests administered by the U. S. Forest Service. The remaining Federal land includes public domain and Bureau of Reclamation withdrawals administered by the Bureau of Land Management. Federal ownership is mainly in the wild, forested portions of the basin.

State, county, and municipal land constitutes less than 1 percent of the basin. Most of this land is in State ownership and is scattered in small blocks throughout the basin. Landownership for each subbasin in the John Day River Basin is tabulated in table 3.

Fifty-nine percent of subbasin 1 is Federally owned, mainly in the Umatilla and Malheur National Forests. Private land, about half of which is owned by large timber companies, constitutes 40 percent of the area. The remaining 1 percent is owned by the State of Oregon.

Subbasin 2 is almost evenly divided between Federal and private ownership. Federal land occupies 50 percent of the area; private lands,

Table 3 Land use and ownership, by subbasins, John Day River Basin, Oreg., 1961

Land use	1. North Fork John Day Subbasin — Ownership					2. Upper John Day Subbasin — Ownership				
	Federal			State and other		Federal			State and other	
	National forest	Other	Private		Total	National forest	Other	Private		Total
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Forest land:										
Commercial	846,200	16,000	304,000	3,800	1,170,000	427,500	32,900	141,200	900	602,500
Commercial-reserved	.....	.....	.....	600	600	15,300	.....	.....	100	15,400
Noncommercial	37,300	6,800	30,300	600	75,000	40,300	35,000	20,000	800	96,100
Total forest land	883,500	22,800	334,300	5,000	1,245,600	483,100	67,900	161,200	1,800	714,000
Nonforest land:										
Cropland:										
Irrigated	.....	.....	9,900	.....	9,900	.....	.....	28,800	.....	28,800
Dryland	.....	.....	24,800	.....	24,800	.....	.....	5,200	.....	5,200
Range	77,000	15,000	299,000	1,900	392,900	39,200	82,900	463,300	5,000	590,400
Other	1,500	200	5,000	100	6,800	8,700	1,200	8,500	200	18,600
Total nonforest	78,500	15,200	338,700	2,000	434,400	47,900	84,100	505,800	5,200	643,000
Total	962,000	38,000	673,000	7,000	1,680,000	531,000	152,000	667,000	7,000	1,357,000

Land use	3. Lower John Day Subbasin — Ownership					Totals for Basin — Ownership				
	Federal			State and other		Federal			State and other	
	National forest	Other	Private		Total	National forest	Other	Private		Total
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Forest land:										
Commercial	64,200	4,000	171,000	900	240,100	1,337,900	52,900	616,200	5,600	2,012,600
Commercial-reserved	.....	.....	.....	100	100	15,300	.....	.....	800	16,100
Noncommercial	4,200	30,100	22,400	2,500	59,200	81,800	71,900	72,700	3,900	230,300
Total forest land	68,400	34,100	193,400	3,500	299,400	1,435,000	124,800	688,900	10,300	2,259,000
Nonforest land:										
Cropland:										
Irrigated	.....	.....	10,300	.....	10,300	.....	.....	49,000	.....	49,000
Dryland	.....	.....	473,000	.....	473,000	.....	.....	503,000	.....	503,000
Range	12,000	73,200	1,171,600	6,000	1,262,800	128,200	171,100	1,933,900	12,900	2,246,100
Other	600	700	35,700	500	37,500	10,800	2,100	49,200	800	62,900
Total nonforest	12,600	73,900	1,690,600	6,500	1,783,600	139,000	173,200	2,535,100	13,700	2,861,000
Total	81,000	108,000	1,884,000	10,000	2,083,000	1,574,000	298,000	3,224,000	24,000	5,120,000

49 percent. The remaining 1 percent is owned by the State of Oregon, counties, and municipalities. Three-fourths of the Federal land is in national forests; the rest is administered by the Bureau of Land Management. Most of the BLM land in the John Day River Basin is in this subbasin. Most of the private land in the subbasin is owned by ranchers.

In contrast, more that 90 percent of subbasin 3 is privately owned. Ninety percent of this land is owned by ranchers and farmers. Federal land, 57 percent of which is administered by the Bureau of Land Management, occupies 9 percent of the subbasin. The remaining land is owned by the State of Oregon.

LAND USE

Much of the land in the John Day River Basin is used for agriculture; mainly livestock, ranching, and wheat farming. Eleven percent of the basin is classified as cropland. Most of the irrigated cropland is used for production of winter forage for domestic livestock; wheat is the most common dryland crop. Forty-four percent of the basin is open range and is used for production of domestic livestock and wild game.

Forty-four percent of the basin is forest land. Thirty-nine percent of the basin is commercial forest land - land used for commercial production of merchantable timber. Four percent of the basin is noncommercial forest land, land of such poor productive capacity that it will not produce commercial crops of timber. Less than 1 percent of the basin is reserved forest land. This land, which includes Federal and State reserves, is dedicated primarily to recreational use. In addition, much of the forest land is used for domestic livestock grazing, public recreation, wildlife habitat, and many other purposes.

Cities, lakes, streams, and barren wasteland make up the remaining 1 percent of the land area. Table 3 tabulates land use in the basin. Figure 4 shows the distribution of land uses throughout the basin. Land use is very closely correlated with land capability in this basin (fig. 2).

Forest land predominates in subbasin 1 with nearly three-fourths of the area. Cropland occupies only 2 percent of this subbasin; most of the rest is rangeland. Most of the nonforest land is used for domestic livestock production.

Subbasin 2 is nearly evenly divided between forested and nonforested land. Ninety-one percent of the nonforest land is rangeland; only 5 percent is classified as cropland. Production of domestic livestock is also the dominant use of nonforest land in this subbasin.

By contrast, 86 percent of subbasin 3 is nonforest land. Wheat ranching and domestic livestock production are important land uses in this subbasin. Use of land for forestry and related purposes is of far less importance than in the other subbasins.

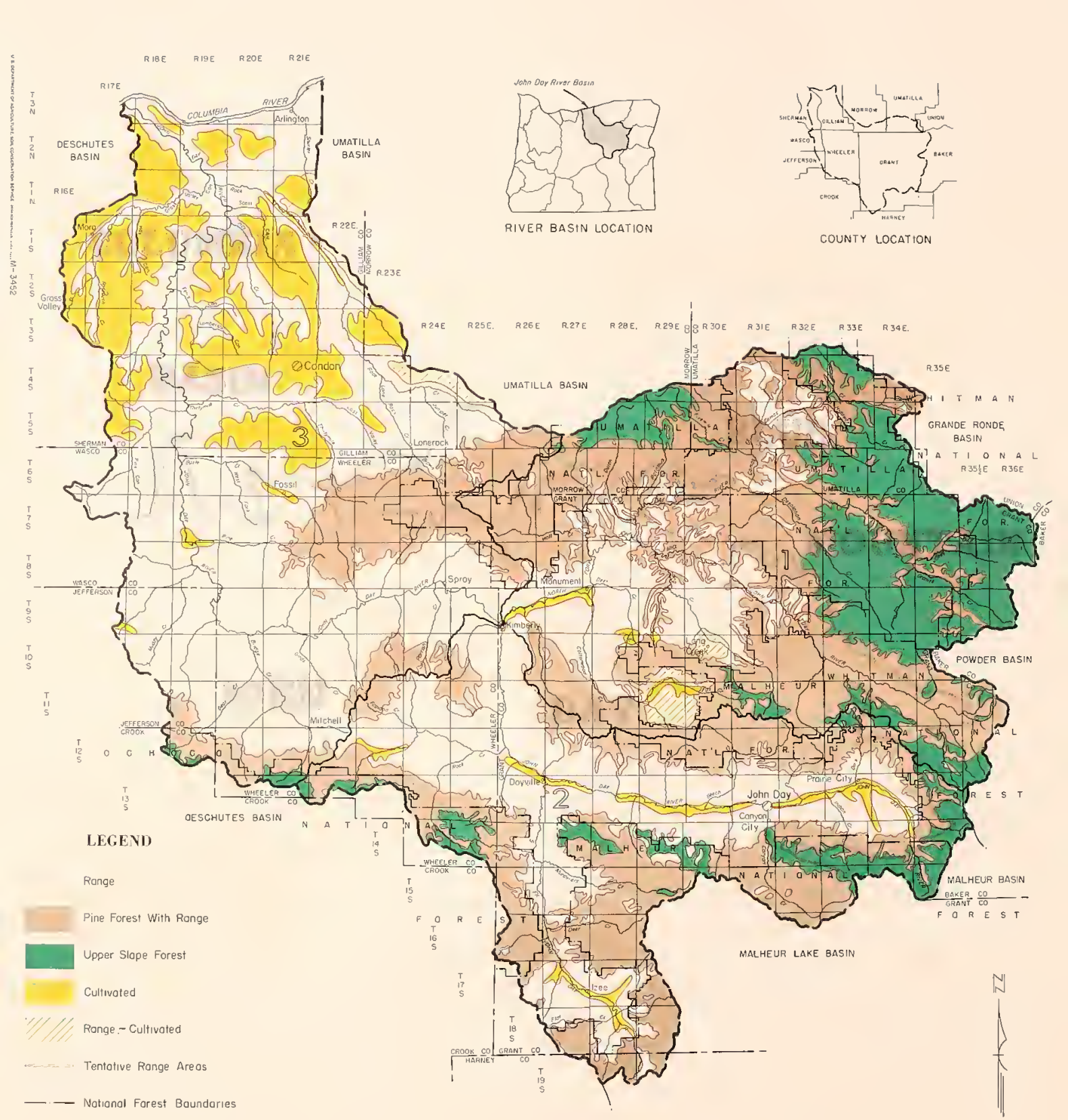


FIGURE 4

GENERALIZED LAND USE

JOHN DAY RIVER BASIN

OREGON

AUGUST 1961

FORESTRY IN THE BASIN

INTRODUCTION

Forest land in the John Day River Basin occupies 44 percent of the total area, or 2,259,000 acres (table 3). The forests are almost exclusively softwoods. Except for bottomland stringers, forests generally do not occur below 4,000 feet elevation, being limited by a lack of precipitation.

A belt of western juniper usually separates the forest zone from the open range below. Ponderosa pine is the most abundant forest tree species, often occurring in pure stands at lower elevations. As elevation increases and moisture conditions become more favorable, such species as Douglas-fir, white fir, western larch, lodgepole pine, and western white pine are found in increasing proportions. On the cool, moist, upper slopes, generally above 6,000 feet elevation, alpine, fir, lodgepole pine, and Englemann Spruce predominate. Extensive pure stands of lodgepole pine are found on dry, rocky sites, or where catastrophic agents, such as fire or insects have destroyed the original stand.

Areas of grassland, up to over a thousand acres, are intermingled in the forest land zone. These areas occur in all elevation zones and furnish much of the summer feed for livestock and big game.

Forest lands serve many purposes. They are the "tree farms" for commercial production of timber and other forest products. They are the habitat for a large wildlife population. They serve as summer range for domestic livestock. They are the center of the rapidly growing field of outdoor recreation. They are vital as the source of, and storage place for, much of the basin's water supply. Each of these key values of forest land are discussed in the sections which follow, with regard to its history, present status, and projected future status as related to the basin's economy and water supplies in the basin. Other fields of forest land management, such as fire protection, are also discussed where they are directly pertinent to the forest situation.

PROTECTION OF FOREST LAND FROM WILDFIRE

Maintenance of an optimum watershed condition on forest lands in the John Day River Basin depends upon protection of the land from widespread wildfires. Fires result in a destruction of the vegetative cover and soil organic matter, which in turn produces accelerated soil erosion and rapid surface runoff of precipitation resulting in downstream flooding and siltation. Adequacy of fire protection will also determine, to a large extent, the economic values realized from tree farming and livestock ranching. This is particularly true of land used for timber production, for many years are required to produce a marketable crop, and fire at any time during this period may destroy the entire investment.

The wildfire season in the basin extends from June to October

and reaches its peak in August; it is characterized by a near absence of precipitation, low daytime humidities, and high temperatures. Periodic severe lightning storms, accompanied by only minor amounts of precipitation, are of equal importance with human activities as a source of fires. Ground fuels, consisting of light and flashy grass and litter, make prompt initial fire suppression action very important if large fires are to be avoided.

Access via surface transportation is generally good to the more hazardous low elevation areas. However, much of the upper watersheds are relatively inaccessible, making aerial transportation of fire suppression forces of value.

Fire protection in the basin is shared by the Federal Government, the State of Oregon, and several rural fire districts. There is considerable cooperation between these groups in their fire protection efforts. The Federal Government, acting through the U. S. Forest Service, protects national forest land and some adjacent private lands. The State of Oregon protects forested land and intermingled and adjacent nonforested land located outside of the national forests. The rural fire districts protect town and ranch properties in a few of the more heavily settled areas. Some portions of the basin, usually well outside the forest zone, are without organized fire protection. Fires starting on these lands may occasionally spread and become a threat to forest land.

TIMBER

Characteristics of the Resource

There are approximately 2 million acres of land in the basin suitable for growing crops of commercial timber. This land, known as "commercial forest land" presently supports a stand of 17.5 billion board feet of commercial timber. 1/ Ownership of this commercial forest land and timber is shown in table 4. In addition, there are 16,100 acres, with 0.2 billion board feet of timber, which are reserved from harvest of commercial timber crops. This land, called "commercial-reserved forest land", is primarily in national forest reserves such as the Strawberry Mountain Wild Area, streamside and roadside protective zones, campgrounds and administrative sites.

An additional 230,300 acres of forest land is not capable of producing commercial timber. This land, consisting of low-elevation stands of juniper, steep, rocky areas, and small areas of subalpine timber just below timberline, is known as "noncommercial-unproductive forest land". Two-thirds of this land is outside the national forests.

About three-fourths of the forest land supports stands of timber which are more that 150 years old. This timber is past rotation age (rotation age is 125 to 140 years in the basin), so is relatively slow-growing and susceptible to insect and disease attack. Full potential

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1/ All timber volumes used in this report are in terms of log scale, Scribner rule, in trees 11 inches D. B. H. and larger.

Table 4 Commercial forest land area and sawtimber volume by subbasins, John Day River Basin, Oreg.

Forest types and condition classes	1. North Fork John Day Subbasin										2. Upper John Day Subbasin									
	Federal										Federal									
	Nat'l. forest 1/		Other 1/		Private		State and other		Total		Nat'l. forest		Other		Private		State and other		Total	
	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume
Virgin stands:																				
Ponderosa pine	210.4	2,370	9.2	153	80.0	1,264	2.1	30	301.7	3,817	213.9	2,355	15.3	266	34.1	543	0.4	6	263.7	3,170
Other	393.0	3,496	1.2	13	17.2	172	0.3	6	411.7	3,687	100.8	1,560	2.1	23	9.0	86	...	..	111.9	1,669
Residual stands:																				
Ponderosa pine	80.3	550	3.5	30	87.2	862	0.6	5	171.6	1,447	64.5	496	9.4	79	43.0	349	0.1	1	117.0	925
Other	38.5	308	0.5	3	17.4	107	...	..	56.4	418	20.2	184	1.2	7	8.2	48	...	..	29.6	239
Young-growth stands:																				
Ponderosa pine	28.4	1	0.7	...	50.8	7	0.6	..	80.5	8	14.0	2	3.4	...	39.4	.....	0.2	..	57.0	2
Other	89.5	36	0.8	...	48.1	8	0.1	..	138.5	44	11.3	.....	1.2	...	3.5	.....	...	..	16.0	.....
Non-stocked land	6.1	.....	0.1	...	3.3	.....	0.1	..	9.6	.....	2.8	.....	0.3	...	4.0	.....	0.2	..	7.3	.....
Total	846.2	6,761	16.0	199	304.0	2,420	3.8	41	1,170.0	9,421	427.5	4,597	32.9	375	141.2	1,026	0.9	7	602.5	6,005

Forest types and condition classes	3. Lower John Day Subbasin										Totals for Basin									
	Federal										Federal									
	Nat'l. forest		Other		Private		State and other		Total		Nat'l. forest		Other		Private		State and other		Total	
	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume
Virgin stands:																				
Ponderosa pine	39.0	494	2.0	27	36.9	502	0.7	10	81.3	1,033	463.3	5,219	26.5	446	153.7	2,309	3.2	46	646.7	8,020
Other	13.5	332	...	..	2.7	32	...	..	16.2	364	507.3	5,388	3.3	36	28.9	290	0.3	6	539.8	5,720
Residual stands:																				
Ponderosa pine	5.1	54	0.8	5	87.0	544	0.1	1	93.0	604	149.9	1,100	13.7	114	217.2	1,755	0.8	7	381.6	2,976
Other	1.8	37	0.1	1	7.9	59	...	..	9.8	97	60.5	529	1.8	11	33.5	214	...	..	95.8	754
Young-growth stands:																				
Ponderosa pine	1.8	...	1.0	..	26.5	.....	0.1	..	29.4	.....	44.2	3	5.1	...	116.7	7	0.9	..	166.9	10
Other	2.8	1	0.1	..	5.3	.....	...	..	8.2	1	103.6	37	2.1	...	56.9	8	0.1	..	162.7	45
Non-stocked land	0.2	...	...	..	2.0	.....	...	..	2.2	.....	9.1	.....	0.4	...	9.3	.....	0.3	..	19.1	.....
Total	64.2	918	4.0	33	171.0	1,137	0.9	11	240.1	2,099	1,337.9	12,276	52.9	607	616.2	4,583	5.6	59	2,012.6	17,525

Source: Data for national forest land is from timber resource inventory data of the forest concerned. Inventories were made during 1957 and 1958. Other data is from the Pacific Northwest Forest and Range Experiment Station. Forest surveys were made between 1953 and 1959.

1/ Areas are in thousands of acres.
Volumes are in millions of board feet.

growth of timber will not be realized until these overmature stands are replaced by an even distribution of age classes, younger than rotation age. However, this cannot be realized over a short period of time. The overmature stands must be harvested over a period of at least 60 to 80 years to assure a sustained supply of timber until the present young-growth stands reach maturity.

History and Trends in Development and Marketing

Commercial timber harvesting began about 1930, mainly on private land. National forest timber harvesting became important during World War II; however, during recent years, more than half of the log production has come from private land (tables 5 and 6). Public Domain and State lands are of small area and cannot contribute significantly to the basin's log production.

Logging began in the ponderosa pine stands, since pine was the most valuable species, and occurred in the most accessible areas. Since 1950 a significant amount of white fir, Douglas-fir, and other coniferous species has been harvested, although these species are still not nearly as marketable as ponderosa pine.

Lumber is almost the exclusive product manufactured from the basin's timber. Important sawmills are located at Kinzua, Bates, Izee, Long Creek, and in the John Day area. These mills have a combined installed annual capacity of about 250 million board feet. In addition, about one-third of the log production goes outside the basin for primary manufacture to such centers as Burns, Prineville, and Pendleton.

More than 50 percent of the pine lumber is planed and dried; most of the other species are sold as rough-green or air dried lumber. Except for a minor amount of local retailing, most of the lumber is hauled by truck to railroads at Prineville, Pendleton, and Baker, where it is shipped to markets throughout the United States.

Though utilization of harvested timber has steadily improved in recent years, there are still many opportunities for improvement. Presently the only market for the waste products of lumber manufacture is a fibreboard plant at Pilot Rock. Much of the waste material is consumed as fuel to produce power to run the sawmills. There probably is a sufficient source of raw material to justify construction of fibreboard plants in the John Day area and in Subbasin 1, where there are extensive stands of presently unutilized lodgepole pine and young ponderosa pine. However, there are several factors current in the basin which tend to discourage development of secondary wood manufacturing plants including:

1. The relatively small supply of mill wastes, which are much more economical to utilize than small logs.

2. High transportation costs. Sawmills are located in many widely scattered locations, so chips would generally have to be hauled a long way to a central manufacturing point. Small logs from thinnings would also have to be hauled

long distances.

3. Lack of a dependable year-round water supply.

Harvesting and Regeneration Methods

Timber harvesting practices vary widely with ownership. Much of the timber harvesting on private lands has been on a near-clear-cutting, liquidation basis. Nearly half of the private commercial forest land has been cutover. Regeneration is generally present, though many of the cutover stands are inadequately stocked. On many private tracts, particularly those owned by ranchers, the owner is mainly interested in growing forage for livestock, so much of this land is gradually being converted to grassland. Some of the larger timberland owners, particularly those with sawmills that are dependent upon a sustained raw material supply, are practicing conservative cutting with adequate provision for regeneration.

