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WATER AND RELATED LAND RESOURCES

GUNNISON RIVER BASIN-COLORADO

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**The Curecanti Needle
Black Canyon of the Gunnison River**

A Report Based on a Cooperative Study by

COLORADO WATER CONSERVATION BOARD

and

UNITED STATES DEPARTMENT OF AGRICULTURE

Economic Research Service—Forest Service—Soil Conservation Service

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From the High Mountains
To the Irrigated Lands

A Report Based on a Cooperative Study by
COLORADO WATER CONSERVATION BOARD

and

2 UNITED STATES DEPARTMENT OF AGRICULTURE +2a

PREPARED BY:

2a ECONOMIC RESEARCH SERVICE // FOREST SERVICE - SOIL CONSERVATION SERVICE

5a SALT LAKE CITY, UTAH - NOVEMBER 1962

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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U.S.D.A. FIELD ADVISORY COMMITTEE
GUNNISON RIVER BASIN
321 New Custom House
Denver 2, Colorado

October 4, 1962

Honorable Stephen L. R. McNichols
Governor of Colorado
Denver, Colorado

Dear Governor McNichols:

The attached United States Department of Agriculture report presents information regarding opportunities for watershed protection, flood prevention and water resource development in the Gunnison River Basin of Colorado. It is submitted as a report on participation by the Department of Agriculture in a cooperative survey with the Colorado Water Conservation Board.

This cooperative survey was undertaken in response to a request from the Colorado Water Conservation Board dated February 10, 1961, for cooperation by the Department of Agriculture in such a survey. The Department's part of the cooperative survey included the development and presentation in cooperation with the Colorado Water Conservation Board of the material contained in this report.

Department of Agriculture participation in the survey was under the provisions of Section 6 of P. L. 566, 83rd Congress, as amended, which authorized the Department to cooperate with other Federal, State, and local agencies in making investigations and surveys of the watersheds of rivers as a basis for the development of coordinated programs.

This investigation and survey is coordinated with the study and reports of the Colorado Water Conservation Board, relating to the several tributary basins of the Colorado River Basin of western Colorado. It presents information obtained from cooperative investigations by the Economic Research Service, Forest Service and Soil Conservation Service of the Department of Agriculture and by the Colorado Water Conservation Board of the State of Colorado.

This is a report of a reconnaissance investigation and survey which we believe covers the assignment of the Department of Agriculture as provided in the Plan of Work for the Gunnison River Basin study.

Sincerely yours,



F. A. Mark, State Conservationist, SCS
& Chairman, USDA Field Advisory Committee



CONTENTS

SUMMARY	i
AUTHORITY AND ORGANIZATION	1
PURPOSE AND SCOPE	1
GENERAL DESCRIPTION OF THE BASIN	3
Location and Size	3
Climate	3
History of Settlement	3
Population	4
Soils	4
Topography	8
Land Use, Cover Conditions and Management	8
Recreation	10
Land Status	11
Water Supply and Use	12
Water Rights	15
PREVIOUS STUDIES	16
Studies by Federal Government	16
Studies by State Government	16
AGRICULTURAL ECONOMY	17
The Resource Base	17
GUNNISON RIVER SUBBASIN REPORTS	24
UPPER GUNNISON SUBBASIN	25
Physical Description of Subbasin	25
Water Supply	28
Present Water Use	31
Agricultural Economy	32
Potential Water Requirement	36
Opportunities for Developments Through Watershed Protection and Flood Prevention and Other USDA Authorities	40
SMITH FORK-CRYSTAL SUBBASIN	41
Physical Description of Subbasin	41
Water Supply	44
Present Water Use	46

Agricultural Economy	47
Potential Water Requirements	52
Opportunities for Developments Through Watershed Protection and Flood Prevention and Other USDA Authorities	54
NORTH FORK SUBBASIN	55
Physical Description of Subbasin	55
Water Supply	58
Present Water Use	60
Agricultural Economy	63
Potential Water Requirements	67
Opportunities for Developments Through Watershed Protection and Flood Prevention and Other USDA Authorities	70
UNCOMPAHGRE SUBBASIN	71
Physical Description of Subbasin	71
Water Supply	76
Present Water Use	77
Agricultural Economy	78
Potential Water Requirements	84
Opportunities for Development Through Watershed Protection and Flood Prevention and Other USDA Authorities	84
WHITEWATER SUBBASIN	89
Physical Description of Subbasin	89
Water Supply	92
Present Water Use	94
Agricultural Economy	94
Potential Water Requirements	98
Opportunities for Developments Through Watershed Protection and Flood Prevention and Other USDA Authorities	100
COORDINATED BASIS FOR PROJECT PLANNING	101
USDA WATER AND LAND RESOURCE PROGRAMS	102

WATER AND RELATED LAND RESOURCES

GUNNISON RIVER BASIN

COLORADO

SUMMARY

This report presents information concerning water and related land resources of the Gunnison River Basin in Colorado. It is based on a cooperative study by the Colorado Water Conservation Board and the U. S. Department of Agriculture. The study and report is coordinated with a study and report of the Colorado Water Conservation Board relating to the several tributary basins of the Colorado River in western Colorado. Department of Agriculture participation was authorized under the provisions of Section 6 of P. L. 566, 83rd Congress, as amended.

The Gunnison River Basin encompasses an area of 8,020 square miles, or about eight percent of the area of the State of Colorado. Elevations vary from 4,550 feet to 14,300 feet above sea level. Average annual precipitation ranges from less than 10 to more than 40 inches. Average annual frost-free period in the agricultural areas varies from 70 to 190 days. Settlement of the Basin began in 1873, with mining being the principal industry. Livestock raising and growing of crops followed the decline of the mining industry. Seventy-one percent of the land in the Gunnison Basin is in Federal ownership, 28 percent is privately owned, and approximately one percent is owned by the State of Colorado. Approximately five percent of the lands of the Basin are used for crop production, with the remaining 95 percent being used for grazing and timber production, watershed and recreation purposes. The 1960 population of the Basin is estimated at approximately 36,000.

This is a report of a reconnaissance study. The information presented for the Gunnison River Basin is prepared for the Basin as a unit and for each of the five major subbasins. These subbasins were delineated because of the nature of their individual water and related land resources. The subbasins are shown on the attached map and are identified as follows: Upper Gunnison, Smith Fork-Crystal, North Fork, Uncompahgre and Whitewater.

Soils of the Basin may be divided, on the basis of climatic influence on soil profile characteristics, into five major groupings as follows: (1) Desert-Sierozem, (2) Brown-Chestnut, (3) Mountain Prairie-Chestnut, (4) Gray Wooded-Mountain Prairie, and (5) Alpine Meadow-Alpine Bog. The majority of the irrigated land is located in the Desert-Sierozem and Brown-Chestnut groupings, with a lesser amount in the Mountain Prairie-Chestnut grouping.

In appraising opportunities for the development of the water and related land resources of the Gunnison River Basin, program coordination is necessary in order to assure that proposed project development opportunities complement each other and provide for coordinated development of the resources of the Basin. Proposed Bureau of Reclamation projects have been recognized in making this study and are included in the analysis.

In addition to the proposed Bureau of Reclamation projects, several project-type development opportunities have been identified where USDA authorities can be utilized. These projects would complement the major water projects in the Basin by further developing the water and land resources and by making the best use of improvements provided by other programs. Chief among these project possibilities are opportunities provided in the Watershed Protection and Flood Prevention Act (P. L. 566, 83rd Congress, as amended).

This report points out eighteen project opportunities in the Gunnison Basin where P. L. 566 project-type opportunities have been identified. These include water storage projects, flood prevention projects and combination multiple purpose-type projects. Cost and benefit determinations have not been made on these projects; however, on the basis of reconnaissance inspection, which eliminated obviously unsuitable proposals, these project opportunities appear to be feasible and might be developed if group-type action were taken by local sponsoring groups. In addition to these potential P. L. 566 projects, several other project development opportunities have been identified where other USDA authorities could be utilized.

Average annual undepleted water supply of the Gunnison River Basin for the 1943-60 study period was 2,175,000 acre-feet. This varied from about 1,130,000 acre-feet to more than 3,600,000 acre-feet. Annual consumption of water in the Basin for this same period averaged 468,400 acre-feet. Major use of water was for the irrigation of 264,000 acres of land. Average annual discharge of water from the Basin was 1,706,500 acre-feet.

Water resources within the Basin are adequate to meet the water supply needs for the development of proposed projects. These include Bureau of Reclamation irrigation projects, USDA P. L. 566 project possibilities, other USDA potential projects, plus increased demand for additional municipal, domestic, recreational and other uses. With these proposed developments, an average of about 655,500 acre-feet of water would be consumed in the Basin annually. This would include water for the irrigation of 323,800 acres of land. Average annual discharges of water from the Basin with proposed developments would be 1,519,400 acre-feet. Potential industrial requirements are not included in this report.

The principal use of the irrigated land in the Basin is for the production of feed for livestock. Irrigated forage crops and Federal and private rangeland complement each other in the production of livestock feed. General cash-crops, specialized fruit crops, and some vegetable

crops comprise lesser amounts of the irrigated acreage. The principal uses of the nonirrigated lands in the Basin are for timber production, grazing by domestic livestock, habitat for wildlife, recreation and mining. The Federal lands within the Basin have a great potential value for recreation and wildlife.

From an agricultural standpoint, the major water and land resource problems are:

1. Management of irrigation water supplies on the farm.
2. Improvement and maintenance of individual farm and group irrigation water delivery systems.
3. Construction of additional irrigation water storage facilities.
4. Selection of suitable new lands for proposed irrigation development.
5. Farm drainage and water disposal.
6. Improvement of watershed condition in critical range areas.
7. Adjustment in land use.
8. Local flood and erosion control.
9. Change in vegetative composition of rangelands to more desirable species through spraying, land treatment and improved management.
10. Improvement of potential timber producing lands by timber-type restoration and tree planting.
11. Maintenance and improvement of fishing waters and wildlife habitat.
12. Development of recreation sites to provide outdoor recreation facilities for public benefit, provide for public safety, prevent pollution of water supplies and to protect public and private property.

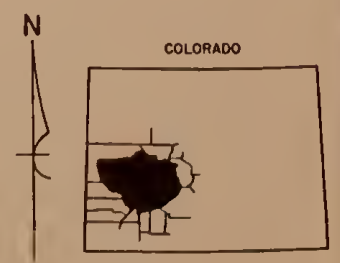
Department of Agriculture programs can be used in helping to solve some of these problems. These programs include the cost-sharing features of the Agricultural Conservation Program; the information and education services of the Agricultural Extension Program; the loan features of the Farmers Home Administration; the administration, protection and management of the national forests and assistance through the cooperative forest management program by the Forest Service; research programs of the Agricultural Research Administration and Economic Research Administration and cooperating State experiment stations; and the technical assistance services of the Soil Conservation Service. The Watershed Protection and Flood Prevention Act, P. L. 566, administered by the U. S. Department of Agriculture provides another program which can be utilized to assist people in the Gunnison River Basin and in the development of the water and related land resources of the Basin.





LEGEND

- CITIES AND TOWNS
- ▭ RESERVOIR
- BASIN BOUNDARY
- - - SUB-BASIN BOUNDARY
- - - COUNTY LINE



GUNNISON RIVER BASIN COLORADO

SCALE: 1 0 1 2 3 4 5 6 MILES

AUTHORITY AND ORGANIZATION

This report presents information concerning water and related land resources of the Gunnison River Basin, Colorado. It is based on a co-operative study by the Colorado Water Conservation Board and the U. S. Department of Agriculture.

Department of Agriculture participation was authorized under provisions of Section 6, P. L. 566, 83rd Congress, as amended, which authorizes the Department to co-operate with other Federal, State and local agencies in making investigations and surveys of the watersheds of rivers as a basis for the development of co-ordinated programs.

Survey work of the U. S. Department of Agriculture was carried out by the Soil Conservation Service, Forest Service and Economic Research Service and was co-ordinated by a USDA Field Advisory Committee, Gunnison River Basin, composed of representatives of these services.

PURPOSE AND SCOPE

The purpose of this report is to present information on water and related land resource use and management which will provide a basis for an effective means of co-ordinating USDA programs for watershed protection, flood prevention, agricultural water management and national forest administration, with related activities of local, State and other Federal agencies. It also presents information which will provide a basis for the development of projects under the Watershed Protection and Flood Prevention Act, P. L. 566, as amended.

The study was reconnaissance in nature and applicable data from previous investigations were utilized wherever possible. The report is developed from the results of field surveys and the analysis of material collected from several sources. It is presented in the form of an inventory or information document rather than an action or authorizing report.

Several State and Federal agencies, in addition to the U. S. Department of Agriculture and the Colorado Water Conservation Board, have provided data and much helpful assistance for this report. Chief contributors are the Bureau of Reclamation, Bureau of Land Management, Colorado State Soil Conservation Board, Colorado Natural Resources Division, Colorado River Water Conservation District, Upper Colorado River Commission, U. S. Bureau of Census, U. S. Statistical Reporting Service, U. S. Geological Survey, U. S. Weather Bureau, U. S. Public Health Service, Colorado State Planning Commission, Colorado State Department of Agriculture, Gunnison, Cimarron, Uncompahgre, Delta, Shavano, Upper Grand Valley and Glade Park Soil Conservation Districts and the Uncompahgre Valley Water Users Association.

GENERAL DESCRIPTION OF THE BASIN

Location and Size

The Gunnison River Basin is located in West-Central Colorado. Its boundary encompasses an area of 8,020 square miles and includes all or major portions of Gunnison, Montrose, Delta and Ouray Counties and portions of Mesa, Hinsdale, Saguache and San Juan Counties. The Continental Divide forms the east and southeast boundary of the Basin and the San Juan Mountains and Uncompahgre Plateau form the south and southwest boundary. The Basin is bounded on the north by the Elk Mountains and the Grand Mesa and on the northwest by the Grand Valley. It is approximately 145 miles long east and west and 95 miles wide at its widest point north and south. The Gunnison River and its tributaries drain about 8 percent of the area of the State of Colorado.

Climate

Climate in the Gunnison River Basin varies considerably but generally could be considered as semiarid. Variation is due largely to the wide range in elevations. The elevation of Uncompahgre Peak on the southern edge of the Basin is 14,301 feet above sea level, while at Grand Junction, where the Gunnison River enters the Colorado River, the elevation is 4,550 feet.

Average annual precipitation varies from more than 40 inches in the upper reaches of the Basin to less than 10 inches in the lower valleys. Measured average annual snowfall varies from more than 460 inches at Ruby and 400 inches at Savage Basin, to approximately 170 inches at Crested Butte in Gunnison County and 20 inches at Grand Junction. Upper basin lands have an annual frost-free period of less than 70 days, while lower basin valleys near Grand Junction average around 190 days.

History of Settlement

The first explorations in the Basin were made by the Spanish. Many of the names of streams and mountains still bear the names given them by Captain Juan Marie de Rivera in 1765 and Father Escalante in 1776. In 1853 Captain Gunnison was commissioned by the Government to search for a feasible railroad route across the Continental Divide. His party did much of the early exploration in the Basin.

The Ute Indians retained possession of the Gunnison River Basin until 1873 when they ceded to the Federal Government a large tract of upper basin land, which was immediately opened for settlement. The lower basin was not settled until the compromise of 1881 between the U. S. Government and the Ute Indians. As a result of the compromise, the Indians agreed to leave the area and locate in the Uintah Reservation in the territory of Utah.

The lure of gold, silver and other minerals caused an influx of people and the population increased rapidly until 1893. With the decline of the mining industry, agriculture became the basic industry of the Basin. Many of the miners, disappointed in their search for gold and silver, turned to stock raising and growing of crops as a means of livelihood. Irrigation was found necessary to mature crops and by 1900 most of the readily available sources of irrigation water had been developed by private individuals and small irrigation companies.

Population

The population of the Gunnison River Basin in 1960 is estimated at approximately 36,000. Montrose is the largest incorporated city with a 1960 population of 5,044. Delta had a 1960 population of 3,832, Gunnison 3,477, Paonia 1,083 and Ouray 785.

Population of the Basin by counties, based on 1960 U. S. Census, is as follows:

Gunnison River Basin Population, 1960

<u>County</u>	<u>1960 Population</u>
Delta	15,602
Gunnison	5,477
Hinsdale *	147
Mesa *	451
Montrose *	12,811
Ouray	1,601
Saguache *	<u>138</u>
Total	<u>36,227</u>

*Estimated for portion of county within Basin.

Soils

Soils of the Gunnison River Basin have developed on gently to strongly sloping floodplains and terraces, moderately to strongly sloping mesas and low rolling hills, and steep to very steep rough mountainous uplands. They have developed in alluvium, residuum and colluvium from shale, sandstone, rhyolite, breccia and tuff, under low to high effective precipitation, at elevations ranging from 5,000 to 14,000 feet. Natural vegetation consists of desert shrubs, sagebrush, oakbrush, juniper, pinyon pine, ponderosa pine, lodgepole pine, Douglas fir, Engleman spruce, alpine fir, aspen, alpine willows and associated climatically adapted grasses and forbs.

On the basis of the climatic influence on soil characteristics, five major groupings of great soil groups have been recognized. These groupings have

been delineated on the generalized soil and vegetation map, with numbers corresponding to the numbers assigned to the following names: 1. Desert-Sierozem, 2. Brown-Chestnut, 3. Mountain Prairie-Chestnut, 4. Gray Wooded-Brown Podzolic-Mountain Prairie, and 5. Alpine Meadow-Alpine Bog.

Within the five climatic soil groupings are soils that do not exhibit the influence of climate in profile characteristics. These are the young soils (Alluvials and Regosols), soils shallow to parent rock (Lithosols), poorly drained soils (Humic Gleys), high sodium soils (Solonetz) and miscellaneous land types (rockland, rock outcrops and rock slides). Kinds or species of vegetation change with the major soil groupings. These changes may be sharp or they may be broad transitions.

Soils presently irrigated are primarily Humic Gley, Alluvial, Sierozem, Brown and Chestnut. There is also an additional acreage of soils suitable for irrigation, primarily in the Brown, Chestnut and Alluvial groups. Acreage of great soils groups, by major groupings, and distribution of this acreage by irrigated land and vegetative types for the Gunnison River Basin is given in table 1.

1. Desert Sierozem

Soils of this grouping have developed under low effective precipitation, on gently to moderately undulating floodplains and strongly to steeply sloping, severely eroded low rolling shale hills, in alluvium and residuum from sandstone and saline shale, at elevations ranging from 5,000 to 6,000 feet. They are deep, generally slowly permeable, moderately coarse to fine textured soils which have an alkaline reaction, a horizon of high lime accumulation in the solum and may have some disseminated lime at or near the surface. This grouping also includes about 3 percent Solonetz (high sodium) soils; 6 percent of deep, moderately fine textured Regosols; 15 percent of deep, medium to fine textured Alluvial soils; 22 percent miscellaneous land types; and 17 percent moderately coarse to moderately fine textured Lithosols.

There are about 94,200 acres of irrigated land in this grouping, primarily on the Sierozem and Alluvial soil groups. Salinity is a major problem and is reflected in the spotty crop growth observed on these soils. The common natural vegetation consists of shadscale, mat salt bush, gardner salt bush, greasewood, rabbit brush, winter fat, cactus, galleta, three awn and squirrel tail.

2. Brown-Chestnut

Soils of this grouping have developed under slightly higher effective precipitation than the Desert-Sierozem soils, on gently sloping stream terraces, outwash fans and valley fills, and moderately to steeply sloping uplands, in glacial till, alluvium and residuum from sandstone and shale, at elevations ranging from 6,000 to 8,000 feet. They are deep, moderately coarse to moderately fine textured soils, which are nearly neutral in reaction and have lime leached deeper in the soil profile than grouping number 1. This

grouping also includes about 19 percent miscellaneous land types; 8 percent deep, moderately coarse to fine textured Alluvial soils; 14 percent moderately coarse to medium textured Lithosols; and 4 percent Humic Gley soils.

This grouping has the largest acreage of irrigated land in the Gunnison River Basin (131,600 acres), with about 75,000 acres of the Brown soils, 13,960 acres of Chestnut soils, 37,040 acres of Humic Gley soils and 5,600 acres of Alluvial soils. The common natural vegetation consists of sagebrush, juniper, pinyon pine, western wheatgrass, phlox, Indian rice grass, needle-and-thread grass and squirrel tail.

3. Mountain Prairie-Chestnut

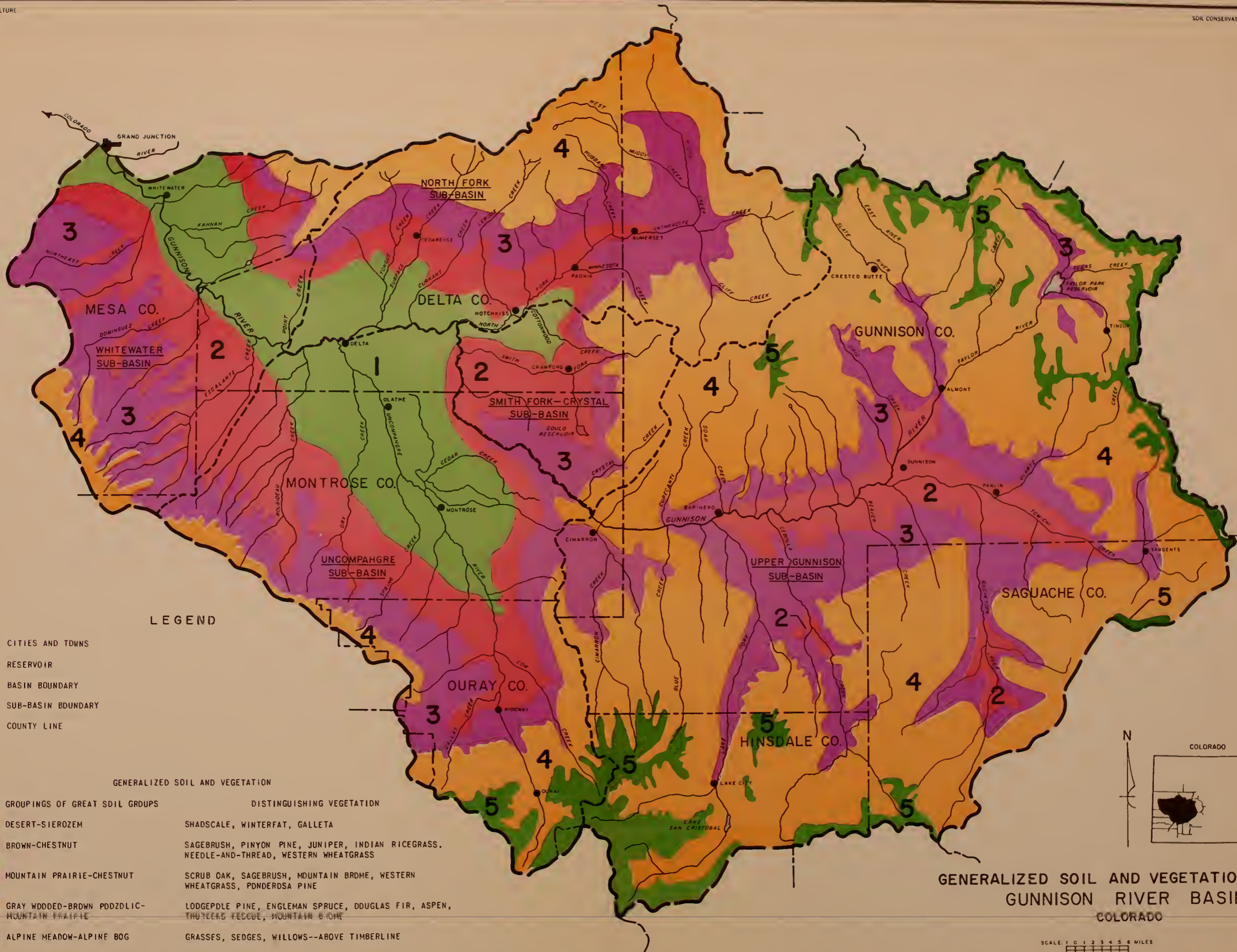
Soils of this grouping have developed under a higher effective precipitation than those in soil grouping number 2. They have developed on gently to moderately sloping Alluvial fans and valley fills, and steep to very steep mountainous uplands, in glacial till of mixed parent rock and alluvium and residuum from a variety of parent rocks at elevations ranging from 7,000 to 9,000 feet. They are moderately deep to deep, moderately coarse to moderately fine textured soils which are slightly alkaline to slightly acid in reaction and generally the lime is leached deeper in the soil profile than soils in grouping number 2. This grouping also includes about 17 percent miscellaneous land types; 7 percent moderately coarse to medium textured Lithosols; and 5 percent deep, moderately coarse to moderately fine textured Alluvial soils with inclusions of deep, moderately coarse to moderately fine textured Humic Gley soils.