National forest timber is managed, by law, on a "sustained yield" basis -- that is, harvesting is kept in balance with growth. Management practices are used which will result in optimum production of timber crops without impairment of the productivity of the land. Cutting has generally been on an individual tree, or group selection, basis; although small clearcuts are used where adequate advance regeneration is already present, and in north slope stands of mixed coniferous species. Regeneration methods include protection of existing young trees during logging, leaving groups of older trees as a source of seed, and planting nursery-grown seedlings where necessary. Livestock grazing is controlled, as necessary, to protect the seedlings. Natural regeneration is often slow and uncertain because of drought conditions.

Harvesting practices on other Federal lands are very similar to those on national forest land. However, the scattered nature of these lands makes intensive management extremely difficult.

Most of the cutover land in the basin has been logged by tractor methods. Where the ground is steep, or the soil is of an erosive nature, or where skidroads are located without sufficient regard for soil protection needs, considerable damage to the watershed may result. This has been true to some extent in the past of logging operations on all ownerships. Today logging operations on national forest land are generally carefully planned for soil and watershed protection. Skid trails and other areas where the vegetative cover has been disturbed are seeded to grass if an erosion hazard exists. Even with these measures, some erosion may result because vegetative cover is slow in re-establishing itself and because of heavy spring runoff from melting snow. The mixed-conifer stands that are beginning to be harvested on national forest land are generally located on steep ground and require some form of cable yarding.

Logs are generally skidded in 16 to 32 foot lengths and are hauled by truck to the sawmill over the network of timber access roads.financed by development of the basin's timber resources. These roads make the forest land more readily accessible for all phases of intensive

Table 5 Timber harvested from all forest land, John Day River Basin, Oreg., 1956-1960 1/

Year	Subbasin			Total
	1. North Fork John Day	2. Upper John Day	3. Lower John Day	
1956....	132 2/	147	40	319
1957....	118	115	26	259
1958....	133	123	30	286
1959....	144	132	35	311
1960....	128	119	27	274

1/ Source: State Forester's records.
2/ Volumes in millions of board feet.

Table 6 Volume and value of timber harvest from national forest land, John Day River Basin, Oreg., 1956-1960

Year	Subbasin 1 North Fork John Day		Subbasin 2 Upper John Day		Subbasin 3 Lower John Day		Total	
	Volume	Value 1/	Volume	Value	Volume	Value	Volume	Value
1956..	47	739	36	655	28	513	111	1,907
1957..	40	431	20	299	21	353	81	1,353
1958..	48	460	17	216	3	21	68	697
1959..	81	1,221	37	633	6	74	124	1,928
1960..	91	1,007	30	370	7	75	128	1,452

Source: Timber management records of the national forests concerned.
1/ Volumes are in millions of board feet.
Values are in thousands of dollars.

Table 7 Allowable annual timber cut and average rotation age, national forest land, John Day River Basin, Oreg., August 1, 1961

Subbasin	Allowable annual cut	Rotation age
	Millions of board feet	Years
1. North Fork John Day...	87	125-140
2. Upper John Day.....	38	135-140
3. Lower John Day.....	9	140
Total.....	134	

Source: Timber management plans of the national forests concerned.

management and use but present a sizable soil erosion potential.

Sustained Yield Potential

National Forest Land. The present allowable annual timber harvest from national forest land in the basin is 134 million board feet (table 7). This is derived by pro-rating the allowable cut figures for the various national forest working circles 1/ included in the basin to the portion of each working circle that is in the basin.

This is an empirical figure because national forest working circle allowable cuts are determined for an entire working circle. The location of cutting may vary widely from one portion of a working circle to another from year to year. Thus, in a given year the entire cut for a working circle that is partially inside the basin may occur on land in the basin while in other years there may be no cutting in the basin. The actual cut in any one year may also fluctuate widely with varying market conditions, as illustrated by table 6. Thus, the figures are of value only as long term indications of sustained yield.

In addition, allowable cuts are subject to recalculation at approximately 10 year intervals, a process which is presently being completed in several of the basin's working circles. Such factors as degree of wood utilization, rapidity of regeneration of cutover land, and accessibility of salvagable dead timber may affect the allowable cut. For instance, increased demand for small logs, defective logs, and low valued species in recent years have resulted in allowable cuts being increased. Changing techniques of collection and evaluation of inventory data may also affect the allowable cut. Under intensified management, a gradual long-term increase in allowable cut is expected.

Other Federal and State Land. These lands are comparable in productivity and management to national forest land. Thus, an allowable annual cut in proportion to its acreage might be assumed for this land, or about 5 million board feet.

Private Land. Because of present rapid depletion of the timber stand on private land, it is difficult to assign it a sustained yield volume. For the immediate future, continuing depletion may be expected with near exhaustion of private timber within perhaps twenty-five years, followed by an extended period of little or no cutting while present young stands are attaining merchantable size. During this period, the timber supply for the basin will be almost entirely from public land. Thereafter, timber production from private lands will be closely related to intensity of management. Under optimum management, an allowable cut proportionately at least comparable to expected national forest yields, or 60 million board feet, might be expected. However, there are several conditions current in this basin which will tend to limit the extent of forest conservation practices on private land. These conditions include:

1/ A working circle is the basic planning unit for national forest timber management. It generally consists of several drainages with a common market point for harvested timber.

1. The generally low productivity of much of the forest land.

2. The low market value for species other than pronderosa pine and the near-absence of markets for small second-growth logs.

3. High transportation cost for forest products because of the relatively great distance to markets.

4. The relatively high value of forest land for forage production.

Improved markets for forest products may change some of these conditions, but private forest land management is expected to remain on a generally extensive basis for some time. Thus, a sustained production of 30 million board feet annually is thought to be realistic for these lands.

Thus, the sustained-yield annual timber production of all commercial forest land in the John Day Basin is between 170 and 200 million board feet, depending upon intensity of management.

RANGE

The forest range resource is discussed as a part of the general livestock economy discussion later in this report.

On forest lands, grazing must be controlled to a point where it is compatable with other resource needs. This has not always been the case on forest lands in the John Day Basin. Overstocking and unduly long seasons of use have been too common in the past. Today the forested range carrying capacity is believed to be about a fourth of what it was originally.

Presently permitted national forest grazing in the basin is shown in table 8. Permitted numbers of stock and season of use are determined by periodic analyses of range conditions and trends. In recent years, sizable reductions in permitted numbers of livestock have been necessary because of depleted range conditions. However, reductions have not been as drastic as good watershed protection practice would dictate because the livestock industry is heavily dependent upon this summer range, and sudden drastic reductions in permitted use would have a very adverse effect on the entire livestock economy. For this reason, reductions have been gradual and planned well in advance. In addition, the Forest Service and the permittees are cooperating in range revegetation, construction of range improvements, and better control of livestock movement, which should eventually result in restoration of much of the range to its original productivity.

Permits to use national forest land for grazing purposes are issued on a preferential basis which was established when the grazing land was first organized into specific allotments. A grazing preference remains with a ranch indefinitely, unless it is waived or abandoned. When base ranch property is sold, the national forest grazing preference is also transferred and enhances the value of the base property.

However, all preferences are contingent upon the permittee maintaining his base property so as to support the permitted livestock during the time they are off the forest range. Range improvements such as fences and water developments may be constructed by either the Forest Service or by the permittee, who receives no direct monetary compensation for his efforts; however, these improvements result in better range utilization. In recent years, national forest grazing charges have averaged $0.50 per animal-unit month, varying with the level of the livestock economy. Based on presently permitted use, total receipts are about $40,000 per year (table 8).

Forested public domain grazing lands are leased to individual ranchers on a term basis under authority of the Taylor Grazing Act, and are managed by the lessee. Rates are somewhat less than for national forest grazing.

Table 8 National forest grazing resource and permitted use by subbasins, John Day River Basin, Oreg., 1961

Subbasin	Area suitable for grazing		Permitted stock			
	National forest	Private 1/	Cattle and horses		Sheep and goats	
	Acres	Acres	Number	AUM 2/	Number	AUM 2/
1. North Fork John Day	650,000	76,000	9,457	41,177	18,513	10,647
2. Upper John Day	280,000	31,000	5,499	23,412	3,350	1,900
3. Lower John Day	55,000	4,000	421	1,962	2,069	1,241
Total	985,000	111,000	15,377	66,551	23,932	13,788

Source: Range management plans of the forests concerned.

1/ These are intermingled private lands owned or leased by the permittees which are included in the national forest allotments by mutual agreement.

2/ One cow with or without unweaned calf or five sheep with or without unweaned lamb grazing one month equals one animal-unit month.

Private forest land, as previously stated, are often owned by ranchers who manage the land primarily for grazing. In addition, much of the forested lands owned by timber companies and others is leased to ranchers for grazing purposes.

WILDLIFE AND WILDLIFE HABITAT

General

The wildlife resource of the basin is managed by the Oregon State Game Commission. The wildlife habitat is managed by the landowners often, as is the case on national forest land, in close cooperation with the Game Commission. Wildlife populations are often influenced

more strongly by habitat conditions than by hunting pressure.

The wildlife resource, particularly big game, is very important to the economy of the basin, and hunting and fishing attract many people to the area. For instance, in 1960, there were more than 90,000 visitor-days of hunting and fishing on the national forests of the basin, many from outside the basin. This accounts for more than half of the national forest recreational uses.

Big Game

The big game species of the basin are mule deer and Rocky Mountain elk. Surveys by the Game Commission indicate that populations of both species are relatively stable. Statistics of the Game Commission indicate the following data concerning big game harvest for 1960: 1/

	Elk	Deer
Number of Hunters	8,700	29,200
Harvest	1,800	19,700
Percent of Hunters Successful	21%	68%
Harvest per Square Mile	0.2	2.5

Both the success ratios and the harvest per square mile for deer are significantly above the average for the entire state.

Summer big game ranges are generally at high elevations on forest land. With the coming of cold weather in October and November, the herds migrate to winter ranges at low elevations in the valleys. Here they must compete with domestic livestock for feed, causing a severe conflict for use of winter range. Heavy concentration of big game on winter ranges may result in destruction of the vegetative cover and accelerated soil erosion. A shortage of suitable winter range is the most important limiting factor in big game populations in the basin. The Game Commission has purchased or leased key tracts of land for winter range to relieve some of the pressure on ranch properties.

Conflicts between big game and livestock are not serious on summer ranges because herds are more dispersed at that time of the year. It is generally agreed that big game herds have not contributed significantly to past deterioration of forest rangelands in the basin. However, populations could build up to damaging levels in the future unless they are carefully controlled.

Other Game Animals and Predators

The major upland game bird species are pheasant, mountain quail, and blue and ruffed grouse. Game Commission surveys indicate that populations are subject to wide fluctuation, but that a downward trend has been apparent in recent years, primarily due to a succession of very dry summers. Small game hunting, for rabbits and squirrels, attracts a relatively small number of hunters, mainly from the local area.

1/ No attempt has been made to reconcile these figures with those shown for national forest big game hunting in table 9.

The basin has a small migratory waterfowl population because of a lack of suitable habitat.

Several furbearing species are represented in the basin including mink, muskrat, and beaver. Value of the harvest of these animals in 1960 was approximately $5,000.

The predator and nuisance species include coyote, bobcat, bear, cougar, and porcupine. Porcupines are a serious pest in forest stands of ponderosa pine, girdling and causing deformity in older trees and killing younger trees. Cougar populations have decline in recent years, and the species is in danger of extinction in the basin.

Anadromous Fish

The basin's streams are spawning grounds for steelhead and chinook salmon. The Game Commission estimates that 65 percent of the John Day River steelhead run and 80 percent of the chinook salmon run spawn in the North Fork and its tributaries, mostly in the forested area. The remainder use other streams throughout the basin. Placer and dredge mining and other land management practices have caused destruction of spawning beds, excessive stream siltation, and abnormally high summer stream temperatures, all of which have contributed to a steady decline in the size of anadromous fish runs.

The Game Commission is currently rehabilitating some gold-dredged stream channel in the North Fork John Day drainage by placing gravel in the streams and leveling the stream gradient. This and accompanying good land management practices are necessary if anadromous fish runs are to be maintained.

Native Fish

There are only 9 lakes, totaling 274 acres in the forested portion of the basin. These are of relatively minor importance for fishing. Several lakes and many of the basin's streams are stocked annually by the Game Commission with hatchery-raised trout. The demand for more good fishing waters is expected to increase.

RECREATION

Recreation is the fastest growing use of forest land in the basin, having increased by 30 percent since 1956 (tables 9 and 10). Sizable increases are foreseen in the next 40 years. In 1959, the U. S. Forest Service began a study and evaluation of the recreation resources of national forests, known as the "National Forest Recreation Survey". Its purpose was to provide basic data about recreation resource, correlated with projected recreation demand for the years 1976 and 2000. The projected demand, computed for each state, was based upon the assumptions of increasing population, leisure time, income, and faster travel. The state projections were then allocated to individual national forests and ranger districts, considering the past recreation pattern, future population growth, future highway and reservoirs, and other factors. The projections, as applied to the John Day Basin indi-

Table 9 Recreational use of the national forests, John Day River Basin, Oreg., 1956-1960

Primary purpose of visit	Number of visits				
	1956	1957	1958	1959	1960
Camping	17,400	18,500	19,300	22,100	24,200
Picnicking	12,000	13,300	15,000	16,200	18,150
Swimming	100	100	150	150	150
Winter sports	200	150	200	200	200
Hunting: Big game	32,400	34,000	35,700	38,200	41,800
Small game	7,000	7,400	7,700	7,800	8,000
Fishing	12,500	13,000	14,200	15,500	16,300
Hiking and riding	1,600	1,700	1,800	2,100	2,200
Wilderness travel	250	300	250	300	300
General enjoyment and sightseeing	15,200	16,000	17,500	18,200	18,700
Gathering forest products for pleasure	3,300	3,600	3,900	4,200	4,600
Scientific study and hobbies	4,200	4,300	4,500	4,500	4,600
Other activities	300	300	300	300	300
Total	106,450	112,650	120,500	129,750	139,500

Source: Annual recreation reports of the forests concerned.

Table 10 Past and projected recreation use of the national forests, by subbasins, John Day River Basin, Oreg.

Year	Subbasin 1 North Fork John Day	Subbasin 2 Upper John Day	Subbasin 3 Lower John Day	Total
Estimated number of visits 1/:				
1956	69,200	31,900	5,350	106,450
1957	74,200	32,800	5,650	112,650
1958	79,300	35,150	6,050	120,500
1959	85,300	37,900	6,550	129,750
1960	91,700	40,850	6,950	139,500

Source: Annual recreation reports of the forests concerned.

1/ Length of visit currently averages 1.5 days, so number of visits x 1.5 = visitor days.

cate a 600 percent increase in recreational use in the next 40 years.

Recreational use of other forest land is presently less intensive than that on national forest land but will also increase greatly in the future. Recreational use must be given ever-increasing recognition in the future.

Camping and Picnicking

There are presently 16 national forest campgrounds in the basin, containing 107 family units. In 1960, these were used by 42,300 persons, who visited the national forests primarily to camp and picnic, or 400 visits per family unit. The present facilities are considered to be inadequate to accommodate these visitors. In addition, many recreationists who visit the national forests primarily for other reasons than camping and picnicing also use the campgrounds. This is particularly true of big game hunters who also use undeveloped campsites where there is a water supply and room to pitch a camp but no developed facilities. Sanitation is a problem at many of these "hunter camps". Enlargement of present campgrounds and the development of additional campgrounds is possible to provide about 15 times the camping facilities presently provided.

Hunting and Fishing

Hunting and fishing seasons are determined by the State Game Commission after consultation with landowners and other interested groups. Most hunting seasons are in the autumn. Hunters find the forest land of the basin very attractive, with good access, much comparatively gentle terrain, and little underbrush. Big game hunting attracts many persons from outside the basin.

In contrast, fishing is mostly limited to local people. Streams provide good trout fishing during the spring, early summer, and fall. Stream fishing is generally poor during hot summer weather. The few fishable lakes are heavily used. Winter steelhead fishing is fairly light and success is poor compared to other rivers in Oregon.

Other Activities

The national forests of the basin are used for a wide variety of activities in addition to those mentioned above. About half of these visits are for the purpose of general enjoyment and sight-seeing.

Hiking and horseback riding and wilderness travel visits are mainly to the Strawberry Mountain Wild Area and other undeveloped areas. Use of the Strawberry Mountain Area is limited by a lack of access trails.

Winter sports activities are of minor importance. Several ski areas, located adjacent to, but just outside the basin, attract moderate use. Several good sites are available for winter sports development on national forest land in the basin if the demand should develop in the future.

There is very little opportunity for boating and related water sports, for there are very few lakes.

WATER

Water Yield

In an undisturbed forest, precipitation returns to the atmosphere through evaporation and transpiration or moves slowly to streams or underground storage. Surface runoff occurs only during periods of prolonged and heavy rainfall. Vegetation and soil porosity are responsible for this watershed stability. A protective canopy of tree crowns and brush catches rain and snow, breaking its fall and preventing some of it from reaching the ground. Litter and humus, plant rocks, and soil organisms increase soil porosity and are a barrier to surface runoff so that water filters into the soil very readily. Water than gradually moves into streams, or may percolate deeper into the ground water storage. Trees and other vegetation along streams maintain cool water temperatures by providing shade.

Much of the precipitation in the John Day River Basin falls on forest land at the higher elevations. Most of this precipitation occurs as snow, which accumulates through the winter and melts between April and July. Because of this great snow storage capacity and the forest soil's water detention capacity, most of the late spring and summer water flows in the basin's streams comes from forested land.

Thus, the net effects of maintaining a healthy cover on a watershed are: (1) sustained flows and a more uniform hydrograph; (2) cooler water temperatures which are highly beneficial to fish life; and (3) better controlled stream flows with peak flows at the time of heavy spring snow melting.

Water Quality. The primary responsibility of the forest land manager with relation to water quality is to maintain water purity, temperature, color, and taste within a tolerable variation to what it was under natural conditions. Some measures that should be taken to meet this responsibility are:

1. Protection of the soil mantle over the entire watershed to prevent accelerated erosion and resulting siltation. This is accomplished by maintaining the vegetative cover over the soil. When the vegetative cover is disturbed by road construction, logging, fire, grazing, or other activities, it must be promptly replaced as completely as possible. A large portion of the sediment load of streams in the basin comes from a few watersheds that have suffered from destructive logging practices, faulty road design and construction, repeated fires, or continuous overgrazing.

2. Protection of stream banks and stream channels against disturbance by road construction, logging, and grazing by domestic livestock. A common problem is construction

of roads too close to stream channels. During logging, slash and debris may be deposited in stream channels and logs may be skidded across streams, causing alteration of the stream channel and erosion of stream banks. Domestic livestock tend to concentrate along streams, and may deplete the protective vegetation through trampling and grazing, increasing the erosion hazard.

3. Maintenance of sufficient tree and brush shade along streams to keep summer water temperatures at tolerable levels for fish life.

4. Prevention of stream pollution. Recreational use of forest land is a potential source of stream pollution; public awareness and cooperation in solution of this problem is the best preventative. Sanitation facilities must be provided at recreation sites. Heavily used recreation trails should not be in too close proximity to streams. The pollution hazard will increase with heavier use of forest land for recreation.

Early-day placer and dredge mining of many tributary streams in the basin has resulted in an almost total lack of shade along these streams, with resulting higher water temperatures. Dredge mining created many acres of waste land, whose rehabilitation is a sizable land management problem.

Water Quantity. Both the total yield and seasonal variations in yield of water may be affected by forest land management. For instance, creation of small openings in the forest canopy may significantly increase snow storage. Less snow is intercepted by the crowns of large trees, and evaporated without reaching the ground. Thus, carefully designed logging in the extensive dense stands of lodgepole pine and mixed conifers in Subbasin 1 might result in a reshaped hydrograph with significantly higher early summer water yields. This effect is highly variable, depending upong many factors including shape and size of openings created, exposure, elevation, and prevailing winter winds.