About 36,700 acres of this soil grouping are irrigated, with 8,000 acres of Mountain Prairie soils, 22,000 acres of Chestnut soils and 6,700 acres of Alluvial soils. The common natural vegetation consists of big sagebrush, oakbrush, service berry, choke cherry, Arizona fescue, mountain muhlenbergia, and western wheatgrass. Some good stands of ponderosa pine are also found on these soils.

4. Gray Wooded-Brown Podzolic-Mountain Prairie

Soils of this grouping have developed under high effective precipitation on moderate to strongly sloping valley fills, alluvial fans and mesa tops, and steep to very steep mountainous uplands, in alluvium, residuum and colluvium, from sandstone, shale, tuff and rhyolite, at elevations ranging from 9,000 to 11,500 feet. They are moderately deep to deep, moderately coarse to moderately fine textured soils, generally with a high percentage of large angular pieces of parent rock throughout the profile, neutral to acid in reaction and have the lime leached deep into the parent material. Common inclusions in this grouping are small, wet depressional areas of peat, muck and mineral soil. This grouping also includes about 21 percent miscellaneous land types; 18 percent deep, moderately coarse to moderately fine textured Alluvial soils; and 5 percent moderately coarse to medium textured Lithosols.





LEGEND

- CITIES AND TOWNS
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- BASIN BOUNDARY
- - - SUB-BASIN BOUNDARY
- - - COUNTY LINE

GENERALIZED SOIL AND VEGETATION

NUMBER	GROUPINGS OF GREAT SOIL GROUPS	DISTINGUISHING VEGETATION
1	DESERT-SIEROZEM	SHADSCALE, WINTERFAT, GALLETIA
2	BROWN-CHESTNUT	SAGEBRUSH, PINYON PINE, JUNIPER, INDIAN RICEGRASS, NEEDLE-AND-THREAD, WESTERN WHEATGRASS
3	MOUNTAIN PRAIRIE-CHESTNUT	SCRUB OAK, SAGEBRUSH, MOUNTAIN BROME, WESTERN WHEATGRASS, PONDERSA PINE
4	GRAY WOODDED-BROWN PODZOLIC-MOUNTAIN PRAIRIE	LOGGEDLE PINE, ENGLEMAN SPRUCE, DOUGLAS FIR, ASPEN, THURBERS FESCUE, MOUNTAIN BROME
5	ALPINE MEADOW-ALPINE BOG	GRASSES, SEDGES, WILLOWS--ABOVE TIMBERLINE

GENERALIZED SOIL AND VEGETATION MAP
GUNNISON RIVER BASIN
COLORADO

SCALE 1 0 1 2 3 4 5 6 MILES

Table 1. - Generalized soil and vegetation, showing acreage of great soil groups, irrigated land and vegetative types - Gunnison River Basin.

Map Number	Grouping of Great Soil Groups	Name	Acres	Irrigated Land 1/	Acres	Vegetative Types														
						Desert-Sierozem	Lithosol	Alluvial	Regosol	Solonetz	Misc. Land Types	Grass & Willow or Cottonwood	Sagebrush	Oakbrush	Pinyon	Aspen	Conifer	Bare Rock		
1	Desert-Sierozem	Desert-Sierozem	186,903	67,850		119,053														
	Lithosol	Lithosol	83,011			83,011														
	Alluvial	Alluvial	76,772	26,350		46,322	4,100													
	Regosol	Regosol	31,455			31,455														
	Solonetz	Solonetz	12,587			12,587														
	Misc. Land Types	Misc. Land Types	112,518																	112,518
Total			503,246	94,200		292,428	4,100													112,518
2	Brown-Chestnut	Brown Chestnut	355,581	75,000	1,500															
	Chestnut	Chestnut	161,281	13,960																
	Humic Gley	Humic Gley	37,040																	
	Lithosol	Lithosol	127,582																	
	Alluvial	Alluvial	70,425	5,600		535	6,962													
	Misc. Land Types	Misc. Land Types	180,690																	91,153
Total			932,599	131,600	1,500	535	6,962													91,153
3	Mountain Prairie	Mountain Prairie	524,724	8,000																
	Chestnut	Chestnut	324,650	22,000																
	Lithosol	Lithosol	88,840																	
	Alluvial	Alluvial	59,750	6,700		1,859	1,081													
	Misc. Land Types	Misc. Land Types	197,023																	45,283
Total			1,194,987	36,700		7,309	1,081													45,283
4	Gray Wooded-Brown Podzolic	Gray Wooded Brown Podzolic	1,212,921																	
	Mountain Prairie	Mountain Prairie	108,742																	
	Humic Gley	Humic Gley	282,740																	
	Lithosol	Lithosol	3,158																	
	Alluvial	Alluvial	111,901	1,500		8,038														
	Misc. Land Types	Misc. Land Types	40,208			1,000														
	Misc. Land Types	Misc. Land Types	478,361																	
Total			2,238,031	1,500		11,880	865													60,362
5	Alpine Meadow	Alpine Meadow	79,181																	
	Alpine Bog	Alpine Bog	13,197																	
	Misc. Land Types	Misc. Land Types	171,559																	
Total			263,937			200,388	9,584													53,965
GRAND TOTAL ACRES IN THE BASIN			5,132,800	264,000	1,500	220,122	22,592	292,428	1,930,366	404,502	190,606	352,516	1,090,897	363,281						

1/ Irrigated land includes some areas, infested with willows and cottonwood.

There are only about 1,500 acres of irrigated land in this grouping and all of it is on Alluvial soils. Native vegetation consists primarily of Douglas fir, lodgepole pine, Engleman spruce, alpine fir and aspen, with an understory of plants such as kinnikinnick, vaccinium at higher elevations and creeping juniper. In the park areas vegetation is generally sagebrush, Thurbers fescue, Columbia needle grass, blue wild rye, mountain brome and many forbs. Wet areas have sedges and rushes.

5. Alpine Meadow-Alpine Bog

Soils of this grouping have developed under high precipitation in moderately sloping depressions of alluvium and colluvium and on strongly sloping ridgetops and steep side slopes in residuum from tuff, breccia, rhyolite, andesite, basalt and granite, at elevations above timberline and above 11,500 feet. They are very shallow to moderately deep, moderately coarse to medium textured, high organic soils, highly leached and acid in reaction. Most of this grouping (65 percent) consists of miscellaneous land types, which are bare of vegetation except for lichens.

Vegetation on the soils consists of sedges, rushes, grasses, forbs, willows and other woody species. There is a short period of grazing on the alpine meadows. There is high sustained water yield and low sediment yield in watersheds made up of soils in this grouping.

Topography

The Gunnison River Basin ranges in elevation from approximately 4,550 to 14,300 feet and has an extremely variable topography. The lower river basin has broad, nearly level to moderately sloping valleys, flanked by low rolling hills which break rather abruptly into moderately to steeply sloping mesas highly dissected by steep sided drainageways or canyons. Above the mesas on the northeast and south are steeply sloping dissected plateaus which extend to the headwaters of the major streams. The streams are shallow at this elevation and topography is characterized by gently to strongly sloping valleys. These valleys are interspersed with steeply sloping smooth rolling hills at the north boundary of the Basin and very steep rough glaciated peaks on the south boundary.

The upper portion of the Gunnison River Basin is typified by very high glaciated peaks whose slopes descend into gently to strongly sloping high mountain basins and into long steep sided ridges. They are separated by strongly sloping, narrow valleys that become less steep and considerably wider at the confluence of major streams and at lower elevations.

Land Use, Cover Conditions and Management

Lands of the Gunnison River Basin are used primarily for the production of timber, range-forage, mountain meadow hay, and irrigated crops. There are approximately 264,000 acres of irrigated land within the Basin. Fruit and truck crop farming, together with general and cash-crop farming and the



Water Enhances Recreation

A Reservoir-Lake Side Campground and Picnic Area on Grand Mesa National Forest



Water for Fishing

Development of water facilities increases opportunity fishing such as at this reservoir on Grand Mesa National Forest

production of forage and grain crops for livestock feed are the principal types of agricultural cropping. The irrigated lands at higher elevations are limited by a short growing season to the production of legume-grass hay or pasture. Private and publicly owned nonirrigated land furnishes summer grazing for the livestock enterprises.

Timber resources of the Basin are plentiful and harvesting of timber products is expected to increase. Most of the timber is produced on the national forests where approximately one million acres are producing commercial forest products. The proposed allowable annual cut on sustained yield basis on the national forest lands is approximately 76 million board-feet. Timber producing areas in lesser amounts are on the national land reserves and privately owned lands within the Basin.

Cover conditions in the Alpine No. 5 (see map) and spruce-fir No. 4 zones vary from poor to good. These zones have alpine meadows, timber, oakbrush and sagebrush-grass vegetation. Most of the water yield comes from these zones but very little sediment is produced. Most of the runoff is snowmelt, which, in the Alpine zone, carries through most of the year. Some sediment reaches the streams during spring runoff time from brush and grasslands, but usually it is minor.

The lower zones, which are ponderosa pine-oakbrush No. 3, pinyon-juniper No. 2 and desert shrub No. 1, have poor to fair cover. These areas are predominantly oakbrush-grass, sagebrush-grass and desert shrubgrass combinations of vegetation. Overuse in the past years has reduced vegetative cover and the desert climate naturally slows the rate of recovery, so sediment yield is high. These zones are subject to erosion during spring snowmelt runoff and summer rainstorms. Sediment is produced by sheet and gully erosion.