Maintenance of good soil condition, mainly through maintenance of the plant cover, results in an optimum rate of water infiltration into the soil, and minimum surface runoff. Then water is gradually released from the watershed instead of running off immediately.

It is doubtful whether either of these measures will have a large long term effect on total water yields; however, destructive land management practices, if carried on extensively, would have a serious effect on the seasonal distribution of stream flows in this basin.

Water Use

Consumptive Uses. The maintenance of plant growth requires a large amount of water on forest land. This is generally referred to as the evapo-transpiration process, and water quantities involved cannot be measured accurately. However, pine forests do not commonly occur in

the basin where annual precipitation is less than 16 inches. This quantity represents the environmental requirement for tree growth; the consumptive requirement is somewhat less. Other tree species have greater requirements for water and occur only where precipitation is heavier.

Other consumptive water needs on national forest land in the basin at present and for the year 2000 are summarized in table 11. Administrative and recreational water needs are based upon surveys of present consumption and projections of future needs. Consumption by domestic livestock is based on an estimated requirement of 300 gallons per animal-unit month 1/ and the presently permitted and potential range capacity. If suitable areas of grazing land are placed under intensive management in the future, water consumption for forage production will also increase. It is assumed that wildlife populations will remain relatively stable in the foreseeable future. Only a minor amount of water is used now for road maintenance, but much greater future demands are anticipated. In summary, all of these consumptive needs are relatively small, with consumption by wildlife being the largest; however, the water quantities required are essential for realization of ultimate benefits from the national forests.

Water rights are held for only a part of the present national forest consumption. For instance, 85 percent of the administrative water consumption, 35 percent of the recreational consumption, and 5 percent of the domestic livestock consumption is covered by existing water rights.

Consumptive water needs on other forest land are unknown but are believed to be roughly proportionate to that on national forest land.

Nonconsumptive Uses. It is important that water be provided in streams, lakes, and reservoirs as an environment for such recreational activities as fishing, boating, and aesthetic enjoyment. This water is also important as an environment for fish and other aquatic creatures. The quantity and quality of water is very important as it affects its suitability for fish life and its aesthetic appearance. Plans for development of the water resources of this basin should recognize these needs.

Water is also required in forested areas for mining and hydroelectric power production. Current water requirements for these purposes are relatively small.

Nonconsumptive water requirements by the wood products industry consists of water used in log storage ponds and that used for pressure log debarking. A future decline in log production will result in smaller water requirements for these purposes. Secondary wood processing plants, if installed, would require large amounts of pure water,

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1/ This is an empirical figure, for it includes only the water actually consumed by livestock. The amount of water stored for livestock may need to be several times greater than that actually consumed because of evaporation and seepage losses.

little of which would be consumed in the manufacturing process.

Table 11 Estimated water consumption 3/ by subbasins, national forest land, John Day River Basin, Oreg.

Principal use	Subbasin 1 North Fork John Day 1960	1 North Fork John Day 2000	2 Upper John Day 1960	2 Upper John Day 2000	3 Lower John Day 1960	3 Lower John Day 2000	Total 1960	Total 2000
	Millions of gallons per year							
Domestic and other at administrative sites 1/	4.8	10.0	0.1	0.2	2/	0.1	4.9	10.3
Domestic at recreation sites	1.4	7.4	0.6	4.9	0.1	0.2	2.1	12.5
Consumption by domestic livestock	15.5	29.0	7.6	14.2	1.0	1.9	24.1	45.1
Consumption by wildlife	41.0	41.0	25.0	25.0	4.0	4.0	70.0	70.0
Road construction and maintenance	7.0	16.0	4.0	10.0	1.0	4.0	12.0	30.0
Fire control	0.1	0.1	0.1	0.1	2/	2/	0.2	0.2
Other	1.0	2.5	0.6	1.3	2/	0.2	1.6	4.0
Total	70.8	106.0	38.0	55.7	6.1	10.4	114.9	172.1
Total converted to acre-feet	217	325	116	171	19	32	352	528

Source: Projections are based on estimates by personnel of the national forests concerned.

1/ Does not include water obtained from municipal or commercial supplies.

2/ Less than 100,000 gallons per year.

3/ This does not include evapo-transpiration losses. This includes only water actually used and should not be confused with amount of water stored to provide for this consumption. The amount of water to be stored for these uses may be several times greater than that actually used because of evaporation and seepage losses from storage tanks and reservoirs.

CHARACTERISTICS OF AGRICULTURE

Farm Type

The dominant agricultural activities in the John Day River Basin are the production of beef and dryland grain. These two types of farms have developed under the physical and economic conditions in the basin. Dryland grain (predominantly wheat) is produced on the Deschutes-Umatilla Plateau of Sherman and Gilliam Counties in subbasin 3, where the loess soils and annual rainfall of from 8 to 15 inches are favorable for the production of this crop. Most farms operate on an alternate crop-fallow system. Although wheat is the primary source of income, livestock are also raised as complementary enterprises. Areas too steep or rocky to be tilled, grass waterways, and stubbles are utilized for grazing purposes. Hay for wintering livestock is produced on irrigated land in the narrow valleys. Some dryland grain hay is also produced in the area.

Livestock production is the major agricultural endeavor in the southern part of subbasin 3 and in subbasins 1 and 2. The extensive grazing lands in these areas provide summer forage for this type of enterprise. The irrigated lands in valleys adjacent to streams provide hay and pasture for use in conjunction with the grazing land.

Farm type has not changed significantly in the basin. Climatological and other physical and economic factors have tended to discourage any major deviation from the established range livestock and dryland grain type of operation (table 12).

Table 12 Type of farm, for three principal counties in the John Day River Basin, Oreg., 1944-59

Type of farm	Percentage distribution			
	1944	1949	1954	1959
	Percent	Percent	Percent	Percent
Field crops	1/	21	26	25
Dairy	5	3	2	0 2/
Poultry	2	1	3	0 2/
Livestock other than poultry and dairy	53	47	47	54
General	5	11	5	3
Miscellaneous and unclassified	35	17	17	18
Total	100	100	100	100

Source: U. S. Census of Agriculture data for Gilliam, Grant, and Wheeler Counties.

1/ Included in miscellaneous and unclassified.

2/ Less than 1 percent.

Number and Size of Farms

There are about 776 farms and ranches in the basin. Census data indicate that approximately 83 percent are commercial farms and 17 percent are part-time or residential farms. Most of the farms and ranches (463) are in subbasin 3, 158 are in subbasin 2, and 155 are in subbasin 1. Data from the Census of Agriculture for Gilliam, Grant, and Wheeler Counties indicate that farm and ranch numbers in the basin have decreased by more than 50 percent since 1920 (fig.5). This trend toward fewer farms is associated with the trend toward expanded farm size.

Ranches and dryland grain farms in the basin require extensive use of land resources in order to be successful. The average size of farm in the basin in 1959 was about 4,000 acres. The average investment in land and buildings per farm was about 100,000 dollars. Farm size in Gilliam County, which represents the dryland grain area, was slightly less than 4,000 acres per farm while farm size in Wheeler County, which represents a livestock area, was about 5,600 acres per farm. However, investment in land and buildings was higher in Gilliam County at 160,000 dollars per farm compared to 74,000 dollars per farm for Wheeler County.

Farms in the basin are rapidly becoming larger. While farm numbers have decreased by more than half since 1920, farm size has increased about 4 times (fig. 6). At the same time, investment in land and buildings has increased more than 5 times (fig. 7).

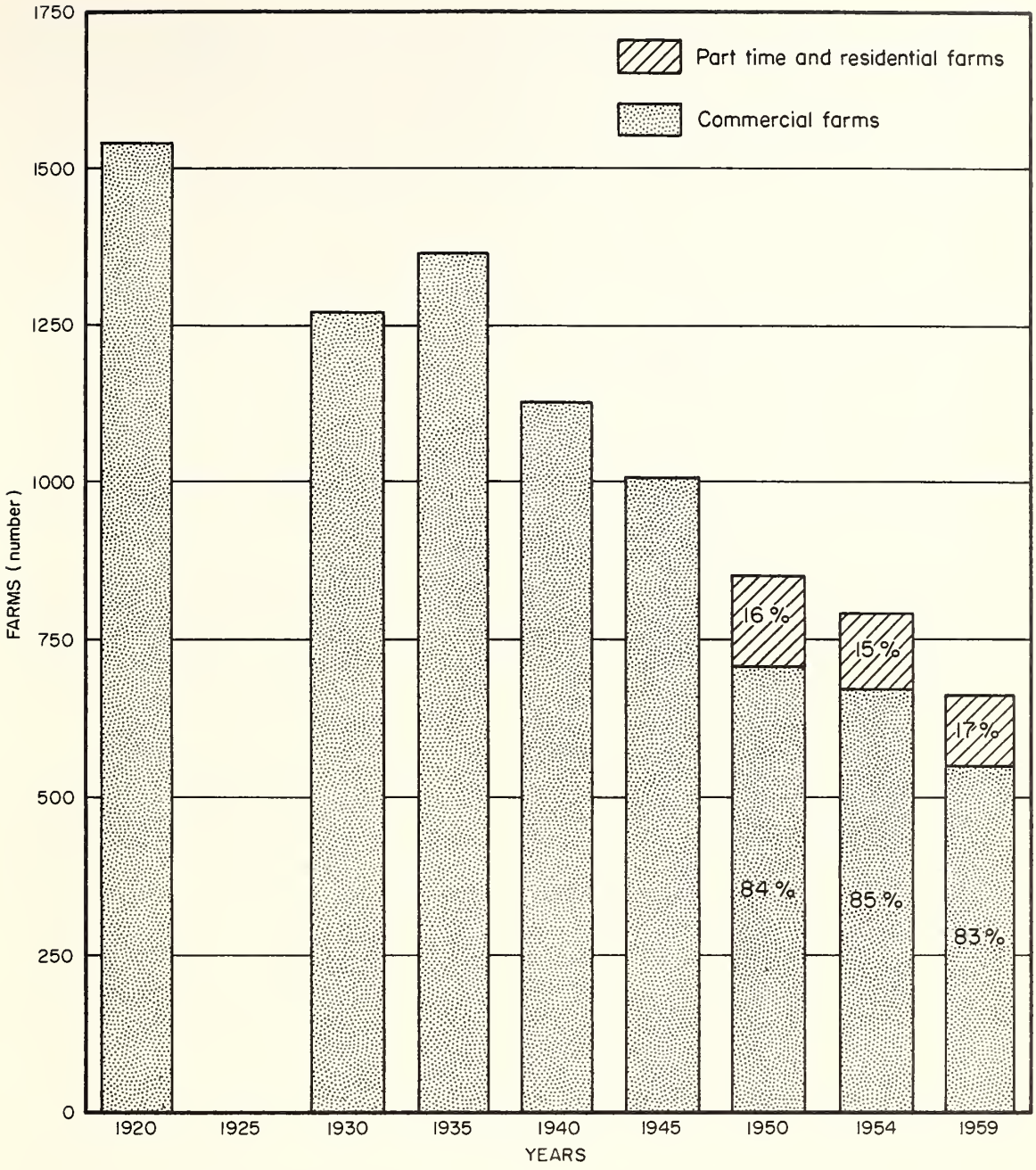
There are a number of reasons for the increase in farm and ranch size. Cost-price problems of recent years have encouraged a constant search for economies in operation. The extensive dryland grain and range livestock operations are particularly conducive to economies of scale. Technology, a major factor in a number of agricultural changes, has influenced expansion in ranch and farm size in at least two ways. First, the use of more efficient equipment and methods makes possible additional work with the same number of man-hours; and second, the cost of new inovations, a fixed expense, must often be spread over a larger number of acres to be economically justified.

Tenure

Census data indicate that about 46 percent of the ranchers in subbasins 1 and 2 own all of the land operated, 49 percent are part-owners, and 5 percent are tenants. Tenure in the southern part of subbasin 3, where ranching is the predominant agricultural endeavor, is similar to that in subbasins 1 and 2. However, in the northern part of subbasin 3, where dryland grain farming predominates, tenancy is higher. Only 29 percent of the farmers in this area are full owners, 41 percent are part-owners, 28 percent are tenants, and 2 percent are professional managers.

Gross Agricultural Income

Agriculture is the most important source of income in the basin. Gross agricultural income in the John Day River Basin in 1959 is esti-



1/ Source: U. S. Census of Agriculture data for Gilliam, Grant, and Wheeler Counties.

FIGURE 5.— Number of Farms for Three Principal Counties in The John Day River Basin, Oregon, 1920 – 59.

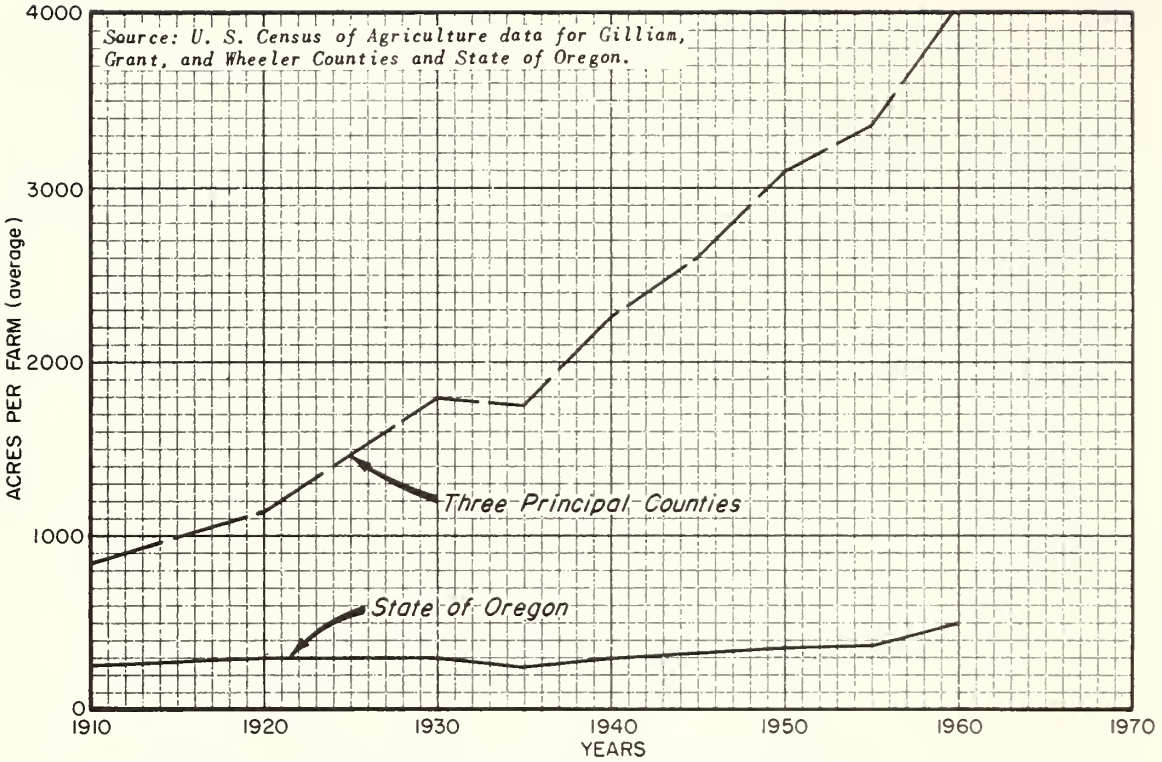


FIGURE 6.– Average Farm Size Per Farm in Acres for Three Principal Counties in The John Day River Basin and The State of Oregon, 1910-60.

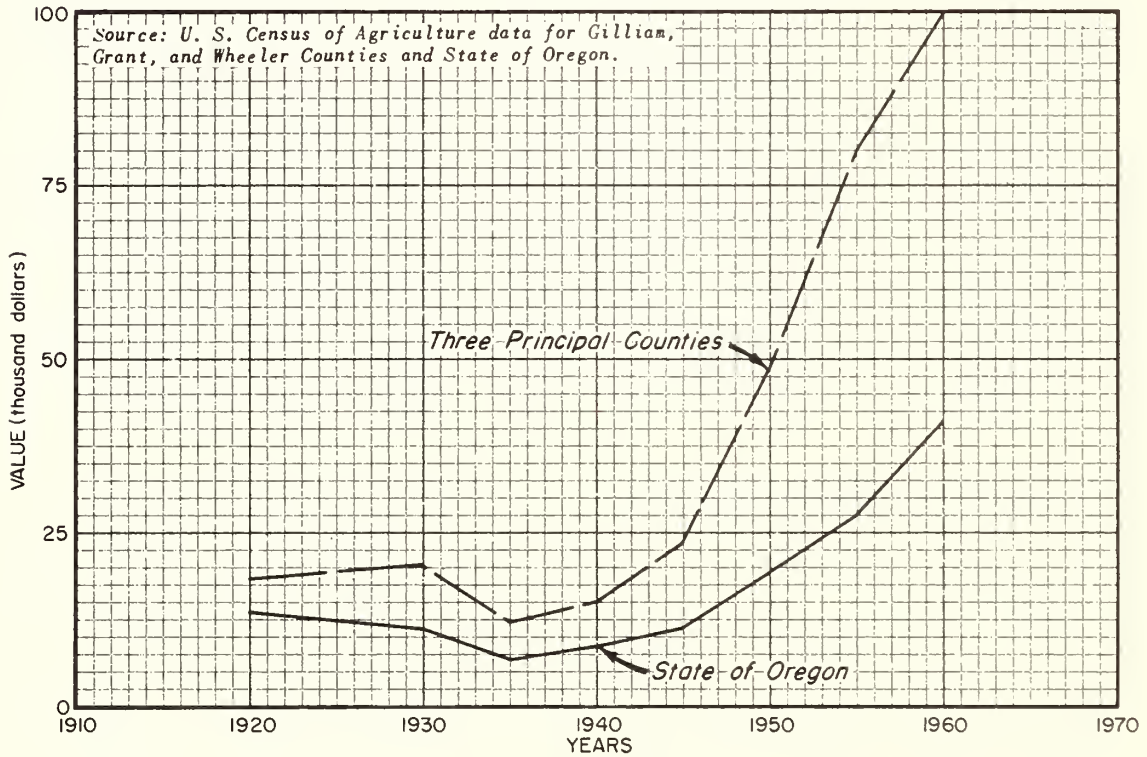


FIGURE 7.– Average Value of Land and Buildings Per Farm for Three Principal Counties in The John Day River Basin and The State of Oregon, 1910 – 60.

mated at about $19.4 million (table 13). Crops accounted for $11.3 million or 58 percent of the total and livestock accounted for the remainder. The dryland grain area in subbasin 3 was the most important source of farm income in the basin. Over half of the gross agricultural income for the basin was derived from grain sold from this area. Livestock and livestock products were the most important source of income in subbasins 1 and 2.

Table 13 Estimated gross agricultural income, by subbasins, John Day River basin, Oreg., 1959

Commodity sold	Value of farm products sold			
	Subbasin			
	1 North Fork John Day	2 Upper John Day	3 Lower John Day	Total John Day Basin
	Thousand dollars	Thousand dollars	Thousand dollars	Thousand dollars
Livestock and livestock products other than poultry and dairy products	2,424	2,258	3,274	7,956
Poultry and dairy products	52	46	33	131
Total livestock	2,476	2,304	3,307	8,087
Field crops other than vegetables, fruits, and nuts	71	123	10,950	11,144
Other crops	47	47	61	155
Total crops	118	170	11,011	11,299
Gross agricultural income	2,594	2,474	14,318	19,386

Source: Based on data from the U. S. Census of Agriculture.

Trends in value of farm products sold for Gilliam, Grant, and Wheeler Counties are shown in figure 8. These trends should be indicative of trends in the basin. Note that the value of crops sold has increased more than the value of livestock sold. However, part of this increase in dollar value of both crops and livestock is a reflection of the decrease in purchasing power of the dollar.

In order to show the real increase in production of crops and livestock in the three counties, the value of production was adjusted to reflect a constant dollar value. As this technique eliminates the effects of inflation or deflation in the purchasing power of the dollar, the real increase in production can be observed.

Figure 9 shows real production after adjustment to reflect values in terms of 1949 dollars. This reveals that while crop production has increased substantially since 1939, livestock production has actually

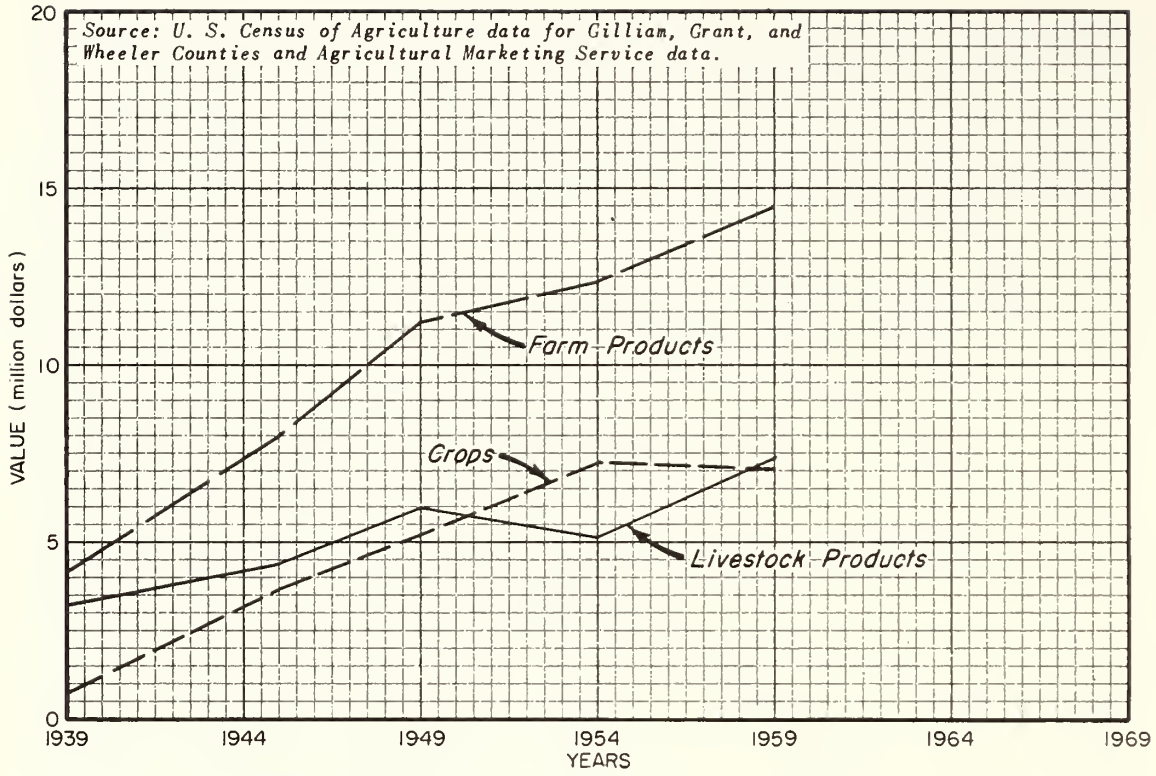


FIGURE 8.– Value of Farm Products Sold for Three Principal Counties in The John Day River Basin, Oregon, 1939 – 59.

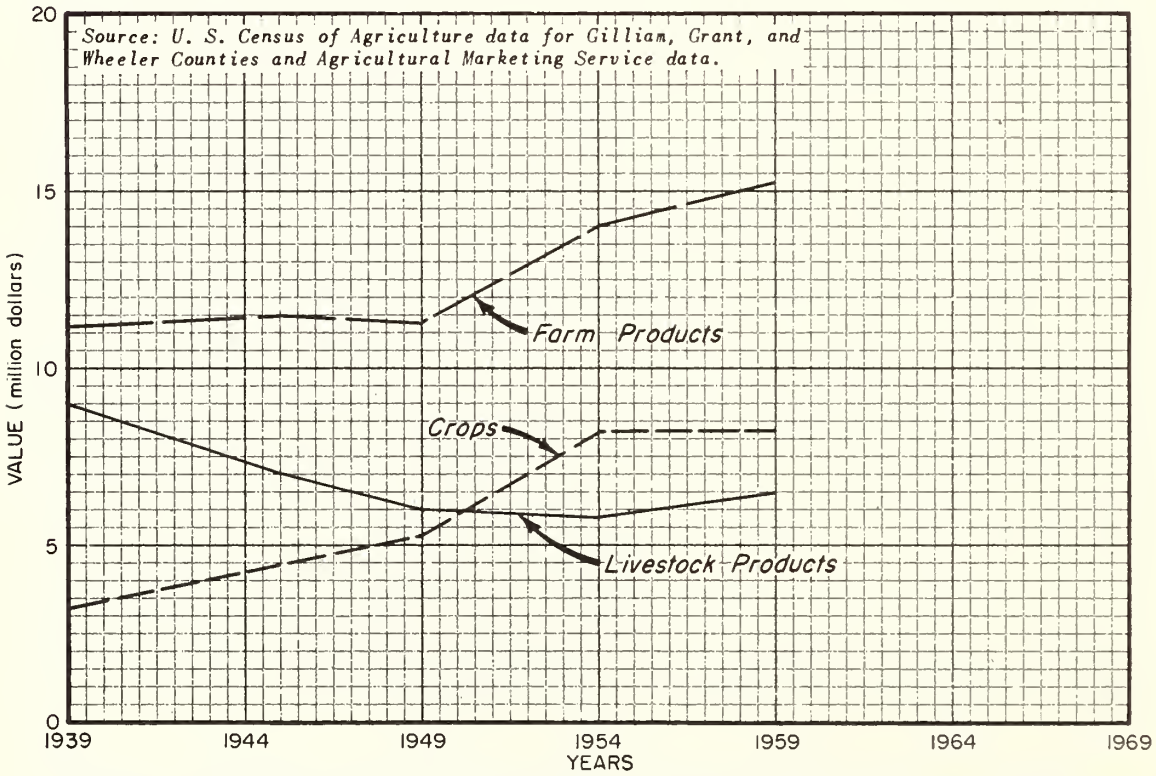


FIGURE 9.– Value of Farm Products Sold in 1949 Dollars for Three Principal Counties in The John Day River Basin, Oregon, 1939 – 59.

decreased. The downward trend in production is a reflection of the reduction in sheep numbers that has occurred in the basin.

Markets

Since there are no major population centers within the basin, markets for most agricultural products are outside the basin. Wheat from the basin is transported via rail, truck, and barge to Portland where it is marketed worldwide. Cattle are marketed through various channels. Weaner calves, yearlings, and long yearlings are either sold through buyers or consigned to feed lots outside the basin. A few cattle are fattened within the basin and consumed locally or marketed in Portland.

LAND USE FOR CROPS AND LIVESTOCK

Grazing Land

Land in the basin is used predominantly for the grazing of livestock. About 77 percent of the total area in the basin is used for this purpose (table 14). Fifty-six percent of the grazing land is open range and 44 percent is forested. This land presently provides approximately 746,000 animal unit months of grazing for domestic livestock and big game.

The history of grazing land use in this basin is similar to its history in areas throughout the West. Extensive grazing of domestic livestock began in the 1870's. Rangeland was in excellent condition, and livestock numbers far in excess of the sustained capacity of the resource were carried. The first indications of range depletion occurred during a series of dry summers about 1910. However, it was not until about 1930 that any significant reduction in livestock numbers took place. By then, grazing land was generally in a depleted condition from which it has only now begun to recover. Present grazing land conditions in the basin are tabulated in table 15.

The grazing resource may be divided into three main areas, which do not entirely correspond to subbasin boundaries. These are the Columbia Basin area, the Blue Mountain area, and the John Day area.

About half of subbasin 3 is in the Columbia Basin area where the range consists mainly of natural grasslands with comparatively productive soils. Lack of water in summer has generally restricted livestock numbers, so this range is in generally fair to good condition. Most of this land is used for spring and fall grazing.

Two-fifths of subbasin 1 and small portions of subbasins 2 and 3 are in the Blue Mountain area and are used primarily for summer grazing because of the cold climate. The grazing land of this area consists of open grasslands at lower elevations, pine grasslands (under pine forest) at intermediate elevations, and fir forests with scattered mountain meadows at high elevations. Most of this grazing land is in fair to poor condition. The forested grasslands are in especially poor condition, particularly along ridgetops which were used as stock drive-

Table 14 Agricultural land use, by subbasins, John Day River Basin, Oreg., 1960 1/

Agricultural land use	Subbasin 1 North Fork John Day	Subbasin 2 Upper John Day	Subbasin 3 Lower John Day	Total John Day Basin
	Acres	Acres	Acres	Acres
Grazing land:				
Open rangeland	392,900	590,400	1,262,800	2,246,100
Forested land	786,200	637,400	300,000	1,723,600
Total	1,179,100	1,227,800	1,562,800	3,969,700
Cropland:				
Dryland				
Grain	550	430	229,250	230,230
Grain hay	13,820	2,740	13,830	30,390
Other hay	8,310	130	1,020	9,460
Other cropland	2,120	1,900	228,900	232,920
Total	24,800	5,200	473,000	503,000
Irrigated				
Improved hay	4,800	13,560	7,500	25,860
Meadow hay	5,050	15,120	870	21,040
Other cropland	50	120	1,930	2,100
Total	9,900	28,800	10,300	49,000
Total cropland	34,700	34,000	483,300	552,000

1/ Includes land in public ownership.

Table 15 Condition of grazing land, by subbasins, John Day River Basin, Oreg., 1960

Grazing land condition	Percentage distribution of condition: Subbasin 1 North Fork John Day	Subbasin 2 Upper John Day	Subbasin 3 Lower John Day	Total John Day Basin
	Percent	Percent	Percent	Percent
Excellent	2	1	3	2
Good	11	4	12	9
Fair	46	28	42	39
Poor	41	67	43	50
Total	100	100	100	100

Source: Based on data provided by the Soil Conservation Service.

ways for many years; in creek bottoms where livestock tend to congregate for water; and in the small alpine meadows.

Three-fifths of subbasin 1, practically all of subbasin 2, and half of subbasin 3 are in the John Day grazing area. The range here consists of mainly open grasslands and browse grasslands at low elevations, with some pine grasslands at intermediate elevations and a small area of fir forests with a few scattered meadows at high elevations. Yearlong grazing is common, with winter range in the valleys where feed is produced in summer. Spring and fall grazing is on the open grasslands and browse grasslands, and summer grazing is in the forested zone. Two-thirds of the John Day grazing area is in poor condition; only about 5 percent is in good condition.

One of the major opportunities in the John Day Basin lies in the improvement of grazing lands. It is estimated that an 87 percent increase in forage production is possible in the basin (table 16). This could be accomplished through improvement in range conditions by 10 to 15 years of improved management and other practices as outlined generally by SCS range practice standards and specifications.

Table 16 Present and potential forage production of grazing land, by subbasins, John Day River Basin, Oreg., 1960

Area	Forage production of grazing land		
	Present	Potential	Percentage increase
	Animal unit months	Animal unit months	Percent
1. North Fork John Day	234,700	402,800	72
2. Upper John Day	205,900	343,700	67
3. Lower John Day	305,200	648,900	113
Total basin	745,800	1,395,400	87

Source: Estimates are based on range site data provided by the Soil Conservation Service.

Cropland

Eleven percent of the land in the basin is cropland (table 14). Most of this is located in Sherman and Gilliam Counties in subbasin 3 and is used for production of dryland wheat. Wheat yields on this land averaged over 33 bushels per acre in 1959. About half of the cropland in this subbasin lies fallow under the alternate crop fallow operation practiced in this area. In addition to producing grain, this cropland also provides fall grazing for livestock. Hay production is the second most important cropland use in subbasin 3 with about 23,220 acres used for this purpose. Thirty-six percent of the hayland is irrigated, and the rest is almost all dryland grain hay. Most hayland is also pastured.

The major use of cropland in subbasins 1 and 2 is for the pro-

duction of hay and pasture (table 14). About 92 percent of the cropland in each of these subbasins is used for this purpose. However, production is higher in subbasin 2 because 84 percent of the hayland in this area is in irrigated improved or meadow hay whereas only 28 percent of the hayland in subbasin 1 is of this type.

Yields from hayland in the basin vary considerably, depending upon growing season, soils, plant type, rainfall, water supply (when irrigated) and level of management. The only readily available source of information on average yields is the Census of Agriculture. Average yields for Gilliam, Grant, and Wheeler Counties in 1959 were: alfalfa 2.2 tons per acre, clover and grass mixtures 1.6 tons per acre, and all other hay 1.3 tons per acre. Yield data from the census may be misleading because aftermath is not considered. Most hayland in the basin, in addition to producing hay, is also pastured. Data from the census do not show any appreciable difference in hay yields on irrigated and nonirrigated land. However, forage available for grazing would normally be considerably higher on irrigated land. Any analysis of yields on irrigated and nonirrigated hayland in the basin should consider the total production on these lands. Time limitations prohibited obtaining this detailed information.

Acreage of cropland in the basin has fluctuated during the last 30 years, but no trend is apparent. Retirement of cropland to use as grazing land has evidently offset development of new cropland. Trends in grain acreage and production for Gilliam, Grant, and Wheeler Counties are shown in figure 10. Although present wheat acreage is less than that in 1949, wheat production has continued to increase. Wheat acreage has been reduced as a result of the allotment program and is being replaced by barley. The increase in wheat production is largely a result of application of improved technology and conservation practices.

Trends in acreage and production of hay are shown in figure 11. Total alfalfa production has increased as a result of increased acreage in this crop. Average yields per acre, however, remain about the same. Total hay acreage has remained fairly stable since 1929 while total production has increased slightly. This increase is primarily because of the increase in acreage of alfalfa.

Livestock

In 1960, the land and water resources of the John Day River Basin supported a livestock population of about 105,390 head of cattle and calves, 38,550 head of sheep and lambs, and 3,870 head of horses and mules. About 1,500 cattle were milk cows, and most of the rest were range cattle. In addition, there were about 5,000 head of hogs in the basin. Estimated numbers of livestock by subbasins are shown in table 17.

Sheep, once numerous in the basin, have decreased significantly in number and are being replaced by cattle (fig. 12). The number of horses has also decreased. The net result has been a continued downward trend in total animal units in the three counties representative of the basin. Declining range condition is probably the reason for

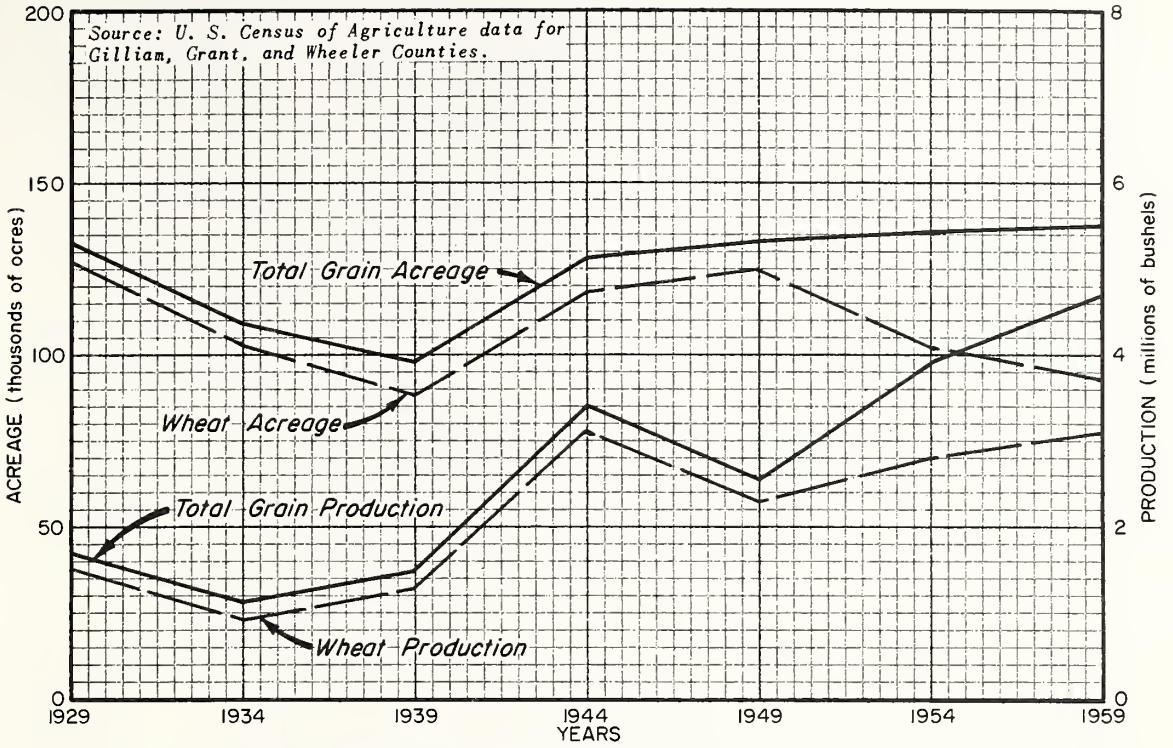


FIGURE 10. – Grain Acreage and Production for Three Principal Counties in The John Day River Basin, Oregon, 1929 – 59.