Very little sediment reaches the main river above the confluence with the North Fork River. The Smith Fork produces some sediment, as do some raw shale slide areas high on the North Fork drainage. Most sediment from these areas will be deposited in the Crawford and Paonia Reservoirs. Most of the sediment that reaches the main stream will be from the runoff of summer showers on Desert Sierran areas below these reservoirs.

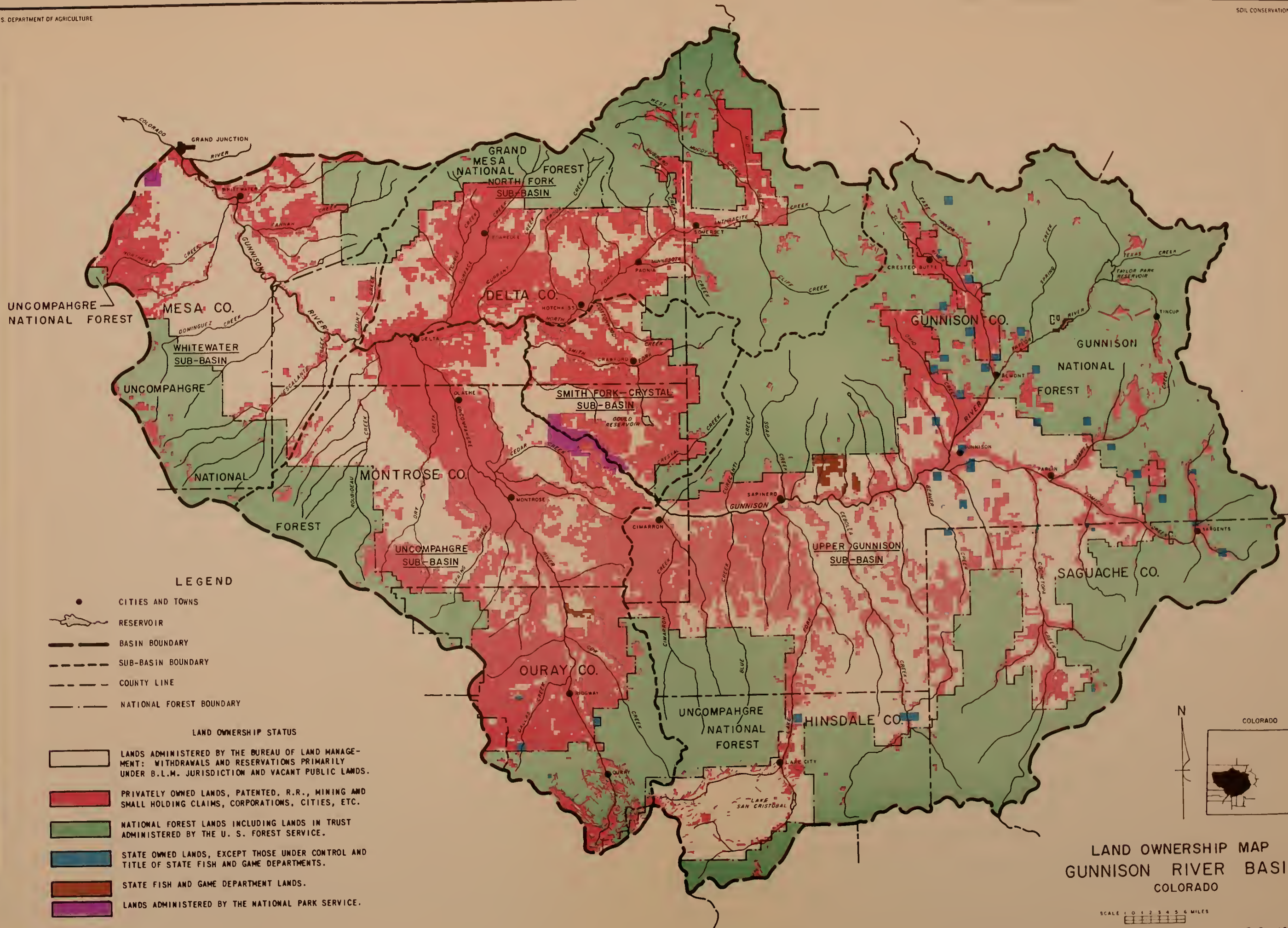
The largest sediment load is delivered to the main stream by the Uncompahgre River. This river drains large areas of Brown Chestnut and Desert Sierran zones with sparse cover. Along the east slope of the Uncompahgre Plateau are many drainages that flood across canals and irrigated lands.

Below the confluence of the Uncompahgre and the Gunnison Rivers many streams such as Kahnah Creek, Dominguez Creek and Escalante Creek drain from high sediment producing areas but yield little sediment due to low rainfall.

Recreation

The Basin is outstanding in many respects in recreational attractions. Mountain scenery, together with fishing, hunting and other recreational pursuits, have caused tourist trade to increase rapidly. A substantial portion of the income in certain sections of the Basin is derived from



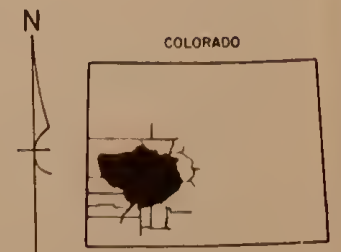


LEGEND

- CITIES AND TOWNS
- RESERVOIR
- BASIN BOUNDARY
- - - SUB-BASIN BOUNDARY
- - - COUNTY LINE
- - - NATIONAL FOREST BOUNDARY

LAND OWNERSHIP STATUS

- LANDS ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT: WITHDRAWALS AND RESERVATIONS PRIMARILY UNDER B.L.M. JURISDICTION AND VACANT PUBLIC LANDS.
- PRIVATELY OWNED LANDS, PATENTED, R.R., MINING AND SMALL HOLDING CLAIMS, CORPORATIONS, CITIES, ETC.
- NATIONAL FOREST LANDS INCLUDING LANDS IN TRUST ADMINISTERED BY THE U. S. FOREST SERVICE.
- STATE OWNED LANDS, EXCEPT THOSE UNDER CONTROL AND TITLE OF STATE FISH AND GAME DEPARTMENTS.
- STATE FISH AND GAME DEPARTMENT LANDS.
- LANDS ADMINISTERED BY THE NATIONAL PARK SERVICE.



LAND OWNERSHIP MAP
GUNNISON RIVER BASIN
COLORADO

SCALE 1 0 1 2 3 4 5 6 MILES

tourist trade. The Gunnison River with its tributaries offers some of the finest stream fishing in the State, while Taylor Reservoir is a major attraction for the boat fisherman. The mountains around Ouray, nationally known as the Switzerland of America, offer incomparable scenery and wilderness for the photographer and nature lover. From its mining heritage of the past, the area has its share of famous mining camps, old ghost towns and abandoned rail-road grades to intrigue the historian and amateur prospector. Large numbers of big game animals, chiefly deer and elk, are found in the Basin. Many productive fishing waters and areas of productive upland game habitat are also found within the Basin.

Grand Mesa, with its many lakes and reservoirs, receives more than 100,000 fishing visits during the season. The Uncompahgre Plateau is one of the most productive deer hunting areas in the State of Colorado. Recently there has been increased development of winter sports facilities. The installation of a telecar gondola at Crested Butte gives promise of making this a major winter sports area.

Land Status

About 72 percent of the land in the Gunnison River Basin is publicly owned. The majority of these public lands are in Federal ownership. Table 2 shows total acreage and percentage of the various land ownerships. Reference is made to the land ownership map for location of these various ownerships.

Table 2. - Land ownership, Gunnison River Basin

Ownership	:	Acres	:	Percent
<u>Federal Land</u>				
National Forest <u>1/</u>		2,318,754		45.2
National Land Reserve <u>1/</u>		1,331,799		25.9
National Parks		<u>15,006</u>		<u>.3</u>
Total Federal Land		3,665,559		71.4
<u>State of Colorado</u>				
State Lands		20,148		.4
Colorado Fish and Game		<u>6,560</u>		<u>.1</u>
Total State Lands		26,708		.5
<u>Private Land</u>		<u>1,440,533</u>		<u>28.1</u>
TOTAL		<u>5,132,800</u>		<u>100.0</u>

1/ Bureau of Reclamation withdrawal lands included.

Water Supply and Use

The water supply for the Gunnison River comes principally from the melting of winter snowpacks on the high mountain peaks, augmented by summer precipitation. There is considerable variation in watershed yield, reflecting climatological and meteorological differences in the different parts of the Basin. Water yields range from more than 30 inches of runoff in parts of the Anthracite Range, West Elk, and San Juan Mountains, to less than 1 inch in the lower, drier parts of the Basin. Even within the higher parts of the Basin, significant differences occur in the watershed yield.

The dominant use of water within the Basin is for irrigation. The climatic regime is such that successful crop production is impossible without supplementing the natural rainfall by irrigation. Total annual water yield of the Basin exceeds total water-supply requirements within the Basin. Since the streamflows are mainly derived from snow melting, they are quite variable. The peak flows characteristically occur in the late spring and early summer. Runoff during this period is generally in excess of immediate requirements throughout the Basin.

The rate of streamflow diminishes during the late summer and in many instances becomes insufficient to meet the crop requirements for irrigation water. Shortages of late-season water are common on tributary streams in those areas which depend on direct diversion of natural streamflow for their irrigation supplies. These shortages are frequently quite severe, and limit the agricultural development and production in several parts of the Basin.

There is only limited regulation of streamflow at present, with Taylor Park Reservoir on the Taylor River being the most important regulating reservoir within the Basin. Equally important to specific areas are a number of small reservoirs located on Grand Mesa and elsewhere, which furnish at least a partial supply during the latter part of the irrigation season when the natural streamflows are inadequate to meet the irrigation demands.

Additional stream regulation is needed within the Basin to meet seasonal requirements and to smooth out the annual variations of water supply. Projects presently authorized or proposed and under study will go far towards meeting these needs for the major irrigated areas. Additionally, smaller projects would contribute materially to the stabilization of the irrigated agriculture within the Basin. Potential projects of this type are noted in succeeding sections of the report. There is a need for a uniform acceptable criteria for determining the suitability of land for irrigation and the selection of new project lands.

The water supply of the Basin is of excellent quality. Generally, it is well suited to long continued irrigation of the farmlands. There are, however, a few places in the lower part of the Basin where return flows from irrigated areas or inflows from salt or sediment producing areas characteristically contain undesirable amounts of sediment or dissolved salts. These flows are small in amount and are rapidly diluted by the larger streams into which they flow. Their effect is therefore limited to the immediate location of their occurrence, and they have little influence on the quality of the water supply of the Basin as a whole.

Snow
fills
mountain
lakes
and
reservoirs



WATER SUPPLY



Snow
source of
mountain
streamflow
for
beneficial use
through
project development

Total undepleted water supply for the Basin averaged about 2,175,000 acre-feet annually for the 1943-60 study period, not considering on-site use by native forest and range vegetation. It ranged from about 1,130,000 acre-feet to more than 3,600,000 acre-feet annually. Water supply depletions in the Basin have been estimated. Net consumptive use by crops was computed by the Blaney-Criddle procedures based on climatic records for the 1943-60 study period and the average crop acreage distribution, with appropriate adjustments for variations in adequacy of water supply. Depletions resulting from crop consumptive use on the 264,000 irrigated acres averaged 312,100 acre-feet annually. Other depletive uses of the water resource were separately estimated by appropriate procedures. These included consumptive use on noncrop water-using areas incidental to irrigation development, use by riparian and nonbeneficial phreatophytic vegetation, evaporation from lakes and reservoirs, municipal and domestic use, and other minor uses. Aggregated, these water-supply depletions averaged about 156,300 acre-feet annually for the 1943-60 study period.

There are several authorized or proposed reclamation projects within the Basin. In addition, other agricultural project opportunities appear feasible as discussed in succeeding sections of the report. Ultimate water-supply requirements to meet the increased needs resulting from completion of these projects, municipal and domestic requirements of increased population, foreseeable increased recreation developments, and other minor consumptive uses, were similarly estimated.

The average annual water resource for the 1943-60 study period, and the present and ultimate potential use, is summarized by subbasin as described on page 24 in the following tabulation.

	Undepleted subbasin supply adjusted for present within-basin diversions	Present average consumptive use	Ultimate consumptive use with potential project developments
	- - - - - Acre-feet - - - - -		
Upper Gunnison	912,000	57,681	102,182
Smith Fork-Crystal	66,800 <u>1/</u>	28,777	69,009
North Fork	469,300	100,770	148,689
Uncompahgre	618,900	239,374	287,909
Whitewater	105,900	25,022	30,913
Unaccounted depletion <u>2/</u>	<u> </u>	<u>14,800</u>	<u>14,800</u>
Totals	2,172,900	466,400	653,500

1/ Does not include potential water supply importation from Upper Gunnison Subbasin.

2/ Unexplained residual between inflow and total of estimated consumptive uses and outflow.

The average contribution of the Gunnison to the Upper Colorado River was 1,706,500 acre-feet annually for the study period, with a range of from 660,000 acre-feet to 3,200,000 acre-feet. With development of potential projects within the Basin (excluding industrial development, which is outside the scope of this report), net crop use for comparable conditions, on the potential total of about 323,800 acres, would increase to 433,100 acre-feet and other uses to 222,400 acre-feet annually. The average contribution of the Gunnison River to the Upper Colorado River with this potential development and under hydrologic conditions comparable to the 1943-60 study period, would have been 1,519,400 acre-feet annually.

Water Rights

(This statement was prepared by the Colorado Water Conservation Board for inclusion in this report).

Appropriation of water in the State of Colorado is authorized by the State Constitution and by certain statutes adopted pursuant to the Constitution. The unappropriated water of any natural stream of the State is subject to appropriation for beneficial use under the doctrine of the first in time is first in right to the continued use of the water.

The procedure for acquiring a water right is for the prospective appropriator to commence surveys for or construction of necessary water use facilities as the first step in establishing the appropriation. Thereafter the appropriator should file a statement of a claim for the use of water in the office of the State Engineer. The appropriation is completed when the water is applied to a beneficial use. The appropriator may then have the water right established by an adjudication proceeding in the proper District Court. The District Court then enters a decree for the water right.

The State Engineer has administrative control of the public waters of the State. It is his duty, along with his duly recognized subordinates, to administer the distribution of water in accordance with decrees. He also has the duty to see that the waters of the state are preserved for the use and benefit of the citizens and inhabitants of the state and are not wasted.

The Gunnison River, tributary to the Colorado River, is located entirely within the State of Colorado. The construction of new water use facilities providing for expanded use of water of the Gunnison River presents no problem as large quantities of unappropriated water discharge to the Colorado River. The construction of the Curecanti Dam and the storage of water will provide the opportunity for water replacement. The establishment of additional water rights on the tributary streams is contingent on availability of unused runoff.

PREVIOUS STUDIES

Several studies concerning water and related land resource development possibilities and covering portions or all of the Gunnison River Basin, have been made by State and Federal agencies.

Studies by Federal Government

The Bureau of Reclamation has prepared several reports on the Basin. A reconnaissance report of the Gunnison River project which comprised the entire Gunnison River Basin was prepared in 1951. This report was based on studies made in the Basin from 1936 to 1950.

Feasibility and/or definite plan reports have also been prepared by the Bureau of Reclamation on the Uncompahgre project, Paonia project, Fruit-growers Extension project, Smith Fork project, Fruitland Mesa project, Bostwick Park project and Curecanti project. These projects are located within the Gunnison River Basin. The Department of Agriculture also prepared reports on the Paonia and Smith Fork projects.

The Bureau of Agricultural Economics, USDA, prepared a water facilities area plan in 1940 for the North Fork of the Gunnison River, together with Surface and Tongue Creeks and their tributaries.

Studies by State Government

The Colorado Water Conservation Board contracted with the engineering firm of Leeds, Hill and Jewett to make a study of the water resources available from surface supplies of western Colorado. A report was prepared in 1953. Data for the Gunnison River Basin is included in this report.

The Tomichi and Gunnison River Soil Conservation Districts sponsored the Gunnison Pilot Area Cooperative Conservation Program in Gunnison County. Reports covering the activities of this program were prepared in 1953 and 1954.

The 1948 report of the Upper Colorado River Basin Compact Commission includes data about the Gunnison River Basin.

In addition to the above listed reports, other published and unpublished data are available for the Basin.

AGRICULTURAL ECONOMY

The principal use of water in the Gunnison River Basin is for irrigation of agricultural lands. Likewise, production of feed crops for livestock dominates use of the irrigated agricultural land. General cash crops, specialized fruit, and some vegetable crops comprise lesser proportionate amounts of the irrigated acreage in the Basin. In general, water supply is plentiful for the irrigated acreage, although shortage of late-season water is common in many areas. The 1950 Census of Irrigation showed 269,397 acres irrigated in 1949. This figure is consistent with the 1949 Census of Agriculture because it is the only year such reconciliation was made by the Bureau of the Census.

Sources of agricultural production data consisted primarily of Annual Colorado Agricultural Statistics, the U. S. Census of Agriculture and Irrigation, Bureau of Reclamation Annual Uncompahgre reports, and farm interviews. Interpolations of county totals into subbasins and addition of subbasins to derive basin totals enabled comparable procedures to be used throughout the study. The composite approach made it possible to account for each part of the counties involved and each of the subbasins as they fit into the Basin as a whole.

The Resource Base

Annual data for crop acreages, production, and values were compiled for the 1943-60 period because satisfactory water-supply data were available for that period only. Averages for 1943-49 and 1950-56 show trends within the 1943-60 period (table 3).

Hay of all kinds averaged about 44 percent of total irrigated land in 1943-60. Its gross value amounted to about 30 percent of the gross value of crops harvested. (Irrigated pasture was not considered part of cropland harvested in determining gross crop values).

Although fruit comprised only about 3.5 percent of the total irrigated acreage, its gross value was about the same as all hay for the 1943-60 period. Combined they accounted for about 60 percent of gross value of crops harvested.

Acreages of corn, dry beans, alfalfa hay, and sugar beets have remained fairly constant over the 1943-60 period. Acreages of small grains and fruit have decreased moderately but potato and vegetable acreages have decreased considerably. An increase in acreage of pastureland has about offset the decrease in cropland harvested. Average irrigated acreage of the Gunnison River Basin for the 1943-60 period has been estimated at 264,000 acres.

Agricultural Production

In addition to crops harvested, a great deal of feed is produced on irrigated pasture and on nonirrigated rangeland. Range livestock depend upon the range for 4 months of summer feed, upon irrigated pasture and

Table 3.- Average acreage, total production and gross value of principal crops harvested in Gunnison River Basin, Colorado, 1943-49, 1950-56 and 1943-60

Crops	Unit	1943-49		1950-56		1943-60	
		Average	Percent of total	Average	Percent of total	Average	Percent of total
Corn							
Harvested	Acres	13,395	5.16	13,425	5.66	13,952	5.62
Production	Bushels	560,149		673,112		681,561	
Value	Dollars	766,877		1,084,493		963,844	
Wheat							
Harvested	Acres	11,018	4.24	7,545	3.18	8,405	3.38
Production	Bushels	290,635		212,474		239,534	
Value	Dollars	499,394		419,007		429,106	
Oats							
Harvested	Acres	12,537	4.83	11,505	4.85	11,216	4.52
Production	Bushels	509,136		485,519		472,490	
Value	Dollars	394,306		424,875		379,772	
Barley							
Harvested	Acres	10,549	4.06	8,008	3.37	9,312	3.75
Production	Bushels	414,131		317,487		387,760	
Value	Dollars	461,724		385,444		413,722	
Potatoes							
Harvested	Acres	2,741	1.05	813	.34	1,506	.61
Production	Bushels	620,059		262,439		382,471	
Value	Dollars	855,974		313,838		492,359	
Beans							
Harvested	Acres	10,122	3.90	7,916	3.34	8,996	3.62
Production	Cwt.	124,751		117,291		125,893	
Value	Dollars	869,011		726,924		821,234	
Alfalfa hay							
Harvested	Acres	(40,007)	(15.40)	(37,383)	(15.76)	(39,709)	(16.00)
Production	Tons	(94,456)		(96,540)		(98,890)	
All hay							
Harvested	Acres	114,507	44.09	103,612	43.68	109,572	44.13
Production	Tons	199,744		186,397		197,032	
Value	Dollars	3,063,174		4,003,277		3,666,454	
Sugar beets							
Harvested	Acres	2,093	.81	2,089	.88	2,099	.85
Production	Tons	27,046		29,960		30,494	
Value	Dollars	285,492		343,648		341,764	
Other field crops ^{1/}							
Harvested	Acres	1,290	.50	762	.32	909	.37
Value	Dollars	50,299		28,887		36,548	
Fruit							
Value	Dollars	3,676,932	3.58	3,322,490	3.39	3,374,648	3.41
Vegetables							
Value	Dollars	934,184	.86	439,773	.44	635,734	.60
Total crops							
Harvested	Acres	189,787	73.08	164,762	69.45	175,931	70.86
Value	Dollars	11,857,367		11,492,656		11,555,185	
Other land irr.							
Acres		69,922	26.92	72,463	30.55	72,362	29.14
Total land irr.	Acres	<u>2/259,709</u>	100.00	<u>2/237,225</u>	100.00	<u>2/248,293</u>	100.00

^{1/} Includes rye and sorghum.

^{2/} Excludes irrigated land not harvested and not pastured.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agri.

field residue for 2 to 3 months, and upon dry feed for the remaining 5 to 6 winter months. Thus, irrigated forageland and nonirrigated rangeland complement each other in the production of feed for range livestock. During recent years, most of the beef ranchers, particularly in the upper reaches of the Basin, have shifted to a cow-calf operation. Weather conditions in the high elevation areas are not conducive to winter feed lot fattening. In the lower elevations of the Basin some beef fattening enterprises are in operation, and there is an opportunity for an expansion of this type of agriculture. Types of farming and location of presently irrigated areas in the Basin are shown on the following map.

Currently, there are 239 Forest Service permits for cattle. Cattle number 39,518 head and graze from June 15 to October 7, for a total of 147,968 animal-unit months. Sheep ranches have 92 permits to graze 71,724 sheep from July 1 to September 15 for a total of 34,870 animal unit months.

Bureau of Land Management permits total 246 for cattle ranches headquartered in the Basin, with 57,724 animal-unit months of grazing. Sheep permits number 73 for ranches headquartered in the Basin, with 33,438 animal-unit months of grazing.