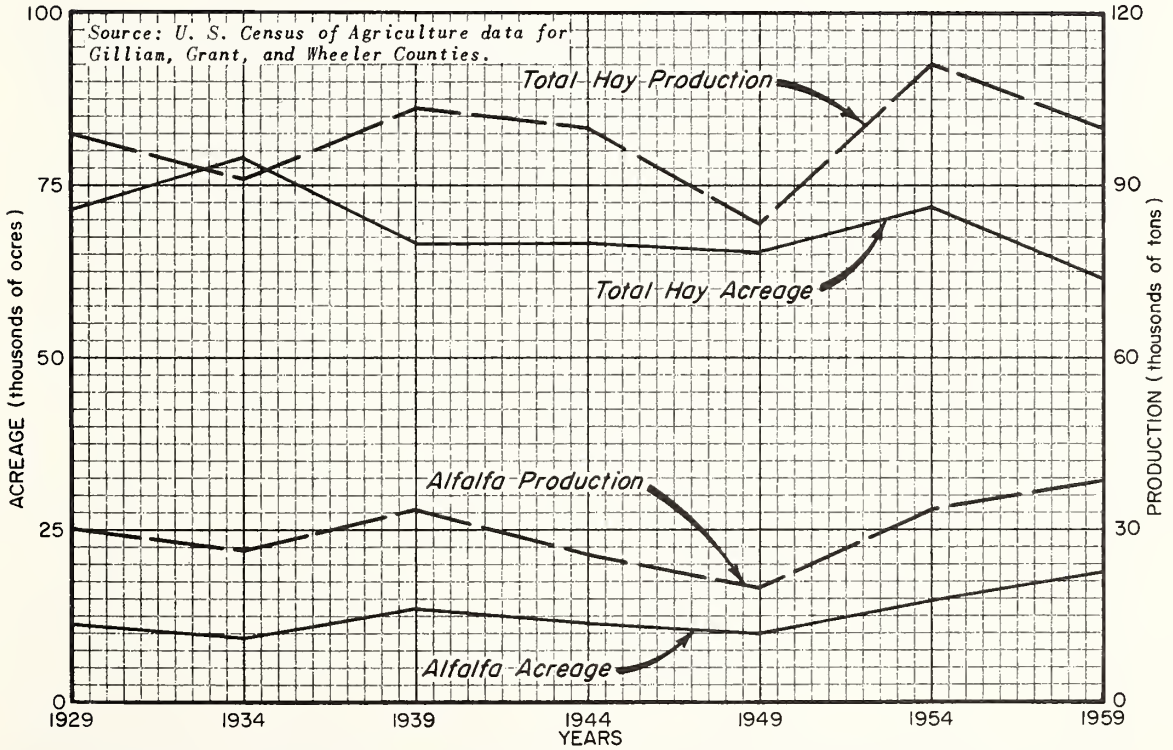
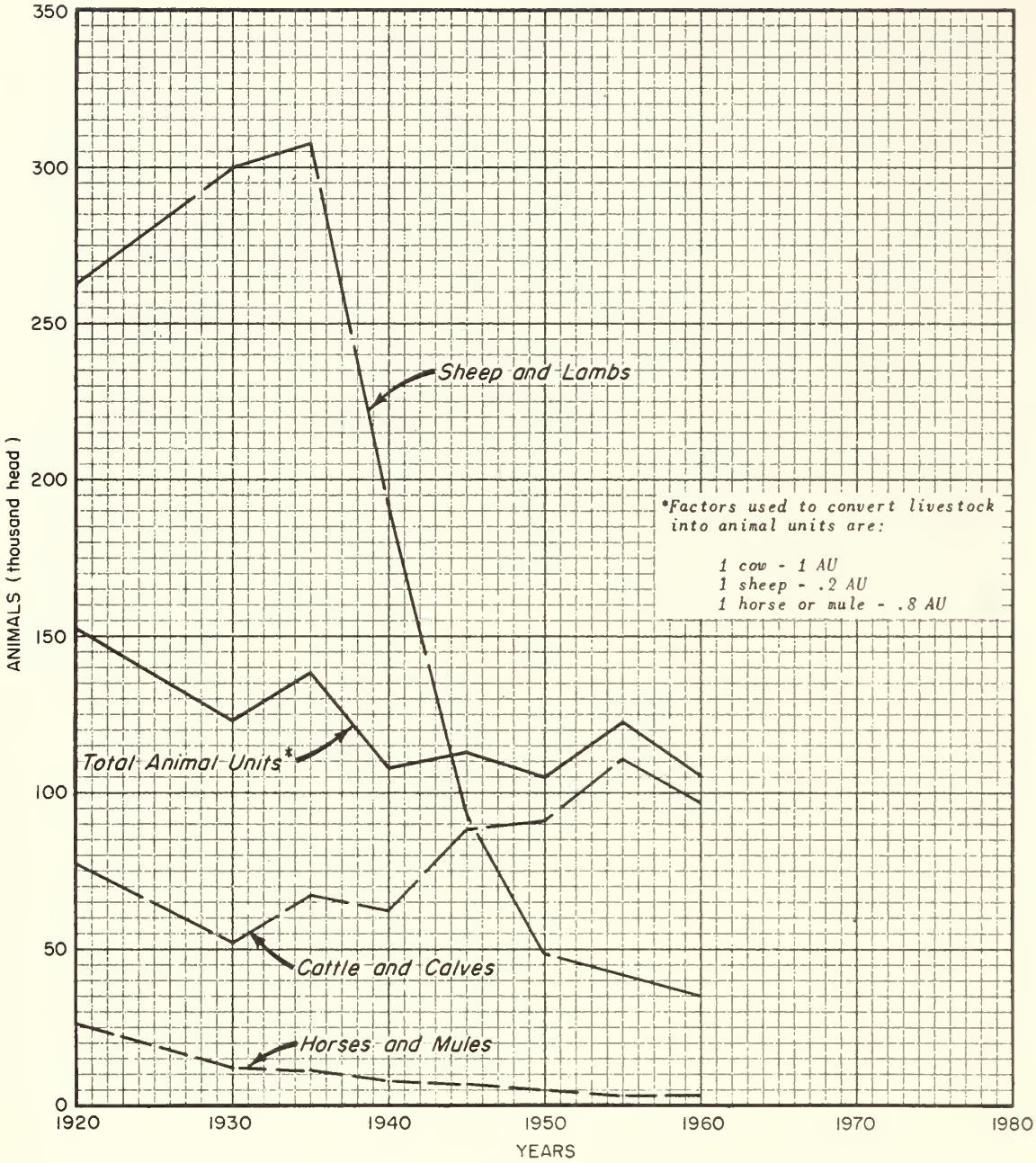


FIGURE 11. – Hay Acreage and Production for Three Principal Counties in The John Day River Basin, Oregon, 1920 – 59.



Source: U. S. Census of Agriculture data for Gilliam, Grant, and Wheeler Counties.

FIGURE 12.– Livestock Numbers and Animal Units for Three Principal Counties in The John Day River Basin, Oregon, 1920–60.

Table 17 Livestock numbers, by subbasins, John Day River Basin, Oreg., 1960

Type of livestock	Number of livestock			
	Subbasin			
	1 North Fork John Day	2 Upper John Day	3 Lower John Day	Total John Day Basin
	Number	Number	Number	Number
Total cattle and calves...	33,060	30,670	41,660	105,390
Sheep and lambs.....	5,940	7,330	25,280	38,550
Horses and mules.....	1,050	1,010	1,810	3,870

Source: Based on data from U. S. Census of Agriculture.

this trend. Also, the rugged terrain of some of the rangeland prevents utilization of forage by cattle in areas that were previously utilized by sheep.

The balance between hay production and grazing forage is of great importance in the livestock-range type of operation in this basin. If forage production on range and forest land is increased, a corresponding increase in hay production would be desirable to provide winter feed for breeding stock. Alternatives would be to ship hay, increase the length of the grazing season and adjust cattle numbers accordingly, or winter livestock in other areas. The potential grazing capacity of rangeland and forest land was discussed in the preceding section. If potential production of forage from grazing land is realized and livestock operations remain about the same, the number of animal units in the basin might be increased by about 87 percent.

The number of livestock the basin will support depends upon several factors. The productivity of range, forest, and irrigated grazing land and the amount of hay available for wintering livestock are the most important factors. The amount of hay required to winter cows varies from less than 1 ton per head at lower elevations where winters are shorter and less severe to around 2 tons per head at higher elevations.

WATER USE FOR AGRICULTURE

Major agricultural uses of water in the basin are for production of forage, grain, and livestock. The most critical future agricultural needs for water will be for irrigation and range livestock. For this reason, this section of the report is limited to discussion of water for these purposes.

Range Livestock

It is essential that adequate water be provided for livestock on the range. The retention of an adequate amount of water distributed over the grazing area in relation to the forage supply is a prime factor in the success of any efforts toward improving the general plant cover.

In order to harvest the present forage crop, about 672 acre-feet of water is required for consumptive use by grazing animals. Normally, water for animals is abundant in the basin during the spring grazing season in most areas. However, during the summer and fall, water must be stored in reservoirs, tanks, and troughs to supplement the few perennial streams in the grazing areas. The amount of water stored may need to be several times greater than the amount of water consumptively used by animals because of evaporation and seepage.

If forage production on grazing lands were improved to their potential, approximately 1,257 acre-feet of water plus evaporation and seepage losses would be required for use by livestock (table 18). Although this is a relatively minor amount of water, it is important that it be provided.

Table 18 Present and potential water needs for consumptive use by livestock on grazing land, by subbasins, John Day River Basin, Oreg., 1960

Area	Water needed for consumptive use by livestock to harvest forage on grazing land	
	Present need	Potential need
	Acre-feet	Acre-feet
1. North Fork John Day	212	363
2. Upper John Day	185	310
3. Lower John Day	275	584
Total John Day Basin	672	1,257

Source: Based on data provided by the Soil Conservation Service.

Irrigation

On the basis of census data and data collected in the area, it is estimated that about 49,000 acres were irrigated in the basin in 1960. There are irrigation water rights for about 74,170 acres. Distribution of irrigated acreage in the basin is almost the same as distribution of water rights (table 19). Almost 60 percent (28,800 acres) of the irrigated acreage in the basin is in subbasin 2. The remaining acreage is split between the other two subbasins with about 20 percent of the total in each area. Irrigation is used primarily for production of hay and pasture. Irrigated land use was discussed in the preceding section under cropland.

Most irrigated land in the basin is located in valleys adjacent to streams. About 44 percent of this land is considered class II land, 36 percent is class IV, 20 percent is class III, and only 1 percent is class I land (table 20).

Type of Irrigation Development

Most of the irrigation development in the basin has been accom-

Table 19 Water rights and irrigated acreage, by subbasins, John Day River Basin, Oreg., 1960

Area	Water rights		Irrigated land	
	Acreage	Percentage distribution	Acreage	Percentage distribution
	Acres	Percent	Acres	Percent
1. North Fork John Day...	15,332	20.7	9,900	20.2
2. Upper John Day.....	44,504	60.0	28,800	58.8
3. Lower John Day.....	14,334	19.3	10,300	21.0
Total John Day Basin....	74,170	100.0	49,000	100.0

Table 20 Estimated percentage distribution of irrigated land in Land Capability Classes I through IV, by subbasins, John Day River Basin, Oreg., 1960

Land capability class	Percentage distribution of irrigated acreage			
	Subbasin			
	1 North Fork John Day	2 Upper John Day	3 Lower John Day	Total John Day Basin
	Percent	Percent	Percent	Percent
I.....	5.5	0.3	1.1	1.4
II.....	24.2	46.0	51.2	43.5
III.....	12.1	22.5	17.7	19.6
IV.....	58.2	31.2	30.0	35.5
Total.....	100.0	100.0	100.0	100.0

Source: Based on data provided by the Soil Conservation Service.

plished on an individual farm basis. Data from the Census of Irrigation indicate that in 1949, 80 percent of the land in the basin was irrigated on an individual farm basis and 20 percent was irrigated from irrigation facilities that served more than one farmer. About 90 percent of the land irrigated by mutual facilities was located in subbasin 2.

Source of Water and Method of Application

Streamflows are the major source of water for irrigation in the basin. About 99 percent of the land is irrigated with water from this source and 1 percent from ground water (table 21). Water stored in reservoirs is a source of supplemental water for 2 percent of the irrigated land. Direct gravity diversion of water from streams is the principal means of diverting water for irrigation. Eighty-five percent of the land is irrigated by this type of diversion, 12 percent is irrigated by pumping from streams, 2 percent by diversion from storage, and 1 percent by pumping from wells. Most of the pumps on streams are located in subbasins 1 and 3. Streams are more deeply entrenched in these areas. Hence, in many instances pumping from streams is the most

practical way of delivering water to the irrigable lands.

Flooding is the most common method of applying water on the land. About 92 percent of the land is irrigated by this method (table 21). Sprinkler irrigation has become more widespread since the advent of power through the Rural Electrification Administration. Sprinkler systems are found throughout the basin but are especially numerous in subbasins 1 and 3 in the area around Spray and Monument.

Table 21 Irrigation water source and method of application, by subbasins, John Day River Basin, Oreg., 1960

Item	Percentage distribution of irrigated land			
	1 North Fork John Day	2 Upper John Day	3 Lower John Day	Total John Day Basin
	Percent	Percent	Percent	Percent
Irrigation water source:				
Direct stream diversion	78	97	58	85
Pumped from streams	20	1	35	12
Pumped from wells	...	...	2	1
Reservoir storage	2	2	5	2
Total	100	100	100	100
Method of application:				
Sprinkling	20	2	14	8
Flooding	80	98	86	92
Total	100	100	100	100

Source: Based on data provided by the Soil Conservation Service.

Cost of Irrigation

The latest data from the Census of Agriculture indicate that the average cost of irrigation water to farmers in the John Day River Basin in 1949 was $0.78 per acre. Costs in the Upper John Day, subbasin 2, above Dayville averaged only $0.45 per acre, whereas costs in the rest of the basin averaged $1.28 per acre. These costs include: (1) cost of electricity or fuel and oil used for pumping for irrigation (2) costs of repairs, maintenance and replacements for irrigation supply works and equipment (including the estimated value of any work done by the farm operator in repairs or maintenance) and (3) payments made for water obtained from another irrigation enterprise and delivered to the land in the farms by means of the irrigation supply works operated by the farm. In order to determine total irrigation costs, the cost of interest on investment in equipment, depreciation, and the cost of the farmer's labor for irrigating would have to be added to the above costs.

Trends in Irrigation

Development of irrigation in the John Day Basin was started near Prairie City about 1860. The amount of land in the basin susceptible to irrigation by direct stream diversion is limited, and much of it was developed prior to 1919. From 1919 to 1949, irrigated acreage in the basin remained fairly stable at around 40,000 acres (table 22). Although additional irrigated land was developed during this period, this development was offset somewhat by the abandonment of irrigation on other land. Inadequate water supplies and high operation and maintenance requirements on canals, flumes, and diversions are the major reasons for abandonment of irrigation in these areas. In some instances, direct pumping from streams has replaced lengthy canals and flumes. However, direct diversion of irrigation water from streams remains the principal source of irrigation water.

Table 22 Irrigated acreage in the John Day River Basin, Oreg., 1919-60

Year	Irrigated acreage in the John Day River Basin
	Acres
1919	36,141
1929	40,495
1939	43,525
1949	43,873
1960	49,000 1/

Source: U. S. Census of Agriculture.

1/ Estimated on basis of census data for counties and other data collected in area.

Since 1949, irrigated acreage in the basin has increased by about 5,100 acres. Most of this land was brought under irrigation by means of irrigation pumps. Pump irrigation from streams has been the means of applying water on about two-thirds of this 5,100 acres. The availability of REA power to the basin in recent years has been a major factor influencing the increase in pump irrigation.

Future Irrigation

Future irrigation developments in the basin will be for the purpose of irrigating additional land and furnishing supplemental late-season water to land presently irrigated. Irrigation development will be governed by several physical and economic factors. The availability of suitable land and the availability of water for this land are two of the most important physical factors. There are more than 500,000 acres of land in land capability classes I through IV in the basin. On the basis of soils only, this would be the amount of land that would be susceptible to irrigation. However, location of the land in relation to water supplies and the present use of this land precludes the possibility of irrigating most of it in the foreseeable future.

It is anticipated that irrigation development will continue to be limited primarily to land in valleys fairly close to the sources of irrigation water. Data gathered on a reconnaissance study of tributaries in the basin indicate that at least 17,000 acres of additional land is so located that it could be irrigated (table 23). About half of this could be irrigated at least in the early part of the season from present flows and storage would be necessary on the rest.

Table 23 Estimate of additional irrigable land, by subbasins, John Day River Basin, Oreg., 1960

Item	Subbasin 1 North Fork John Day	Subbasin 2 Upper John Day	Subbasin 3 Lower John Day	Total John Day Basin
	Acres	Acres	Acres	Acres
Additional irrigable land.....	2,300	3,720	10,980	17,000
Acreage natural streamflows would irrigate.....	500	1,480	6,460	8,440

Source: Based on data provided by the Soil Conservation Service.

The need for irrigation development will be influenced by other factors. It is estimated that an 87 percent increase in forage production could be attained on rangeland and forested grazing land through various practices. If this potential is attained, livestock numbers could be increased. If livestock numbers were increased, it would be desirable for hay and pasture production on cropland to be increased also to maintain a balance between forage production on dryland grazing lands and forage production on irrigated lands. Irrigated land would be needed to provide forage for wintering breeding stock and filling in periods of slack production on the dryland range and forests. On the other hand, if forage production on range and forested lands decreases, there will be continued pressure for expansion of irrigated land for pasture and hay in order to sustain present livestock numbers.

It is apparent that physical opportunities for additional irrigation development exist in the basin. It is also apparent that there will be a continued desire for irrigation development. However, the rate of irrigation development will be governed not by physical opportunities or desires, but by economic factors. Since most of the irrigated land is used to provide forage for livestock, the economic returns from livestock will be a major determining factor. A comprehensive analysis would be necessary to determine the future economic returns from irrigation and the value of irrigation water. Such an analysis should consider several factors that as yet have not been appraised comprehensively. Among these factors are the following:

1. The national requirements for agricultural products based on projected population growth, improved dietary standards resulting from higher levels of economic output per capita, and expected shifts in foreign exchange

of agricultural products.

2. Shifts in economic advantage between regions of the country for production and marketing of major classes of agricultural products.

3. Growth of nonagricultural uses of the land and water resources, depletion of resources now used for agricultural production, retirement of inferior land from agricultural use, and the probable effects of these factors on availability of land for agricultural production.

4. Advancement in agricultural production technology resulting from research and educational and technical assistance programs, and the resulting increase in production and utilization of crops and pasture.

5. Opportunities for alternative resource development with expected levels of agricultural output and costs.

An essential first step in analyzing the value of irrigation water is the establishment of the current situation with respect to the agricultural use of the land and water resources as a means of identifying some of the problems involved, which in turn indicate opportunities for adjustments and improvements. The time limit imposed for the completion of this report has restricted the scope of the material presented here to: (1) the collection and analysis of historical data that could be oriented to or would be indicative of the current agricultural situation in the basin, and (2) an indication of some of the needs and opportunities for water resource development in the basin.

WATER RELATED PROBLEMS IN THE BASIN

WATER SUPPLY

The water resources of the John Day River Basin, in total, are favorable since this area of approximately 8,000 square miles has an average yield of about 1,500,000 acre-feet of water after current consumptive use withdrawals. Based upon an assumed five feet of water per irrigated acre, the current use of water would be about 240,000 acre-feet for irrigation, the largest present agricultural water use. Thus, the current use of irrigation water represents approximately 14 percent of gross basin water yield, so total water yields are not a problem at present. However, there are many serious local problems concerning available water for both irrigable land and grazing land. Furthermore, future increases in water needs for additional irrigated land, water spreading, and stock water development will create more water supply problems.

The amount of basin water yield during the accepted irrigation season, April through September, generally represents from 45 to 75 percent of the total annual yield. However, the monthly yield progressively diminishes through the irrigation season to the extent that the yield for September ordinarily is less than 1 percent of the total annual yield. Hence, all irrigated lands, even those along the main rivers, can experience late-season water shortages. Streamflow records indicate that late-season low flows can occur in all subbasins; the most serious situation was in subbasin 2, where flows from the 1,580 square mile gaged area were as low as 1 c.f.s. for several days in August and September, 1930. The situation, of course, is much more serious in the smaller tributaries because there are greater variations in the monthly distribution of annual yield and often the flow of water is very low or nonexistent in late summer. A review of forty-two small tributary watersheds indicates that 76 percent of them have inadequate total or late-season water supplies for existing irrigated lands (table 24).

Table 24 Summary of tributary watersheds with inadequate late summer irrigation water supply, by subbasins, John Day River Basin, Oreg.

Subbasin	Total number of tributaries checked	Number of tributaries with inadequate water
	Number	Number
1. North Fork John Day	9	6
2. Upper John Day	12	8
3. Lower John Day	21	18
Basin total	42	32

Therefore, modifications of the runoff pattern through reservoir storage would be essential to provide a fully adequate water supply for much of the presently irrigated land. In addition, if the 17,000 acres

presently estimated as suitable for reasonable expansion of irrigation are developed, the actual need for irrigation water in the basin might rise to about 325,000 acre-feet, an increase of about 35 percent. Since most of the potential for irrigation expansion lies in the tributary watersheds, much of the additional water needed would need to be stored.

An estimated 670 acre-feet of water is consumptively used by grazing animals in harvesting the present range forage crop. This could rise to around 1,260 acre-feet under optimum production and use of range forage. Normally, water for animals is abundant during the spring growing season. However, during the summer and fall, stored water is required to supplement the few perennial streams and springs in the area. It is important that these water storage developments be well located in relation to available forage supply if proper use of this crop is to be made. Because no generally acceptable figures are available for the overall efficiency of stockwater developments in the basin, it is impossible to estimate the total additional volume of late season water needed. However, the approximate distribution of need by subbasins is indicated in table 18.

The principal water supply problems on forest land are: (1) low flows and high water temperatures in the upper tributaries during the summer are unfavorable to fish life; and (2) there is need for more retention reservoirs to increase the very small water surface area that is now available for recreational purposes. There is great potential of fish producing streams in the basin, but increased late-summer flows would be necessary on many streams to develop a satisfactory habitat for fish.

IRRIGATION SYSTEMS

Four-fifths of the irrigated land in the basin is served by individual systems, a situation that has created many problems of water diversion and control. The other one-fifth is served by group ditches that generally deliver water to from two to five farms, sometimes up to ten or eleven. Ninety percent of the group systems are in subbasin 2.

Perhaps the most difficult problem, at least on the larger streams, is the gravity diversion of water at the source. Census data indicate that in 1950, 1,016 individual diversion dams were used in the basin. Of these only 4 percent were concrete or masonry, 15 percent were timber, and 81 percent were earth, gravel, rock, and miscellaneous. Many diversions are gravel dams pushed up from the streambed and plugged with straw and manure. Most of these require repair or replacement each year. Figure 13 is a picture of a common diversion dam.