Number of cattle, tons of all hay, and acres of irrigated pasture are a few of the items presented in table 4 for census years 1944-59. Cows and heifers that have calved increased steadily in numbers from 1944 to 1959, while hay production remained fairly constant and irrigated pasture acreage increased at about the same rate as the increase in numbers of cows and heifers. Milk cows have decreased in number and in percent of total cows since 1944. They are presently 11 percent of total cows, which indicates the beef cattle operation is more profitable than dairying in the Gunnison River Basin. No attempt was made to compile range sheep numbers because of the wide variation due to different counting dates and the nomadic nature of sheep operations.

Sale of farm products by source is another item shown in table 4. In comparing gross income from sale of farm products with gross value of crops harvested, the difference is due, in part, to some of the feed crops being used in livestock production. Sale of farm products also includes the value made of irrigated pasture, nonirrigated range by livestock use and value of forest products. In 1949 and 1959 it was more profitable to feed the crops than to sell them. In 1944, sale of farm products was not enough greater than value of crops harvested to offset the additional inputs from livestock feeding which resulted in a loss for cattlemen. In 1954, the additional inputs from livestock feeding about offset the additional value of farm products sold, over the value of crops harvested. As may be noted in table 4, gross value of crops harvested per acre was highest in 1954 and lowest in 1949 for the four census years. Fruit sales accounted for most of the difference with price, rather than production, making the difference. Relative prices for livestock were opposite to those of fruit in 1944, 1949 and 1954.

Data to this point were compiled on a composite basis because of the size of the Basin and because of the reconnaissance nature of the study. However, some detail on a per farm basis should be mentioned. Number of farms

Table 4.- Cattle numbers, value of farm products sold by source, value of crops harvested, and other selected items, Gunnison River Basin, Colorado, Census years 1944-59

Item	: Unit	: 1944	: 1949	: 1954	: 1959
Cattle and calves	Number	<u>1</u> /99,236	<u>2</u> /102,199	129,757	128,267
Cows and heifers that have calved	Number	<u>1</u> /52,775	<u>2</u> / 50,634	58,957	59,014
Milk cows	Number	<u>1</u> /10,174	<u>2</u> / 9,507	8,190	6,513
All hay harvested	Acres	120,151	112,847	105,046	112,102
Production of all hay	Tons	209,745	193,619	188,863	211,321
Irrigated pasture	Acres	66,221	77,857	73,992	78,403
Total irrigated land <u>3</u> /	Acres	263,406	265,972	238,425	252,097
Value of farm products sold by source:					
Field crops	Dollars	1,865,655	2,821,091	2,806,505	2,971,177
Vegetables	Dollars	603,979	396,578	233,866	290,255
Fruits and nuts	Dollars	2,746,099	1,349,330	4,748,053	2,706,022
Forest products and hort. specialties	Dollars	197,099	79,903	163,371	87,429
Poultry and poultry products	Dollars	459,591	409,787	338,934	196,261
Dairy products	Dollars	739,053	774,082	826,202	903,675
Livestock and livestock products <u>4</u> /	Dollars	6,158,336	11,404,719	8,226,333	13,829,057
Total farm products	Dollars	12,769,812	17,235,490	17,343,264	20,983,876
Value of crops harvested	Dollars	11,885,465	9,534,936	13,332,075	12,379,731
Value per acre	Dollars	60	51	81	71
Crop acreage harvested	Acres	197,185	188,115	164,433	173,694
Total farms	Number	3,489	3,358	3,039	2,516
Average size of farms and ranches	Acres	458	602	632	755
Value of land and buildings per farm	Dollars	9,442	24,602	35,287	49,187
Proportion irrigated farms of all farms	Percent	NA	96	94	96
Average acreage irrigated per farm	Acres	75	79	78	100
Proportion of tenancy	Percent	18	12	11	9

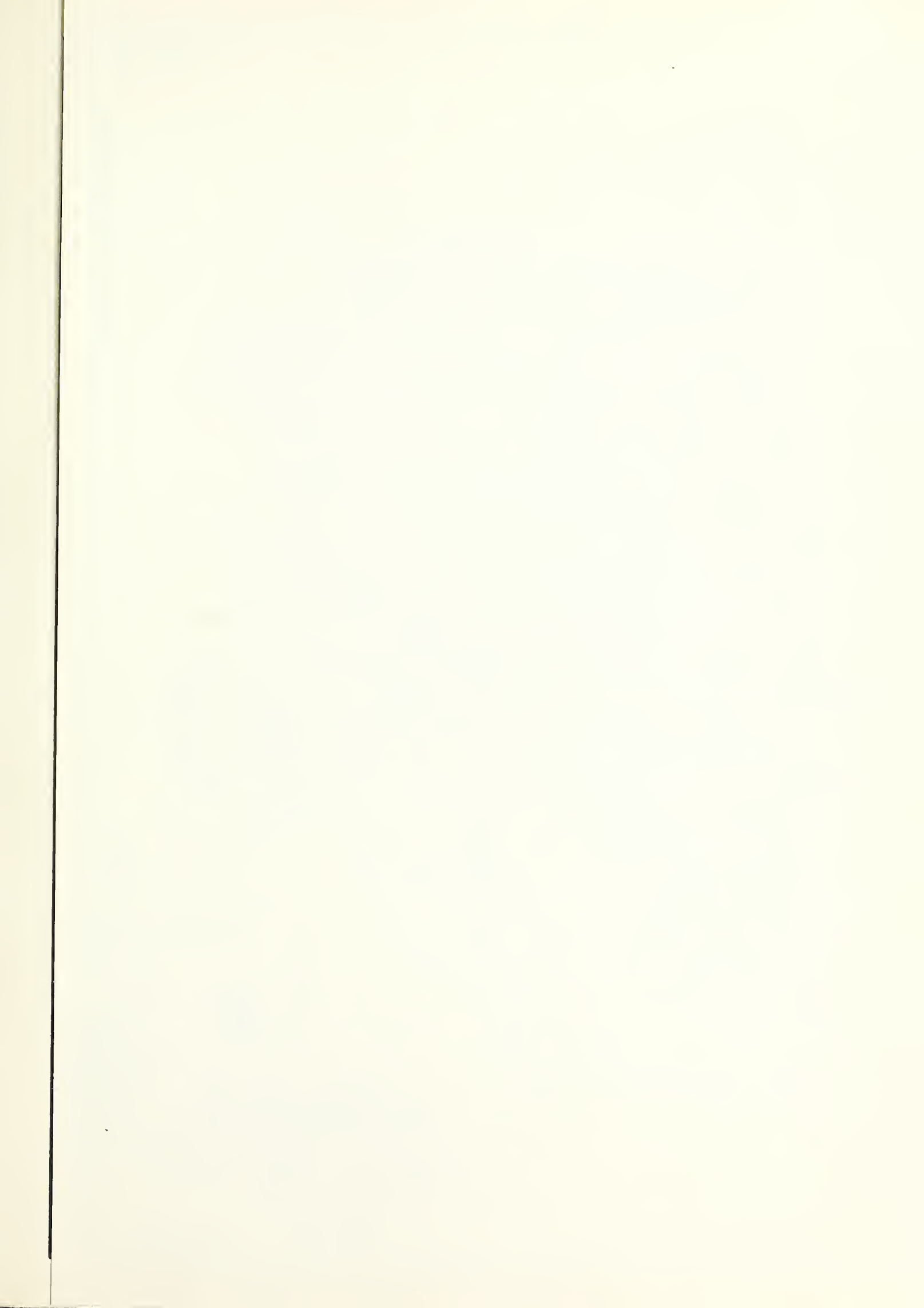
1/ January 1, 1945.

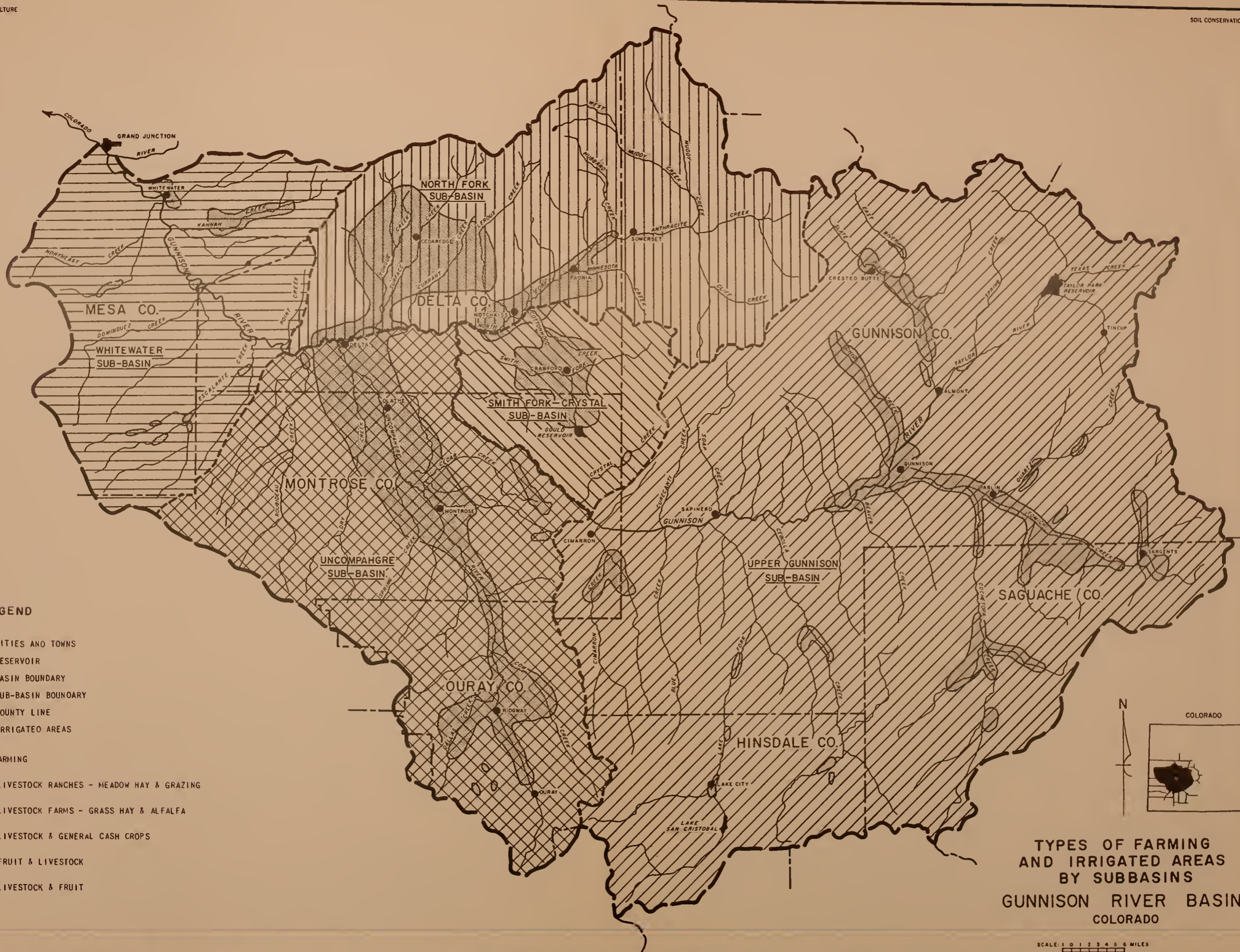
2/ April 1, 1950.

3/ Excludes irrigated land not harvested and not pastured.

4/ Exclusive of poultry and poultry products and dairy products.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agriculture.



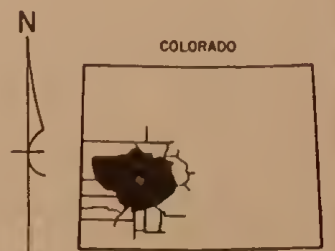


LEGEND

- CITIES AND TOWNS
- RESERVOIR
- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- COUNTY LINE
- IRRIGATED AREAS

TYPES OF FARMING

- LIVESTOCK RANCHES - MEADOW HAY & GRAZING
- LIVESTOCK FARMS - GRASS HAY & ALFALFA
- LIVESTOCK & GENERAL CASH CROPS
- FRUIT & LIVESTOCK
- LIVESTOCK & FRUIT



TYPES OF FARMING
AND IRRIGATED AREAS
BY SUBBASINS
GUNNISON RIVER BASIN
COLORADO

SCALE 1 0 1 2 3 4 5 MILES

decreased 28 percent from 1944 to 1959. Average size of farms and ranches, value of land and buildings per farm, and average acreage irrigated have all increased considerably. Thus, fewer farmers are operating larger farms with a larger investment than any time since 1944. Irrigated farms comprise 96 percent of all farms. Tenancy decreased from 18 percent in 1944 to 9 percent in 1959 (table 4).

Markets

Most of the cattle sold from the Gunnison Basin are calves. They are sold to contract buyers who ship them by truck to the Midwest for feeding. A few of the calves are fed out locally in the lower elevations where winters are more moderate. Still others go to feed yards in Arizona, Utah, California and in other areas of Colorado

Fruit is next in importance to livestock in sales. Apples and peaches move principally by truck to New Mexico, Oklahoma and western Texas. Only the better grades can stand the cost of shipping such a long distance, and, too, they arrive in better shape than poorer grades.

Southwestern States, including Texas, buy most of the dry beans produced in the Montrose-Delta area. Sugar beets are processed at the local factory in Delta. Denver constitutes the market for vegetables produced and it is also the best market for meadow hay grown in the Upper Gunnison Subbasin. Alfalfa hay, most of the meadow hay and feed grains are fed in the Basin. Corn is shipped to Utah, Nevada, New Mexico, and Texas. Moravian (malting) barley is grown for the Coors Distillery at Golden, Colorado.

Transportation

The main line of the Denver and Rio Grande Railroad passes through Grand Junction. A branch extends to Montrose and Ridgway and also connects with Paonia and Somerset.

Transcontinental U. S. Highway 50 extends from the eastern edge of the Basin to Grand Junction on the west. U. S. Highway 550 provides a route from Montrose to Durango and points west and south. Many state highways intersect the Basin and provide adequate transportation facilities.

Relationship Between Irrigated Lands and Rangelands

Most of the cattle ranchers are dependent upon national forest lands and national land reserve for their dry range. Most ranchers with grazing permits have the same number of beef cows for their breeding herd as their permitted number on the National Forest. Thus, meadow hay supplies the dry winter feed while irrigated pasture and field residue supply the remaining feed that the Federal range cannot.

Ranchers in the Basin estimate the average value of a cow permit at \$400 per animal, which includes the value of livestock and other ranch property.

Likewise, irrigated meadow hay land is valued at \$200 per acre, which includes livestock permits, the value of livestock, and other ranch property. About two acres of meadow hay are required for each cow permitted on the forest. Thus, values of irrigated meadow hay land and national forest permits complement each other because neither is worth proportionately as much alone.

Comparison of Acreage Irrigated and Water Supply

Water supply refers to the total water resources of the Basin rather than the direct seasonal supply needed for irrigated land. As such, it has amounted to 1-3/4 million acre-feet average in excess of crop and other uses within the Basin. Most of the water has not been available for direct irrigation when needed because of lack of reservoir storage and consequent regulation of streamflow. However, for comparative purposes, acreage irrigated was collated with water supply.

Two consecutive 7-year periods, 1943-49 and 1950-56, were selected for comparison. Acreage irrigated in 1950-56 averaged 91 percent of the 1943-49 period, while water supply in 1950-56 averaged 75 percent of the 1943-49 period (combine table 3 and figure 1). There were greater relative annual fluctuations in water supply than in acreage irrigated, but a definite relationship existed between them.

Acreages of small grains, potatoes, beans, hay, fruit and vegetables were smaller in 1950-56 than in 1943-49. Acreage of irrigated pasture was larger (table 3).

COMPARISON OF CUMULATIVE ACREAGES OF CROPS HARVESTED AND IRRIGATED PASTURE WITH WATER SUPPLY, GUNNISON RIVER BASIN, COLORADO, 1943-1960.

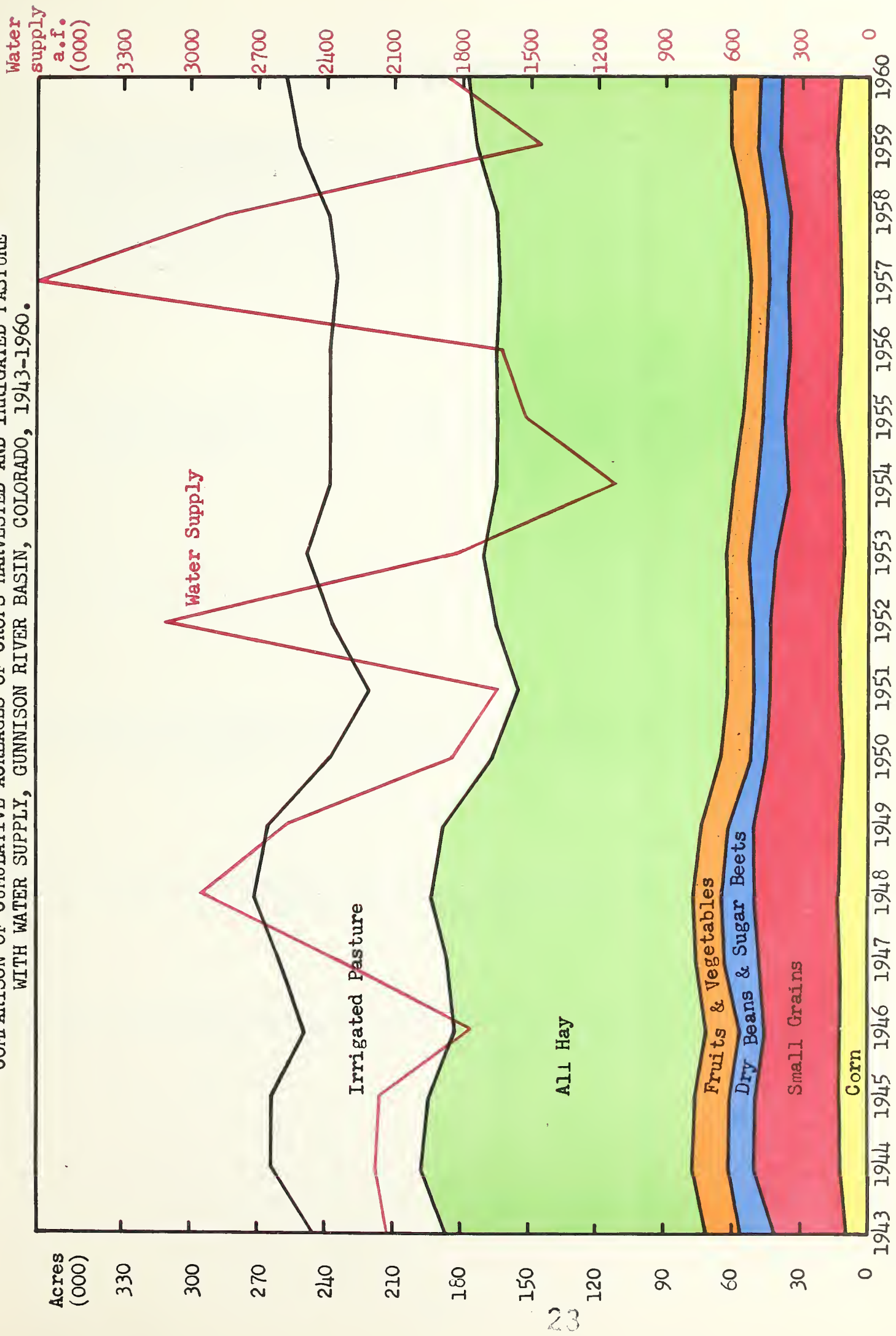


FIGURE 1

GUNNISON RIVER SUBBASIN REPORTS

To facilitate the analysis and presentation of data, the Gunnison River Basin was divided into five subbasins. These subbasins were delineated because of the nature of their individual water and related land resource problems. Soils, vegetation, water supply, present water use, economic development, and potential water development possibilities and related water requirements are discussed for each of the subbasins. The subbasins are delineated on the project location map following page 24 and are described as follows:

Upper Gunnison Subbasin

This subbasin includes the drainage area of the Upper Gunnison River above the Gunnison Tunnel midway in Black Canyon. Major streams include the Taylor, East and Lake Fork Rivers, Cebolla, Cochetopa, Tomichi, Quarts and Ohio Creeks.

Smith Fork-Crystal Subbasin

This subbasin includes the drainage area of the Smith Fork, Iron and Crystal Creeks.

North Fork Subbasin

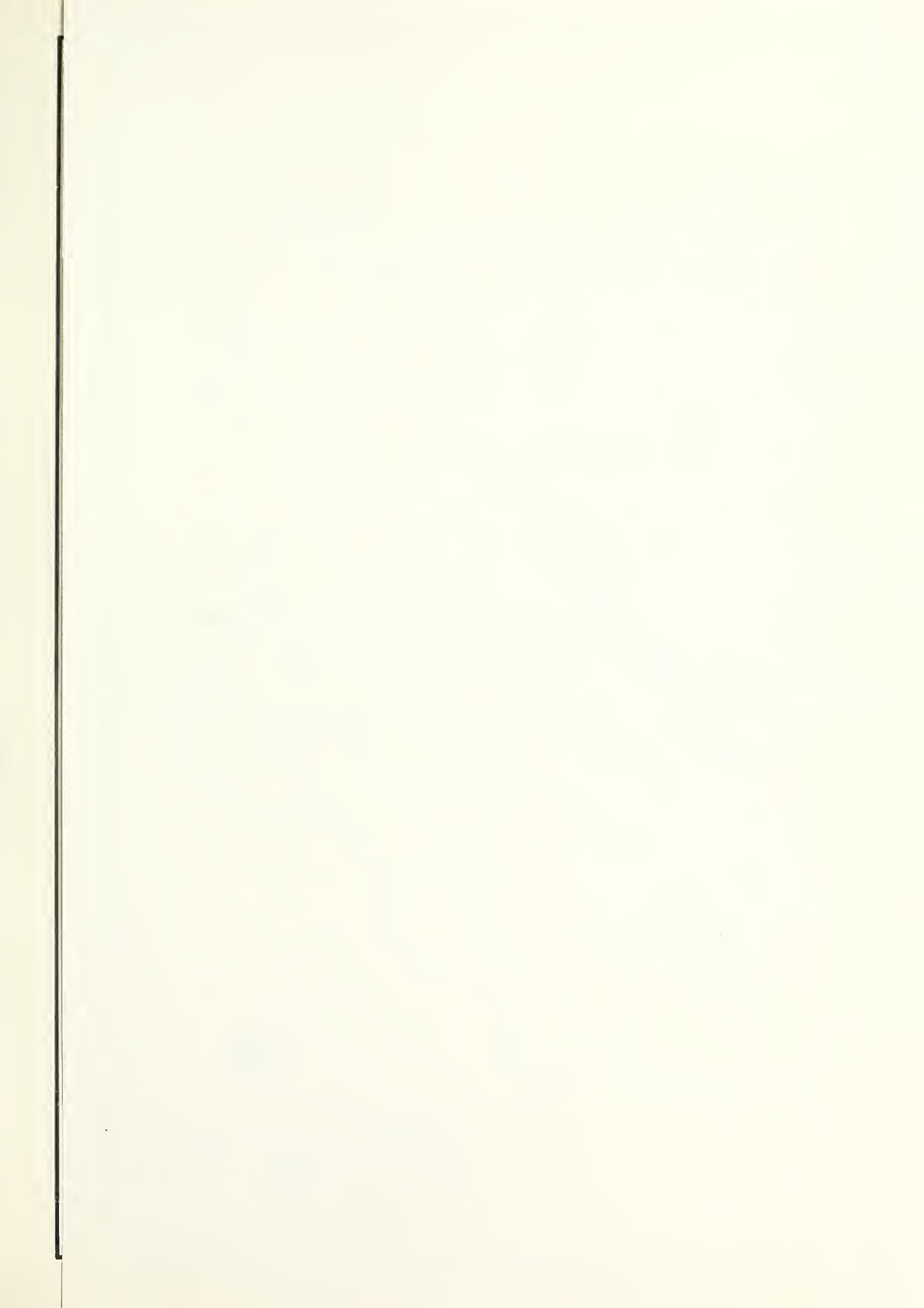
The drainage area of the North Fork of the Gunnison River and tributaries, and Leroux, Carrant, Surface and Tongue Creeks, are included in this subbasin.