Along the lower main river in subbasin 3, the size and flow of the stream generally precludes the use of gravity diversion structures to supply water to the small scattered irrigable lands. In this area it is necessary to lift water from the river by pumps for subsequent gravity or sprinkler irrigation use. This situation creates costly installation and maintenance problems.

Figure 13 Irrigation diversion dam on a small creek in subbasin 3.

A difficult situation exists in the transmission and control of water in open ditches once it has been diverted from the stream. In 1950, 538 miles of open ditches were operated by 259 enterprises for irrigation of about 44,000 acres of land. In addition, some of these ditches have large seepage losses. Much of the land is rough, making water delivery difficult. More and better structures are needed, but economic factors deter rehabilitation and improvement of systems. Figure 14 shows an example of some of the problems encountered on even relatively small systems.

In the area between Spray and Monument, along the main John Day River and its North Fork, the rough boundary topography makes the construction and maintenance of ditches particularly difficult for much of the irrigable land. Thus, expensive sprinkler systems pumping from the river are required to irrigate segments of the area.

Another problem affecting the irrigation systems in numerous ways is the difficulty of applying water to some of the lands. In some instances, rough topography affects the uniformity and efficiency of sprinkler irrigation. In others, surface topography is such that wild flooding is currently used to apply irrigation water.

Figure 14 Irrigation structure across John Day River near Dayville, Oregon. Capacity 8 c.f.s.

DRAINAGE

Approximately 21,000 acres, or 4 percent of the total arable soils in the John Day Basin, are subject to excessive wetness. Since virtually all of the excessively wet soils are presently irrigated, this condition is present on about 43 percent of the total irrigated land. These wet conditions are generally caused by unfavorable soil conditions or soil associations. An estimate of the amounts of soil with dominant problems of excessive wetness, by subbasins, is shown in table 25. This table also shows the percentage distribution of excessively wet soils by subbasins and lists the percentage relationship of wet soils to the total irrigated land in each subbasin.

The excessively wet soils in subbasin 1 are predominantly in Land Capability Class IV, a type of soil suitable for only occasional cultivation. Therefore, these wet areas are generally used for perennial hay and pasture. These lands are scattered along the minor streams with most of them in the valleys of Camas, Long, and Fox Creeks. These soils are fine textured through their profile and prone to cracking after drainage. The principal problem is the provision of satisfactory drainage at a favorable cost.

The largest amount of excessively wet soils is found in subbasin 2. These soils are in Land Capability Classes II, III, and IV and are predominantly along the main John Day River from above Prairie City down through Mt. Vernon; in addition, there are scattered wet areas from Mt. Vernon to the gorge below Dayville. The drainage problems in this

Table 25 Estimate of the excessively wet soils within Land Capability Classes I-IV and distribution, by subbasins, John Day River Basin, Oreg.

Land capability class	Subbasin 1: North Fork John Day	Subbasin 2: Upper John Day	Subbasin 3: Lower John Day	Total John Day Basin
	Acres	Acres	Acres	Acres
I	...	...	...	...
IIw	...	7,200	200	7,400
IIIw	...	3,500	...	3,500
IVw	3,800	5,000	1,300	10,100
Total	3,800	15,700	1,500	21,000
	Percent	Percent	Percent	Percent
Percentage distribution of excessively wet soils	18	75	7	100
Percentage excessively wet soils are of total irrigated land	38	54	15	43

subbasin are complex. In many areas, there are old channels filled with gravel through which water works into the fields. Also boils (springs) occur in some fields and can create sinks after installation of drainage. The occurrence of sink areas together with severe after-drainage cracking of very fine textured soils necessitates additional land smoothing and leveling. In many cases group drainage facilities are necessary to secure adequate outlets where several landowners have related wet areas.

Subbasin 3 has a comparatively small amount of excessively wet land. Most of these wet soils are in Land Capability Class IV and are found in small scattered bodies in meadowlands in the forest fringe. The principal problem is seeped areas caused by springs outletting in areas of fine textured soils.

FLOOD

The flood problems in the John Day Basin result from two different occurrences. First, and most routine, is the high winter or spring runoff in all streams and rivers caused generally by snow melt and sometimes affected in varying degree by rains. This high runoff varies in time by specific location, elevation, and temperature but usually occurs in April and May on the main rivers, possible in March on small streams in the lower basin and in June on small creeks in the higher mountains. The second cause of flooding, relatively infrequent but sometimes disastrous, is cloudburst storms. These storms generally occur during June through August. They can occur in any part of the basin but are reported to be most frequent and intense within Wheeler and Grant Counties. A brief resume of floodwater, sediment, and erosion problems with em-

phasis on agricultural aspects is presented below.

Floodwater Damage

Floodwater damage on forested lands is generally limited to roads and drainage structures, and is often caused by improper location and design of these improvements. Much of the damage to major drainage structures is caused by debris left in and adjacent to streams after logging.

Considerable floodwater damage occurs in subbasins 1 and 2. Agricultural land along the main rivers and tributary streams is subject to overflow during high flows, sometimes aggravated by ice jams. Figure 15 illustrates the type of damage that has occurred on farmlands. Such damage would be more widespread and severe if the land were not used primarily for perennial hay and pasture crops. Cloudbursts have damaged crops, irrigation structures, farm facilities, roads, and urban areas. The town of Mt. Vernon has experienced serious floodwater damage in the past. In addition to other damage, inundation of wet farmland by flood waters aggravates drainage problems.

Figure 15 Recently leveled field near Mt. Vernon, Oregon, as it appeared after the 1955 John Day River flood.

Floodwater damage in subbasin 3 is generally caused by high spring runoff. It is sporatic and occurs on land along lowland streams. The Rock Creek area in Gilliam County has been flooded about three times in the last 40 years with damage to crops, roads, and structures. The Butte, Bridge, and Mountain Creek areas in Wheeler County experience

flooding because of cloudburst storms about one year in five with varying amounts of damage to farmland, irrigation structures, and urban areas. The town of Mitchell has experienced serious floodwater damage five times since 1874.

Sediment Damage

The overall rate of sediment production in the basin ranges from low to moderate. Available estimates of the unit rate of sediment production indicate that the annual rate is from 0.02 to 0.1 acre-feet per square mile for all parts of the basin except that portion of Gilliam County south of Rock Creek. Here the annual sediment production is estimated to be from 0.2 to 0.5 acre-feet per square mile. Although basinwide sediment production is not large, there are numerous localized problems.

There has been major sediment damage to the fishery resource in both the tributaries and main streams. Streamflow characteristics may be seriously altered, spawning grounds ruined, and aquatic food sources diminished. Serious problems of this sort have resulted from cloudburst storms and from heavy spring runoff from headwater tributaries, particularly in the Hamilton-Kimberly-Mt. Vernon areas.

Heavy loads of sediment are deposited on the main highway in areas from the gorge below Dayville in subbasin 2 to above Monument in subbasin 1, necessitating frequent cleaning. Roads and drainage ditches in other portions of the basin are also subject to localized sediment damage. Figure 16 illustrates typical damage to a county road in subbasin 3.

Probably the largest single monetary loss resulting from sediment is the cost of removing sediment deposited on roads and in road ditches. However, other sediment damages are not inconsequential. The few estimates of pond sedimentation now available indicate that these structures usually experience an average annual capacity loss of from 0.5 to 2.5 percent with the lowest losses for ponds in range areas and the higher losses in wheat-fallow areas.

Other sediment damages are to irrigation ditches, farm facilities, spring developments, and urban areas.

Erosion Damage

Approximately 90 percent of the arable land in the basin is limited in use by hazards of wind or water erosion. In addition, virtually all of the range and forest lands are subject to varying degrees of water erosion, depending upon natural conditions and management.

Erosion problems on forest land are generally minor because of the relatively small extent of human activity. However, overgrazing by livestock has resulted in severe erosion in some areas. The present problems, however, are an indication of what may be faced in the future if proper land management is not practiced. The forest soils in the basin are generally light and highly susceptible to erosion. Vegetative

Figure 16 Siltation of Gilliam County road by sediment from wheat field, 1961.

cover is slow in re-establishing itself on disturbed areas because of deficient moisture conditions during the growing season. The major man-related activities that produce accelerated erosion of forest land are road construction, logging, fire, and grazing of domestic livestock.

Road locations in the basin are often planned for the cheapest route to an individual patch of timber, even though this cheapest route may be through areas of unstable soils or up a stream channel. Construction methods may ignore proper drainage and include sidecasting of waste excavation material into streams. Often there is no provision for grass seeding of raw cuts and fill slopes or for construction of water bars, outsloping, and similar procedures when use of a road is completed.

Crawler-type tractors are generally used in logging. Landings are usually located at the lowest point on a logging "side", often in or beside a stream course. Thus, all of the skid roads converge and, after logging is completed, runoff and eroded material is channeled directly into the stream. The normal practice of felling trees downhill and the location of landings in or near stream courses results in a large amount of debris being left in the streams after logging. This debris acts as material for jamming the stream, causing channel changing and erosion. During floods, the jams may break and the stream

Figure 17 Streambank erosion along Rock Creek, sub-basin 3, cutting into irrigated hayland. Note silt deposition in foreground.

Figure 18 View of gully erosion in wheat field, sub-basin 3.

"flush out" causing flash flooding with resultant damage far downstream.

While fire protection is generally adequate on forest land in the basin, large wildfires have occurred. Usually these have been on mixed forest and rangelands at lower elevations. For example, a fire in the Ditch Creek area in subbasin 1 burned some 10,000 acres of forest land and 12,000 acres of rangeland in July 1961. These fires completely destroy the vegetative cover over large areas, leaving the soil vulnerable to immediate serious erosion from summer and fall rainstroms. The natural re-establishment of vegetative cover is very slow on these burns, and erosion of the upper soil layers makes the soil even less hospitable to vegetative growth. Public lands are generally reseeded promptly in these burns, but funds are usually lacking for such work on private lands.

The north side of the John Day River between John Day and Mt. Vernon and the Kimberly-Monument area are the portions of the basin with the most critical range erosion problems. These areas have a history of erodable soils, steep topography, repeated fires, and overgrazing.

Water-erosion problems on the arable lands are of several principal types; streambank, sour, gully, and rill or sheet erosion.

Streambank erosion problems occur on tributary streams and rivers in all parts of the basin. Extreme bank erosion is spotty and usually occurs as the result of acute channel curvature or gravel bars deflecting currents. These problems are serious to individual landowners, especially along the main rivers as they are large in relation to available resources for prevention of such troubles. Figure 17 shows an example of this type of erosion.

Scour erosion resulting from overflowing floodwaters can cause serious damage to fields unprotected by vegetation. This type of damage occurs generally along the main rivers during the larger floods. Figure 15 shows a good example of this problem..

Gully and rill or sheet erosion can occur on any land with insufficient vegetative cover. However, this type of erosion is more frequent on cultivated lands and is most troublesome in the wheat-fallow areas in subbasin 3. Figure 18 shows a developing gully.

In general, water-erosion problems on arable lands occur in all subbasins. Damages are principally topsoil and land loss, reduced productivity, and inconvenience in farm and ranch operations.

WATERSHED MANAGEMENT

There is a need for continuing maintenance and improvement of the condition of all watersheds in the basin. In general, the best watershed conditions will prevail when all resources are managed in a manner that insures the optimum sustained yield. The most important management items pertaining to forestry and agriculture are outlined in the following section.

Forest Areas

In general, forested areas of the watersheds are in a stable condition, mainly because the impact of man has been light. A few areas have been heavily logged, and problems have developed there which should be a warning for the future when most forested land will be heavily used. Some needs and applicable practices are:

1. Adequate fire protection should be provided emphasizing: (a) rapid initial fire suppression action with adequate personnel and rapid transportation; and (b) provision for financial and personnel resources to meet extreme emergency fire conditions. Organized fire protection should be extended to include all lands.

2. Timber harvesting programs should include adequate consideration of terrain and soil conditions of each watershed and provide for: (a) road construction and logging techniques that result in minimum watershed disturbance; (b) leaving enough of a residual stand in each watershed to insure prompt natural regeneration and to maintain watershed stability; and (c) artificial regeneration of the timber stand, if necessary.

3. Grazing of domestic stock and big game should be limited to the long-term carrying capacity of the land.

4. Stream pollution by recreational and other use should be prevented.

5. Areas disturbed by fire, logging, and other uses of forest land should be promptly revegetated (fig. 19).

6. Further investigation is needed to determine the effect of various forest land management practices on the timing, quality, and quantity of water yields. It might be possible to significantly increase water yields from forest land by use of specific cutting patterns and by thinning of dense young-growth stands. Thinnings would at least result in improved stand vigor and growth of usable wood, even if there is no resulting increase in water yield.

Figure 19 Grass stand established by artificial seeding of temporary logging road. Revegetation of such disturbed areas is a much needed erosion-prevention measure in the basin.

Many forest land watershed management problems are centered on private lands, where land management practices are mainly based on the monetary profits the landowner derives therefrom, rather than on the benefit to the total watershed including downstream areas. The private forest owner must be provided additional encouragement and incentive to manage his lands for the benefit of all of the basin.

The solution to watershed management problems on public forest land lies in providing additional trained personnel, additional funds for watershed rehabilitation, and more careful planning and supervision of all land use activities.

Range Areas

Approximately half of the rangeland watersheds are in poor condition with deficient vegetative cover and considerable accelerated erosion. Rehabilitation of the rangeland is essential both to realize maximum benefits from the land and to minimize downstream flood and sediment damage. Some programs and practices that should be continued or initiated are:

1. Large scale land treatment programs including erosion control measures, removal of encroaching juniper and brush species which occupy the site but furnish little forage or soil protection, and revegetation with soil-protecting, drought-resistant grasses (fig. 20). The key areas for such programs are (a) watersheds tributary to the John Day River from the north in the vicinity of John Day and Mt. Vernon, and (b) tributary watersheds in the Monument area.

Figure 20 Contrast between over grazed and protected range. Note juniper infestation in background.

2. More intensive development of the better rangeland areas, through reseeding and waterspreading of spring runoff to provide additional forage, thereby relieving some of the grazing pressure on badly depleted ranges.

3. Improved control of timing and intensity of livestock grazing through (a) development of additional supplies of water for consumption by livestock; (b) construction of fences to control livestock movement; (c) salt distribution and herding of livestock to obtain more uniform use of forage.

4. Control of forest and range fires is essential to protection of the forage crop and watershed cover. The fire protective agencies need to be provided with additional financial resources to permit control of fires while they are still small. Burned-over areas should be revegetated promptly.

5. Special areas should be set aside and developed as a source of winter feed for big game and herd numbers should be held to propulation levels that the range is capable of supporting.

Rangeland areas of steep topography, naturally sparce vegetation, or extremely erodable soils, should be left in a relatively undisturbed condition. Grazing should never deplete the ground cover to a point where protection of the watershed and maintenance of desirable vegetation is impaired.

Cultivated Areas

Watershed management practices are important on arable lands that are cultivated or used for perennial hay and pasture. There is a continuing need for conservation cropping systems together with erosion control practices, and improved irrigation and drainage measures. Many marginal hay and pasture fields could be replanted to better grass and legume mixtures and managed for increased production. A summary of needed measures directly related to water follows.

Irrigation. Of equal importance to the need for more irrigated land is improvement of water management on presently irrigated land. Much of the land is still irrigated by "wildflooding" methods. Limited late season water supplies could be used more efficiently through better land shaping and leveling, and improved diversions and control structures (fig. 21).

There are also some instances of excessive water losses from ditch systems that can be corrected by improving, relocating, or lining ditches. Even well planned and constructed flooding and sprinkler systems are sometimes mismanaged by not moving the water or lateral lines soon enough or waiting too long between irrigations. There is need for more factual information on waterholding capacity of these soils and their intake rates by both technicians and irrigators to facilitate more efficient use of the available water supply. In addition, full use should be made of the advance estimates of expected water supplies as they are forecast from snow surveys. In many cases irrigation operations can be planned to make better use of low water supplies in dry years.

Drainage. An estimated 21,000 acres of land, mostly irrigated, is subject to excessive wetness. Drainage of this land would significantly increase supplementary feed production and, in some cases, increase the available water supply. In many cases drainage could be accomplished by relatively simple interception or relief drains. In other cases extensive random or pattern drainage is needed. Both open and covered drain systems are needed.

Figure 21 Concrete diversion dam with controlled flume outlet on Rock Creek, subbasin 3.

Erosion Control. Erosion on cultivated land is of three types; (1) the cutting away of fields by streambank erosion, (2) the losses from rilling and sheet erosion on the surface of unprotected fields, and (3) wind erosion of unprotected fields. There is a need for more stream channel work including removal of gravel bars, drift and brush, as well as placement of additional rock riprap (fig. 22). Much of this work should be done through group projects.

Soil and water conservation practices are especially important on the dryland wheat-fallow area in subbasin 3 to control the basic problems of wind and water erosion. Strip cropping has been very successful in reducing both wind and water erosion and should be used more extensively. Deep furrow planting in stubble mulch is helpful in conserving the limited precipitation (fig. 23). It also reduces wind and water erosion if done cross wind or cross slope depending on which is the most serious erosion problem.

Two other water erosion control practices that are needed in many more fields are grassed waterways and field diversions, as shown in figures 24 and 25.

WATER DEVELOPMENT

An estimated additional 17,000 acres of land in the basin could

Figure 22 Bank erosion effectively controlled by rock riprap. John Day River below Dayville, Oregon.

Figure 23 Deep furrow stubble mulch seeding catches snow in contrast to black fallow above the diversion, subbasin 3.

Figure 24 Crested wheat grass used in a permanent waterway in a field used for a grain-fallow cropping system near Arlington, Oregon.

Figure 25 Controlled evacuation of runoff water by use of a contoured field diversion, sub-basin 3.

readily be irrigated if additional water sources could be developed. It has also been stated that additional stockwater developments will be needed to help attain the optimum sustained yield and use of forage on grazing land. The most likely ways for development or improvement of water supplies are outlined below.

Ground Water

Underground water from wells is being used but has proven to be rather limited due to the shortage of known aquifers. There is a need for, and will undoubtedly be an increase in, the use of wells in the limited areas where they can be developed. Seeps and springs are potentially a more important source of ground water. It is estimated that the potential for seep and spring development about equals what has been accomplished to date. In addition, many existing developments need to be rehabilitated. Seeps and springs are especially adaptable to stockwater and domestic use since they enable efficient use of relatively small quantities of water. The rate of yield from springs is usually too limited in quantity to supply irrigation requirements.

Drainage water from wet soils can sometimes be collected by tiles and ditches and led into a sump or irrigation ditch to augment the normal irrigation water supply. This possibility should be considered when planning drainage projects, especially where water supplies are very limited.

Surface Water

There is little excess natural flowing surface water in the basin during the middle and late summer, but waterspreading of readily available early runoff from small drainages to adjacent rangeland with deep soils is feasible on some lands. This practice can increase forage and replenish ground waters with water that would ordinarily be wasted as early runoff. It requires carefully laid out semi-automatic systems and is not as efficient as storage reservoirs but can be used relatively cheaply in places where there are no feasible reservoir sites.

Storage

The conservation of excess early runoff in ponds and reservoirs for subsequent irrigation, livestock, recreation, and fish and wildlife use has considerable potential in the basin. There are many existing small and medium size ponds and reservoirs (fig. 26).

It is estimated that approximately 500 ponds (under 10 feet high and storing less than 9.3 acre-feet of water) have been built in the basin (tables 28 A, B, and C). Furthermore, many potential sites for such ponds can be found in each of the subbasins. However, future pond developments will, to a large extent, depend upon the need for additional water and the economics of its development.

Many large reservoir sites have been proposed and studied in the past. In addition to these, there is a definite potential for medium size upstream reservoirs. Table 26 summarizes reconnaissance data as-

Figure 26 A typical combination earthfill and excavated stockpond nearing completion in subbasin 3.

sembled by the U. S. Department of Agriculture on 36 sites that appear to warrant future consideration. The location of these sites are shown on the index map (fig. 27). When possible, new reservoirs should be developed for multipurpose use.

OPPORTUNITIES FOR WATERSHED PROTECTION AND FLOOD PREVENTION PROJECTS

The Watershed Protection and Flood Prevention Act, Public Law 566, as amended, authorizes the Secretary of Agriculture to cooperate with local organizations in planning and carrying out works of improvements for flood prevention and/or for the conservation, development, utilization, and disposal of water in watershed or subwatershed areas. The Act provides for technical, financial, and credit assistance by the U. S. Department of Agriculture to landowners and operators, and other people living in small watersheds. Project-type action under the Act is intended to supplement existing soil and water conservation programs and other programs for the development and flood protection of major river valleys.

The U. S. Department of Agriculture is interested in knowing the general potential for P. L. 566 work as a guide to long range planning and coordination of possible future projects. Therefore, a preliminary review of 42 small watersheds, having significant arable land, was made

Table 26 Reconnaissance data on reservoir sites, by subbasins, John Day River Basin, Oreg., 1961

Subbasin Name and number	Stream Name	Watershed index Number	Reservoir index Number	Drainage area Sq. mi.	Annual yield Acre ft.	Storage Acre ft.	Surface area Acres	Fill + storage cy/ac.ft.	Possible uses Uses 1/	P. L. 566 possibility
1. North Fork John Day	Camas Creek	9	1	105	66,840	12,390	399	57	I,F,R	X
	Snipe Creek	9	2	29	15,444	52,390	498	15	I, R	X
	Middle Fork	3	3	69	16,500	1,800	175	39	I,F,R	
	Crawford Creek	3	4	0.5	400	400	75	40	I,F,R	
	Shumway Meadow	3	5	0.1	100	450	30	67	I, R	
	Long Creek	4	6	21	7,500	300	21	450	I, R	
2. Upper John Day	Birch Creek	7	1	1	500	155	22	226	I, R	
	Beech Creek	6	2	87	21,500	600	50	309	I, R	
	S. Fork Murderers Creek	9	3	3.5	1,400	1,150	90	109	R	
	Do.	9	4	4	2,300	800	60	175	R	
	Upper South Fork	10	5	35	8,800	2,500	125	200	I,F,R	X
	Venator Creek	10	6	3	1,200	250	30	260	R	
	Rock Creek	11	7	83	22,180	2,420	70	168	R	
	Fort Creek	12	8	9	1,165	1,165	97	73	I, R	X
	Mountain Creek	12	9	29	6,100	3,560	178	24	I, R	X
	Sixshooter Creek	12	10	32	4,200	2,333	149	9	I, R	X
	Do.	12	11	43	910	807	53	165	I	X
3. Lower John Day	Rosebush Creek	17	1	16	416	407	43	65	I	
	Rock Creek	1	2	166	13,250	15,000	399	59	I, R	X
	Do.	1	3	67	7,100	11,700	299	75	I, R	X
	Lone Rock Creek	2	4	72	11,560	1,820	91	42	I, R	
	Thirtymile Creek	4	5	210	7,245	7,190	205	49	I, R	
	Butte Creek	5	6	31	2,500	332	24	218	I,F	X
	Do.	5	7	19	1,480	1,450	121	79	I,F	X
	Hoover Creek	5	8	6	294	68	8	32	I	X
	Straw Fork Butte Creek	5	9	5	408	124	9	139	I	
	Sorefoot Creek	18	10	12	350	100	7	400	R	
	Currant Creek	19	11	30	500	140	11	439	I	
	Bear Creek	8	12	81	12,900	6,570	199	117	I, R	
	Do.	8	13	73	11,700	7,180	199	66	I	
	Bridge Creek	8	14	1.2	131	131	8	179	I	
	Alder Creek	12	15	30	3,140	2,205	81	49	I, R	
	Horseshoe Creek	21	16	4	810	740	74	54	I, R	
	Kahler Creek	13	17	38	4,080	900	50	140	I	
	Do.	13	18	16	1,748	153	12	203	I, R	
	Henry Creek	13	19	5	641	582	19	241	I	

Source: Based on a survey by the U. S. Dept. of Agriculture Field Party.

1/ I-irrigation, F-flood protection, R-recreation--fishing, hunting, and boating.

RIVER BASIN LOCATION

COUNTY LOCATION

LEGEND

- 20 — Watershed Areas
- Have Best PL 566 Possibilities
- Not Studied
- 15 — Possible Reservoir Site
- National Forest Boundary
- Subbasin Boundary
- Drainage Basin Boundary

SUBBASINS

1. NORTH FORK JOHN DAY
2. UPPER JOHN DAY
3. LOWER JOHN DAY

FIGURE 27

INDEX MAP OF WATERSHED AREAS and POSSIBLE RESERVOIR SITES

JOHN DAY RIVER BASIN

OREGON

AUGUST 1961

SCALE IN MILES 5 0 5 10 15

M-3652

7-E-17233-N

to gather basic water and land use facts. A summary of these reconnaissance data is presented in tables 28A, 28B, and 28C. In addition to the data in the tables, some narrative information of flooding, erosion, and sedimentation was obtained. The location of these watersheds is shown on the index map (fig. 27).

Many of the water and related land resource problems in the John Day River Basin are of a type applicable to P. L. 566 work. However, under existing conditions and laws there are only a few instances where project-type action under P. L. 566 might be practical and economically feasible in the near future. A review of known problems and conditions indicate that there are in general two types of situations where local projects might be developed with assistance under present P. L. 566 authorizations. These are:

1. Reorganization of Group Irrigation Systems. There are several gravity diversion systems along the main rivers, predominately in subbasin 2, each serving a few farms. In some instances contiguous systems could be combined, reorganized, rehabilitated, and served by a single permanent diversion headgate structure. Such improvements together with needed farm irrigation system reorganization, drainage, land leveling, and application of improved water management practices could result in significant benefits. This sort of development appears to offer a good opportunity for use of P. L. 566 to assist in the solution of basin water problems. However, the exact location and nature of possible developments cannot be delineated at this time since instigation of project-type action would depend upon the needs and desires of local groups having like problems and a developing interest in solving them.

2. Tributary Watershed Improvement. Multi-purpose projects might be developed in some small watersheds for reduction of water deficiencies, expansion of irrigation, improved water use, control of undesirable phreatophytes, watershed treatment, reduction of streambank erosion and flooding, recreation, and enhancement of fish and wildlife habitat. In general, a basic necessity for such developments would be one or more feasible reservoir sites within a reasonable distance of the irrigable lands. The known watersheds of this type that may have some possibility for economically feasible development are listed in table 27 and are delineated on the index map of small watersheds.

The most serious immediate need in the basin is for the improvement of watershed conditions in certain critical range areas such as the north side of the John Day River between Mt. Vernon and John Day. The needed work is basically land treatment and management with but few structural measures. The possibilities for feasible projects of this type appear to be very limited under existing conditions and laws.

Up to the present time there have been no applications for assistance in the John Day Basin under P. L. 566. The overall situation and particular problems in the basin indicate that no intense activity will develop unless program concepts and laws are significantly altered to encourage and facilitate projects whose major feature would be land treatment measures for watershed protection and improvement.

Table 27 List of watersheds that may have current P. L. 566 possibilities, by subbasins, John Day River Basin, Oreg.

Subbasin	Watershed	Gross area	Arable land	Irrigation: Presently irrigated	Irrigation: Additional irrigable
		Acres	Acres	Acres	Acres
1. North Fork John Day	Camas Creek	205,000	2,000	900	800
	Long Creek	126,400	2,500	500	1,000
2. Upper John Day	Mountain Creek	107,500	2,100	1,100	300
	Upper South Fork John Day	164,400	4,200	2,600	400
3. Lower John Day	Butte Creek	117,800	8,900	500	200
	Rock Creek	267,500	85,500	2,200	1,300

COORDINATION OF USDA PROGRAMS WITH OTHER BASIN ACTIVITIES

In general, the forestry and agricultural aspects of water and related land resource problems are often intimately connected with uses of land and water for other purposes such as cities and towns, recreation, industry, and highways. The degree of relationship varies between geographic areas depending primarily upon the resource base available and pressures upon that base.

The ownership and administration of approximately 37 percent of the basin area by the Federal Government is an important factor in the economy of the basin. The U. S. Department of Agriculture is responsible for administering the 30 percent of the basin that is in national forests. The management of these lands must be coordinated with other needs in the basin. This is especially important for the maintenance of the quantity and quality of water flowing from the upper watersheds.

From an agricultural standpoint, there is a need for coordination of effort on present and future problems on an individual, group, and project basis. Of particular importance is the need to make sure that agricultural developments for water control and utilization recognize, to the extent feasible, all other land and water uses and values. Such coordination is necessary to secure a diminishment of mutual problems instead of their compoundment. Notable coordination has occurred and should be continued. This coordination ranges from informal contacts on individual problems to formal liaison between organizations and agencies on the interrelationship of major projects.

Future small watershed projects need to be coordinated to insure the inclusion of all feasible features to enhance the use of both the watershed and its waters for all worthwhile purposes. In addition, small watershed projects need to complement other major water projects in the basin and make the best use of improvements provided under other programs.

Table 28A Reconnaissance data on tributary streams studied, North Fork, Subbasin 1, John Day River Basin, Oreg., 1961

Item	Unit	1 Lower North Fork	2 Lower Middle Fork	3 Middle Fork	4 Long Creek	5 Deer Creek	6 Fox Creek	7 Cotton: Wood Creek	8 Rudio Creek	9 Camas Creek	Total of tributaries studied
LAND USE:											
Woodland	Acres	132,177	39,634	260,712	27,913	10,812	32,818	27,124	18,008	210,603	759,801
Rangeland	do	60,630	35,500	23,620	95,970	21,640	15,750	65,270	15,380	44,900	378,660
Cropland	do	4,500	5,508	2,060	2,500	1,920	9,600	3,054	1,248	2,000	32,390
Other	do	200	...	...	...	...	...	...	...	662	862
Total watershed area	do	197,507	80,642	286,392	126,383	34,372	58,168	95,448	34,636	258,165	1,171,713
Cropland use											
Irrigated											
Improved hay	Acres	1,400	100	560	450	100	1,000	700	200	200	4,710
Meadow hay	do	100	50	1,500	50	...	2,600	...	...	650	4,950
Other	do	...	...	...	...	...	...	...	...	50	50
Total	do	1,500	150	2,060	500	100	3,600	700	200	900	9,710
Dryland											
Grain hay	Acres	2,400	3,848	...	1,400	1,570	2,000	1,854	748	...	13,820
Alf. grass hay	do	500	1,510	...	600	250	4,000	500	300	650	8,310
Grain	do	100	...	...	...	...	...	...	...	450	550
Total	do	3,000	5,358	...	2,000	1,820	6,000	2,354	1,048	1,100	22,680
IRRIGATION:											
Surface water rights	Acres	1,954	186	2,311	952	542	3,752	1,826	275	1,617	13,415
Water source											
Direct stream diversion	Acres	300	100	2,060	500	100	3,600	700	200	...	7,560
Pumped from streams	do	1,200	50	...	...	...	...	...	...	700	1,950
Pumped from wells	do	...	...	...	...	...	...	...	...	...	...
From reservoir storage	do	...	...	...	...	...	...	...	...	200	200
Total	do	1,500	150	2,060	500	100	3,600	700	200	900	9,710
Method of application											
Sprinkling	Acres	1,200	...	...	...	50	...	...	40	700	1,990
Flooding	do	300	150	2,060	500	50	3,600	700	160	200	7,720
Total	do	1,500	150	2,060	500	100	3,600	700	200	900	9,710
Adequacy of water											
Streams											
Quality	Yes/no	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9 Yes
Quantity	Yes/no	Yes	Yes	Yes	No	No	No	No	No	No	3 Yes, 6 No
Wells											
Quality	Yes/no	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Quantity	Yes/no	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Expansion of irrigation											
Additional available acreage	Acres	300	...	...	1,000	...	...	...	200	800	2,300
Acreage natural flows would irrigate	do	1/	1/	1/	1/	...	...	...	1/	500	500
STORAGE:											
Existing											
Ponds	Number	1/	...	...	3	...	4	4	...	30	41
Reservoirs	do	...	...	...	...	...	...	...	...	1	1
Possible reservoir sites	do	...	...	3	1	...	...	...	...	2	6
DRAINAGE:											
Arable land with wet soil	Acres	100	1/	500	50	1/	200	25	10	250	1,135
Needs											
Improved surface drainage	Acres	50	1/	400	20	1/	150	10	5	...	635
Subsurface drainage											
Open drains	do	25	1/	75	10	1/	50	10	5	250	425
Closed drains	do	25	1/	25	20	1/	...	5	...	...	75
RURAL DOMESTIC WATER:											
Wells	Number	30	3	2	10	4	10	7	...	200	266
Springs	do	30	15	10	20	6	5	10	3	12	111
Cisterns	do	...	...	...	...	...	...	...	...	1/	...
Ponds	do	...	...	...	...	...	...	...	...	1/	...
Streamflow	do	...	...	...	...	...	...	...	...	1/	...
Group system	do	2	1	2	1	...	...	...	...	1/	6

Source: Compiled from data furnished by field offices, Soil Conservation Service.
1/ Not reported.

Table 28B Reconnaissance data on tributary streams studied, Upper John Day, Subbasin 2, John Day River Basin, Oreg., 1961

Item	Unit	1 Upper John Day	2 Strawberry Creek	3 Prairie City Bench	4 Canyon Creek	5 South Side	6 Beech Creek	7 North Side	8 Below Gorge	9 Lower South Fork	10 Upper South Fork	11 (excluding Rock Creek) Mountain Creek	12 Mountain Creek	Total of tributaries studied
LAND USE:														
Woodland	Acres	73,728	13,270	41,983	75,390	61,297	44,372	27,721	23,000	99,230	95,587	39,700	33,600	628,878
Rangeland	do	15,190	1,800	10,200	1,050	53,570	29,000	91,216	81,482	124,374	65,725	33,000	70,920	577,527
Cropland	do	2,500	2,280	8,100	800	5,000	340	3,480	1,200	1,325	3,075	400	2,100	30,600
Other	do	...	100	...	760	638	320	...	20	240	9	600	900	3,587
Total watershed area	do	91,418	17,450	60,283	78,000	120,505	74,032	122,417	105,702	225,169	164,396	73,700	107,520	1,240,592
Cropland use														
Irrigated														
Improved hay	Acres	180	250	4,050	120	3,500	340	2,436	1,200	460	420	75	275	13,306
Meadow hay	do	2,320	2,030	4,050	680	1,500	...	1,044	...	790	1,480	200	750	14,844
Other	do	...	...	...	...	...	...	...	...	...	...	25	75	100
Total	do	2,500	2,280	8,100	800	5,000	340	3,480	1,200	1,250	1,900	300	1,100	28,250
Dryland														
Grain hay	Acres	...	...	...	...	...	...	...	...	75	1,000	100	800	1,975
Alf. grass hay	do	...	...	...	...	...	...	...	...	...	75	...	...	75
Grain	do	...	...	...	...	...	...	...	...	...	100	...	200	300
Total	do	...	...	...	...	...	...	...	...	75	1,175	100	1,000	2,350
IRRIGATION:														
Surface water rights	Acres	5,621	3,645	10,185	1,242	7,204	706	4,355	1,213	1,550	1,942	3,092	3,044	43,799
Water source														
Direct stream diversion	Acres	2,500	2,280	8,100	800	5,000	340	3,440	970	1,200	1,810	150	850	27,440
Pumped from streams	do	...	...	...	...	...	...	...	230	50	50	...	...	330
Pumped from wells	do	...	...	...	...	...	...	...	...	...	...	...	...	...
From reservoir storage	do	...	...	...	...	...	...	40	...	...	40	150	250	480
Total	do	2,500	2,280	8,100	800	5,000	340	3,480	1,200	1,250	1,900	300	1,100	28,250
Method of application														
Sprinkling	Acres	...	...	...	...	100	...	40	160	80	50	...	...	430
Flooding	do	2,500	2,280	8,100	800	4,900	340	3,440	1,040	1,170	1,850	300	1,100	27,820
Total	do	2,500	2,280	8,100	800	5,000	340	3,480	1,200	1,250	1,900	300	1,100	28,250
Adequacy of water														
Streams														
Quality	Yes/no	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12 Yes
Quantity	do	Yes	No	No	Yes	No	No	No	Yes	Yes	No	No	No	4 Yes, 8 No
Wells														
Quality	do	1/	1/	1/	Yes	1/	1/	1/	1/	1/	1/	1/	1/	1 Yes
Quantity	do	1/	1/	1/	Yes	1/	1/	1/	1/	1/	1/	1/	1/	1 Yes
Expansion of irrigation														
Additional available acreage	Acres	500	...	1/	200	1,000	40	1,000	200	80	400	...	300	3,720
Acreage natural flows would irrigate	do	500	...	1/	200	1/	1/	1/	1/	80	400	...	300	1,480
STORAGE:														
Existing														
Ponds	Number	...	1	3	1	3	2	2	1	1	1	10	20	45
Reservoirs	do	...	...	...	...	1	...	1	...	...	...	2	2	6
Possible reservoir sites	do	...	...	...	...	...	1	1	...	2	2	1	4	11
ORAINAGE:														
Arable land with wet soil	Acres	1,000	1,500	3,050	40	1,191	...	744	20	...	1,500	...	75	9,120
Needs														
Improved surface drainage	Acres	500	1,500	400	10	60	...	300	22	...	100	...	...	2,892
Subsurface drainage														
Open drains	do	100	1,000	150	30	600	...	244	...	...	40	...	...	2,164
Closed drains	do	400	500	2,500	...	531	...	200	2	...	1,360	...	75	5,568
RURAL DOMESTIC WATER:														
Wells	Number	12	5	4	8	60	2	9	6	2	1	1	3	113
Springs	do	11	2	18	13	23	3	12	12	4	10	2	4	114
Cisterns	do	...	...	...	...	...	...	...	...	...	...	1/	1/	...
Ponds	do	...	...	...	...	...	...	...	...	...	...	1/	1/	...
Streamflow	do	...	...	...	...	...	...	...	...	...	...	2	1/	2
Group system	do	...	1	...	2	1	1	...	1	1/	1/	1/	1/	6

Source: Compiled from data furnished by field offices, Soil Conservation Service.
1/ Not reported.

Table 28C Reconnaissance data on tributary streams studied, Lower John Day, Subbasin 3, John Day River Basin, Oreg., 1961

Item	Unit	1 Rock Creek: (excluding: Lone Rock Creek)	2 Lone Rock Creek	3 Hay Creek	4 Thirty Mile Creek	5 Butte Creek	6 Pine Creek	7 Rowe Creek	8 Bridge Creek	9 Girds Creek	10 Shoofly Creek	11 Service Creek
LAND USE:												
Woodland	Acres	54,920	30,880	...	21,120	17,280	3,680	4,480	36,160	...	19,002	11,539
Rangeland	do	145,015	27,096	39,392	115,061	90,580	37,670	23,120	131,140	19,980	5,120	7,180
Cropland	do	65,654	598	24,347	37,019	8,600	400	2,100	4,000	400	350	300
Other	do	1,912	380	150	1,000	1,340	300	200	1,700	100	200	200
Total watershed area	do	267,501	58,954	63,889	174,200	117,800	42,050	29,900	173,000	20,480	24,672	19,219
Cropland use												
Irrigated												
Improved hay	Acres	1,038	192	80	38	326	75	700	1,800	100	150	30
Meadow hay	do	560	...	...	200	...	...	...	10	...	...	...
Other	do	561	14	3	70	210	...	100	190	...	...	...
Total	do	2,159	206	83	308	536	75	800	2,000	100	150	30
Dryland												
Grain hay	Acres	2,934	166	400	333	877	300	600	1,300	200	80	50
Alf. grass hay	do	34	...	...	...	579	25	100	100	...	...	80
Grain	do	60,527	60	23,264	36,378	6,608	...	300	600	100	120	120
Other	do	...	166	600	...	...	...	300	...	...	...	20
Total	do	63,495	392	24,264	36,711	8,064	325	1,300	2,000	300	200	270
IRRIGATION:												
Surface water rights	Acres	2,248	244	87	374	874	280	870	2,990	152	303	115
Water source												
Direct stream diversion	Acres	1,779	190	83	308	376	45	560	1,900	100	135	15
Pumped from streams	do	380	16	...	...	60	30	80	100	...	...	15
Pumped from wells	do	...	...	...	...	...	...	...	...	...	...	...
From reservoir storage	do	...	...	...	...	100	...	160	...	...	15	...
Total	do	2,159	206	83	308	536	75	800	2,000	100	150	30
Method of application												
Sprinkling	Acres	380	16	...	...	60	...	80	100	...	...	15
Flooding	do	1,779	190	83	308	476	75	720	1,900	100	150	15
Total	do	2,159	206	83	308	536	75	800	2,000	100	150	30
Adequacy of water												
Streams												
Quality	Yes/no	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quantity	do	No	No	No	No	No	No	No	No	No	No	No
Wells												
Quality	do	Yes	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Quantity	do	No	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Expansion of irrigation												
Additional available acreage	Acres	1,266	292	150	150	150	...	100	100	...	100	150
Acreage natural flows would irrigate	do	1,208	192	150	150	150	...	100	100	...	100	150
STORAGE:												
Existing												
Ponds	Number	28	12	25	50	20	6	15	50	8	12	5
Reservoirs	do	...	1	...	1	1	1	1	1	...	1	...
Possible reservoir sites	do	2	1	...	1	4	...	...	3	...	...	...
DRAINAGE:												
Arable land with wet soil	Acres	460	...	...	100	...	...	60	100	20	...	5
Needs												
Improved surface drainage	Acres	230	...	...	...	...	...	...	100	...	...	...
Subsurface drainage												
Open drains	do	230	...	...	100	...	...	...	...	20	...	5
Closed drains	do	...	...	...	...	...	...	60	...	...	...	...
RURAL DOMESTIC WATER:												
Wells	Number	67	1	6	10	10	1	2	6	2	1/	1/
Springs	do	58	12	3	12	18	5	3	20	3	6	6
Cisterns	do	3	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Ponds	do	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Streamflow	do	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Group system	do	1/	1/	1/	1/	1	1/	1/	1/	1/	1/	1/

Table 28C (Continued)

Item	Unit	12 Alder Creek	13 Kahler Creek	14 Haystack Creek	15 Bologna Creek	16 Parrish Creek	17 Grass Valley Canyon	18 Sorefoot Creek	19 Currant and Muddy Creeks	20 Cherry Creek	21 Main Stem: John Day River	Total of tributaries studied
LAND USE:												
Woodland	Acres	24,320	16,960	1,600	3,200	5,760	...	...	...	15,413	12,215	278,529
Rangeland	do	12,530	22,540	9,150	12,720	29,680	23,098	7,552	65,531	24,747	149,225	998,127
Cropland	do	650	900	300	300	100	107,570	122	694	400	180,723	435,527
Other	do	300	300	50	100	300	1,720	6	23	...	9,018	19,299
Total watershed area	do	37,800	40,700	11,100	16,320	35,840	132,388	7,680	66,248	40,560	351,181	1,731,482
Cropland use												
Irrigated												
Improved hay	Acres	150	250	60	...	20	15	55	204	200	2,021	7,504
Meadow hay	do	...	...	...	...	...	...	...	...	100	...	870
Other	do	50	...	...	...	...	96	...	90	...	542	1,926
Total	do	200	250	60	...	20	111	55	294	300	2,563	10,300
Dryland												
Grain hay	Acres	225	300	120	100	80	1,140	67	...	...	4,562	13,834
Alf. grass hay	do	100	...	...	...	...	...	...	...	...	...	1,018
Grain	do	125	100	120	200	...	100,244	...	400	...	173,598	402,864
Other	do	...	250	...	...	...	6,075	...	...	100	...	7,511
Total	do	450	650	240	300	80	107,459	67	400	100	178,160	425,227
IRRIGATION:												
Surface water rights	Acres	331	555	221	35	141	968	66	310	304	3,623	15,091
Water source												
Direct stream diversion	Acres	125	100	...	...	10	5	55	102	150	...	6,038
Pumped from streams	do	75	150	...	...	10	36	...	...	150	2,468	3,570
Pumped from wells	do	...	...	60	...	...	70	...	...	...	95	225
From reservoir storage	do	...	...	...	...	...	...	...	192	...	...	467
Total	do	200	250	60	...	20	111	55	294	300	2,563	10,300
Method of application												
Sprinkling	Acres	50	150	60	...	10	111	...	...	...	430	1,462
Flooding	do	150	100	...	...	10	...	55	294	300	2,133	8,838
Total	do	200	250	60	...	20	111	55	294	300	2,563	10,300
Adequacy of water												
Streams												
Quality	Yes/no	Yes	Yes	1/	1/	Yes	Yes	Yes	Yes	Yes	Yes	19 Yes,0 No
Quantity	do	No	No	1/	1/	No	No	Yes	No	No	No	1 Yes,18 No
Wells												
Quality	do	1/	1/	Yes	1/	1/	Yes	1/	1/	1/	1/	3 Yes, 0 No
Quantity	do	1/	1/	No	1/	1/	No	1/	1/	1/	1/	0 Yes, 3 No
Expansion of irrigation												
Additional available acreage	Acres	100	50	...	50	50	330	...	...	100	7,833	10,971
Acreage natural flows would irrigate	do	100	50	...	...	50	30	...	...	100	3,833	6,463
STORAGE:												
Existing												
Ponds	Number	6	10	6	5	5	122	...	...	3	35	423
Reservoirs	do	...	...	...	...	...	1	...	3	...	...	11
Possible reservoir sites	do	1	3	...	...	...	1	1	1	...	1	19
ORAINAGE:												
Arable land with wet soil	Acres	...	...	2	...	...	60	...	...	80	...	947
Needs												
Improved surface drainage	Acres	...	...	...	...	...	...	...	...	...	...	330
Subsurface drainage												
Open drains	do	...	...	...	...	...	...	...	...	...	60	415
Closed drains	do	...	...	2	...	...	60	...	...	80	...	202
RURAL DOMESTIC WATER:												
Wells	Number	1/	2	3	1/	1/	90	1/	4	2	32	238
Springs	do	12	12	3	1	3	12	1	1	1	40	232
Cisterns	do	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/	3
Ponds	do	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Streamflow	do	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/	1/
Group system	do	1/	1/	1/	1/	1/	3	1/	1/	1/	1/	4

Source: Compiled from data provided by field offices, Soil Conservation Service.
1/ Not reported.

It is hoped that the information in this report and the data gathered for its preparation will be of assistance to others in future coordination of the use of water and related land resources in the John Day River Basin.

MEANS TO HELP ACCOMPLISH WORK - PROGRAMS OF USDA

Several agencies within the U. S. Department of Agriculture administer programs that are directly concerned with various aspects of water and related land resources. Many of the Department's activities and programs are, or can be, helpful in the solution of problems and the accomplishment of needed work in the John Day River Basin. A short resume of pertinent facts concerning each of the USDA agencies most active in the water and land resource fields is contained in the following sections.

Agricultural Research Service

The Agricultural Research Service is the major scientific research agency of the Department of Agriculture. This service is charged with the responsibility for the conduct of fundamental and applied research in the physical, biological, engineering, and agricultural sciences. Research and regulatory activities are organizationally grouped into five major areas as follows:

1. The Utilization Research and Development activities are directed toward the discovery and development of new or improved uses for and methods of utilizing agricultural commodities of all types.

2. Farm Research is concerned with matters relating to farming practices and the production of agricultural commodities.

3. The Regulatory Programs are concerned with measures for preventing the introduction and controlling of the spread of animal and plant diseases and plant pests.

4. The Institute of Home Economics conducts research on matters relating to human nutrition, household economics, and clothing and housing.

Research needs to solve local soil and water conservation problems are submitted annually to ARS by the Cooperative Extension Service and Soil Conservation Service. These needs are organized by categories and priority, and research is initiated and carried out as funds and resources are available.

Agricultural Stabilization and Conservation Service

This agency of the U. S. Department of Agriculture administers, at the State and county levels, the Agricultural Conservation Program, Acreage Allotment and Marketing Quota Program, Price Support Programs,

Soil Bank Program, Wheat Stabilization Program, Feed Grain Program, and other programs assigned to it by the Secretary of Agriculture or by the Congress. Of these, the Agricultural Conservation Programs is the currently active program primarily concerned with conservation of soil and water resources.

The Agricultural Conservation Program is designed to provide a means of cost-sharing with farmers and ranchers a part of the cost of carrying out essential conservation practices. Cost-sharing is provided only on those practices that are satisfactorily performed.

Practices for which cost-sharing is available in this basin are as follows: establishment of permanent protective cover for soil protection and improved soil structure, permeability or water-holding capacity; initial establishment of contour and field stripcropping; establishment of trees and timber stand improvement on farmland; improvement of meadows; reseeding of rangeland; deferred grazing on rangeland; fencing of grazing land for protection of vegetative cover; control of competitive shrubs on rangeland; providing livestock water by means of wells, springs, seeps, dams, pits, ponds, and pipelines for protection of vegetative cover through better distribution of grazing; establishment of sod waterways; construction of diversion terraces, ditches, or dikes; construction of erosion control structures; streambank and shore protection; open and closed drains; shaping and land leveling; reorganization of irrigation systems for conservation of water or erosion control; constructing spreader ditches and stock trails.

The Agricultural Conservation Program is tailored for local conditions by the ASC county committees, supervisors of the Southern Wasco, Sherman, Gilliam, Heppner, Southern Umatilla, Grant, and Monument Soil Conservation Districts, and cooperating agencies. The program is administered locally by elected Agricultural Stabilization and Conservation County and Community Farmer-Committeemen with the assistance, in technical matters, of the Soil Conservation Service, Forest Service, Cooperative Extension Service, and the State Board of Forestry.

The County ASC Committee in each county administers the Soil Bank Program, which helps farmers, during the terms of contracts entered into from 1956 through 1960, to adjust production to current market demands by retirement of cropland to conservation uses.

Farmers participating in the Wheat Stabilization and Feed Grain Programs are required to put into conservation use the acres taken out of these crops and to maintain the normal conservation acreage on the farm.

Cooperative Extension Service

The Cooperative Extension Service, which is made up of the Federal Extension Service, the State Extension Service, with additional financing from each of the several counties of the state, operates as one unit which is referred to as the "Cooperative Extension Service". This agency serves the USDA and the State Land-Grant Universities by accepting the responsibility for and leadership of the information and educa-

tion activities within the John Day River Basin.

The Extension Service serves as liaison between research agencies, educational institutions, and local, Federal, and State agencies, landowners and other individuals, to make available information and educational materials on improved crop varieties and livestock, land management use and practices, soil testing, home economics and family living including youth development, and other similar materials and, on request, works with individual landowners on specific problems relating to livestock, crops, horticulture, pest control, home economics, farm management and economics, etc.

County agents in agriculture, home economics and 4-H work are located in nearly all counties of the United States. Within the John Day River Basin, county agents, with their respective staffs, are located at the county seat of each county in the basin.

These county agents take to the people the results of research and practical experience in subjects related to agriculture and home economics from all pertinent sources available, as well as information with respect to government programs directly affecting these people, whether administered by the U. S. Department of Agriculture, or by State and county governments.

Extension agents take the lead in organizing counties for county program making, in which the lay leaders, technicians, and administrative workers plan together to combine scientific information, local experience and government aids into local programs for the common good.

Cooperative State Experiment Station Service

The Cooperative State Experiment Station Service is the United States Department of Agriculture agency which is assigned the responsibility for administering the funds appropriated by Congress for reasearch at the state agricultural experiment stations. This Service maintains a record of all state experiment station research projects, makes copies of this information available to all the states to eliminate duplication, and to aid in coordination of the state experiment station research with the Agricultural Research Service of the USDA. This office serves as the coordinating agency and information center for all the state experiment station research, both at the central experiment station of the state and at its several branch experiment stations.

Ordinarily the research findings of the state experiment stations are made available in the respective states to the public through the Cooperative Extension Service of the respective states. The research at the state stations includes both fundamental and applied research on animal and plant production and marketing problems, agricultural engineering, farm management and other economic problems relating to both production and marketing.

Branch experiment stations in the general region of the John Day River Basin include the Pendleton station, the Moro station, and the Central Oregon Branch Station with headquarters at Redmond. Research

is conducted in these stations where problems can be more economically and effectively solved than at the central station. Problems affecting broader areas of the state are ordinarily included in the research projects at the central station at Corvallis. The results of these findings have application in the John Day River Basin to a large degree.

Farmers Home Administration

The Farmers Home Administration, through loans and other assistance, helps farmers place their operations on a more efficient basis. It also provides emergency loans for farmers who, because of drought, floods, or similar disasters, need a supplemental source of credit.

Credit extended by the agency supplements but does not compete with loans made by private and cooperative lenders. Veterans with farm experience receive preference for most types of loans. Most loans are made for the operation, purchase, and improvement of family-type farms.

Operating loans, that help farmers make better use of land and labor resources, are made for the purchase of equipment, feed, seed, fertilizer, livestock, and other farming needs including family subsistence. Loans are to be repaid in 1 to 7 years.

Farm ownership loans are made to help farmers buy land, improve land and buildings, and refinance debts. Loans are made from private capital and insured by the government or from appropriated funds. Loans are amortized for periods not to exceed 40 years but can be repaid in less time through larger payments in good years. Insured loans are limited to 90 percent of the fair and reasonable value of the farm.

Soil and water conservation loans are made on an insured loan basis or from appropriated funds. Borrowers may be individual farmers or nonprofit associations serving farmers. Loan funds may be used to pay the cash costs of making improvements directly related to soil conservation; water development; conservation, or use; establishment of improved patures; forestation, farm drainage; and related measures. Water development loans may also be made to provide water for rural communities of 2500 or less population. Individual loans are repayable in periods up to 20 years. Loans to associations may be amortized over periods up to 40 years.

Watershed loans are made to help eligible organizations meet their share of the costs of works of improvement that protect, develop, and use water resources in small watersheds, and that are approved for operation by the Soil Conservation Service. Loans are to be repaid within the shortest time consistent with repayment ability, with a 50-year limit.

Rural housing loans are made to eligible farmowners, and owners of nonfarm tracts in rural areas and small rural communities with populations of not more than 2500. Loans are made for the construction and repair of needed homes and essential farm buildings. The loans are repayable over periods up to 33 years.

All loans are made through the agency's local offices serving all agricultural counties. Loans are subject to approval of applicant's eligibility by the Farmers Home Administration committee for the particular county. Each county committee is made up of three local persons, at least two of whom are farmers. The Farmers Home Administration supervisor in charge of the local offices, which may serve more than one county, receive applications, make loans, assist borrowers with planning and carrying out farm and home plans, receive payments, and handle other phases of local program administration.

Forest Service

The primary Forest Service responsibilities are promotion of wise use and conservation of the nation's forest and related wildland resources. To meet this responsibility, the Forest Service carries on three main lines of work: (1) management of the national forests; (2) cooperation with the States and private landowners in obtaining better forest land management; and (3) forest and related range research.

Administration, protection, and management of the national forests of the John Day River Basin is divided among four national forests, each with a forest supervisor and technical staff. Supervisor's headquarters are at Baker, John Day, Pendleton, and Prineville. Each national forest is further divided into ranger districts, each of which is managed by a district ranger assisted by a technical staff. Ranger district headquarters are at Baker, Bates, Burns, Dale, Heppner, John Day, LaGrande, Prairie City, Prineville, Rager, and Ukiah. The national forests are managed under principles of multiple use and sustained yield. This calls for obtaining maximum yield of the national forest's many renewable resources on a continuing basis to meet local and national needs without impairment of the long term productivity of the land. Though any one of the key resource values (wood, water, forage, wildlife, and recreation) may be of major importance on a given area, each receives equal emphasis in the overall management of the national forests. Most of these key uses are compatable, but when conflicts arise, they are decided on the basis of the greatest good for the greatest number of people in the long run.

Cooperation with the State and with private forest landowners is primarily through the Division of State and Private Forestry of the Pacific Northwest regional office in Portland, Oregon. The Division of Watershed Management of this office also furnishes technical assistance concerning watershed management work on forest land under Public Law 566. Many of the programs of these divisions are administered locally by the national forest offices mentioned previously. These cooperative programs emphasize: (1) protection of forest lands and critical watersheds against fire, insects, and disease; (2) promotion of better forest practices and returns from privately-owned forest land; (3) assistance in production and distribution of planting stock for forests, shelterbelts, and woodlots; and (4) stimulation of development and proper management of state, county, and community forests.

Forest and range research in the basin is carried on by the Pacific Northwest Forest and Range Experiment Station, with headquarters

at Portland, Oregon. Local research centers of the Station are located at Bend and LaGrande, Oregon. The experiment station and its research centers conduct research and surveys in the entire field of forestry and range management, regardless of ownership, including the growth, protection, and harvesting of timber, management of related rangelands, protection and management of watersheds, efficient and economical utilization of forest products, and forest economics.

Rural Electrification Administration

The Rural Electrification Administration administers two loan programs: (1) for rural electrification facilities; and (2) for extension and improvement of rural telephone service. Loans for rural electrification are made to cooperatives, public utility districts, municipalities and power companies to finance electric generation, transmission, and distribution facilities in order to bring electricity to persons in rural areas not receiving central station electric service. The Rural Electrification Act provides that in making electric loans preference shall be given to cooperatives and other nonprofit organizations. It also authorizes loans to finance the wiring of rural establishments and the purchase of electrical equipment by those receiving service. REA loans have been made to finance electric and telephone service in the John Day River Basin through borrowers organized and operating under Oregon law. All Rural Electrification Administration loans are self-liquidating. Loans are made on a maximum 35 year amortization basis with interest at 2 percent.

The administration maintains no field offices. It has, however, a field staff of engineers, accountants, management advisors, and telephone specialists.

Soil Conservation Service

The Soil Conservation Service is the U. S. Department of Agriculture agency primarily assigned to the technical operations phase of soil and water conservation. Its principal duties are: soil surveys, administration of the Watershed Protection and Flood Prevention Act (P. L. 566), technical assistance to the Agricultural Conservation and Conservation Reserve programs, snow surveys, and technical assistance to local landowners through their self administered Soil Conservation Districts.

Most of the assistance provided to farmers for the conservation of soil and water resources in the John Day River Basin by the Soil Conservation Service is through the Canyon City and Condon Work Units serving the Grant, Monument, and Gilliam Soil Conservation Districts. Additional assistance is provided through the Maupin, Moro, Heppner, and Pendleton Work Units which serve the Southern Wasco, Sherman, Heppner, and Southern Umatilla Soil Conservation Districts respectively. All of the lands in the basin are in Soil Conservation Districts except those in Crook, Harney, and Wheeler Counties.

The technical assistance that is available to local landowners through the Soil Conservation Districts includes:

1. Soil Surveys that provide an inventory of soil resources and vegetative inventories. They show the capability of land and serve as a guide to planning needed conservation practices.

2. Assistance to individual landowners to develop Conservation Farm and Ranch Plans that delineate the particular needs on their own land and outline an action program for the conservation of soil and water that is tailored to their operations and resources.

3. Technical assistance in planning and applying conservation practices in the fields of: engineering, agronomy, geology, woodland, range, soils, hydrology, biology, plant materials, and water forecasting. This involves such conservation practices as conservation cropping systems, crop residue use, pasture improvement and management, range improvement and management, pond construction, woodland protection and management, waterway development, farm drainage including tile and open ditch, land grading and smoothing, irrigation system design, proper irrigation water use and similar practices.

4. Helping groups of landowners to plan and apply drainage and irrigation measures that cover more than one ownership.

5. Assist local organizations to develop and apply work plans under the Watershed Protection and Flood Prevention Act (P. L. 566) for the overall solution of flood and water management problems on watersheds of less than 250,000 acres.

The Soil Conservation Service provides technical assistance on permanent type conservation practices to the County Agricultural Conservation Program on their cost sharing programs including the Soil Bank. Needs and feasibility are determined, designs and layouts are made, and completed practices are checked for compliance to technical standards.

Cooperative snow surveys are made on 8 snow courses and 4 soil moisture stations in Grant County for use in forecasting the Upper John Day River flow.

In addition, the Service provides technical information and consultation to private engineers, architects, and others (agencies, organizations, and individuals) who need help on specific soil and water conservation problems.