Uncompahgre Subbasin

The drainage area of the Uncompahgre River and tributaries, and the drainage area of Roubideau Creek, are included in this subbasin.

Whitewater Subbasin

The drainage areas of Escalante, Dominiguez, Northeast, Whitewater and Kahnah Creeks are included in this subbasin.





LEGEND

- CITIES AND TOWNS
- DIVERSION
- RESERVOIR
- BASIN BOUNDARY
- - - SUB-BASIN BOUNDARY
- - - COUNTY LINE

MAJOR PROJECTS (U.S.B.R.)

Authorized

- 1. Paonia
- 2. Smith Fork

Reported

- 3. Fruitland Mesa
- 4. Bostwick Park

Under Investigation

- 5. Ohio Creek *
- 6. Almont
- 7. Quartz Creek
- 8. Dallas Creek
- 9. Grand Mesa

USDA PROJECT POSSIBILITIES

- 10. Long Branch
- 11. Needle Creek
- 12. Pass Creek
- 13. Castle Creek *
- 14. Brush Creek
- 15. Farris Creek
- 16. Henson Creek
- 17. Horsefly Creek
- 18. Dolores Creek
- 19. Happy Canyon
- 20. Spring Creek
- 21. Shavano Valley
- 22. Dry Creek
- 23. Sandy Creek
- 24. Roatcap Wash
- 25. Sumner Draw
- 26. Buttermilk Wash
- 27. Montrose Arroya

* Alternate possibilities.

**PROJECT LOCATION MAP
GUNNISON RIVER BASIN
COLORADO**

SCALE: 1 0 1 2 3 4 5 6 MILES

UPPER GUNNISON SUBBASIN

Physical Description of Subbasin

The Upper Gunnison Subbasin includes the drainage area of the Upper Gunnison River above the Gunnison Tunnel midway in Black Canyon. The eastern boundary is the Continental Divide and the western boundary the drainage divide between Cimarron Creek and the Uncompahgre River and between Mesa and Crystal Creeks. The elevation ranges from 7,500 to 13,000 feet.

Soils

Four of the major soil groupings are recognized in this subbasin: 2. Brown-Chestnut, 3. Mountain Prairie-Chestnut, 4. Gray Wooded-Brown Podzolic-Mountain Prairie, and 5. Alpine Meadow-Alpine Bog. These groupings are discussed in the general description of the Gunnison River Basin. The irrigated acreage in this subbasin is primarily located in soil groupings 2 and 3. Acreage of the great soil groups within these groupings and distribution of this acreage by irrigated land and vegetative types is given in table 5.

Land Use, Cover Conditions and Management

The Upper Gunnison Subbasin has a total area of 2,529,684 acres, or 49 percent of the Gunnison Basin and contains approximately 72,000 acres of irrigated land, which represents 27 percent of the irrigated lands in the Basin. These irrigated lands vary in elevation from approximately 7,000 to 9,000 feet, and have a precipitation range from about 10 inches to 20 inches annually. The frost-free season of about 70 days limits production to short-season crops. The majority of the irrigated land is used for the production of legume-grass hay. Very little alfalfa or clover is grown except as a minor percentage of the hay meadow composition. Grass hays are frost resistant and will grow over a longer time, thus having a favorable yield advantage.

Nonirrigated lands represent 97 percent of the acreage within the subbasin. These lands are used primarily for watershed, recreation, range forage for both livestock and wildlife, timber production and other watershed purposes. Three percent of the subbasin lands are used for irrigated forage production.

Irrigated lands within the subbasin generally have ample water supplies during the early part of the irrigation season, but are subject to shortages in the late season. Much of the irrigated land along the stream bottoms is flooded for weeks during the spring runoff period. Generally the unregulated irrigation water supply has restricted crops to low yielding sedge and wire-grass hay. High yields of good quality hay could be produced by land development and improved management of irrigation water. Other management practices such as drainage, application of fertilizer, seeding of improved hay mixtures and control of approximately 4,000 acres of phreatophytes would increase crop production in applicable areas.

Condition and productivity of the range lands within the subbasin have declined for many years, but now appear to have stabilized or to be improving. The Bureau of Land Management and the Forest Service have made range analysis studies and are adjusting stocking to sustained forage production. Private rangelands have received additional grazing pressure due to reduction in Federal Range Permits, but now are being treated for improvement. It is estimated that approximately 100,000 acres of sagebrush land within this subbasin could be treated for brush control. However, adequate measures would be required to preserve big game winter range and sage grouse habitat. Stock water, fencing, deferred grazing and proper stocking are also needed to improve range forage production.

The high elevation lands, particularly those within the National Forest, are managed under the Multiple Use Concept. This concept provides that no one use will be promoted to the detriment of other uses. These various uses include production of water, timber, range, wildlife and recreation. The Alpine Zone is managed for production of water and forage; wildlife and recreation uses are administered to enhance water production. Timber is produced below the Alpine Zone and overlaps with range use.

On the national forests, there are 717,000 acres producing commercial forest products. Smaller timber areas also occur on the national land reserve and privately-owned lands within the subbasin. An estimated 2 billion board-feet of timber ready for harvesting is growing in the Upper Gunnison area. The Gunnison National Forest currently has 160 million board-feet under contract for cutting with several million board-feet in prospect for sales in the near future. Much land now covered with oak brush can be made productive by reforestation. There are 34,000 acres of national forest land in the Upper Gunnison Subbasin suitable for tree planting.

Cover conditions from a watershed standpoint appear to be generally fair to good above 9,000 feet, but appear poor to fair in the lower area. The higher area includes the Alpine Zone with little timber and the spruce-fir zone where timber is the predominant cover. Lower zones are predominantly sagebrush-grass combinations. Almost all of the water yield comes from above the 9,000 feet elevation.

Sediment generally comes from the lower zones where cover is less effective. Runoff from these areas is low, due to the limited precipitation. Sediment yield is quite low within the subbasin. Summer storms, which account for very little water production, deposit sediment in streams.

Recreation

The Upper Gunnison Subbasin is an area of outstanding outdoor recreational appeal. This outdoor playground ranges from the world-famous fishing in the Gunnison River to mountain climbing among the high scenic peaks of the Rocky Mountains. Recreation is becoming a year-round activity, with skiing at Crested Butte and Monarch Pass. Both deer and elk are plentiful, and fishing is good. In 1960, 25,000 hunters and 80,000 fishermen utilized these resources. Reservoir development may have a detrimental effect on the habitat conditions that maintain fish and game unless compensatory measures are taken.

Recreation use in this subbasin is heavy. Use on the national forest for hunting, fishing, camping, picnicking and sight seeing amounted to about 650,000 man-days in 1961; it is estimated that the total recreation use in the subbasin amounts to about 870,000 visitor-days annually.

The reservoirs of the Curecanti project will attract additional visitors for camping, picnicking, boating and fishing; this increased use is expected to amount to 550,000 visitor days. The proposed Silver Jack Reservoir on the Big Cimarron and Soap Park Reservoir on Soap Creek will attract an additional 64,000 visitor-days use.

The trend of increasing outdoor recreation use will continue. It is estimated this use will triple by 1976 and increase another 250 percent by the year 2000.

Land Status

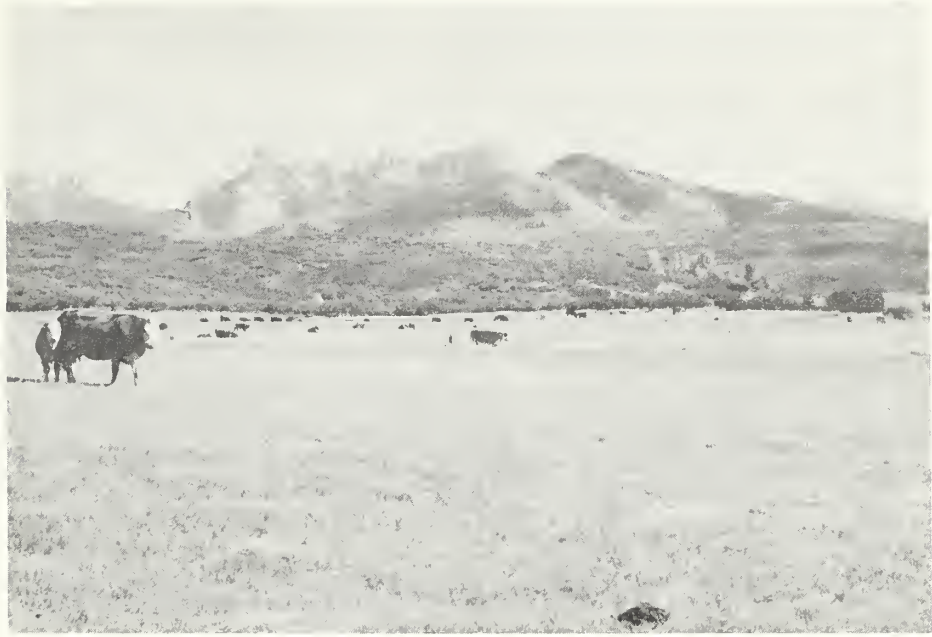
Table 6. - Land ownership, Upper Gunnison Subbasin, Gunnison River Basin

Class of Ownership	Acres	Percent
Federal		
National Forest ^{1/}	1,387,969	55
National Land Reserve ^{1/}	607,159	24
State of Colorado	18,448	0.7
Colorado Fish and Game	4,200	0.3
Private	<u>511,908</u>	<u>20</u>
Total	2,529,684	100.0

^{1/} Bureau of Reclamation withdrawal land included.

Water Supply

Irrigation water developments in the Upper Gunnison Subbasin are largely confined to the construction of dams and canals for the diversion of the natural streamflow. Very little reservoir storage has been developed. The Taylor Park Reservoir on the Taylor River and Lake San Cristobal on the Lake Fork, are the only reservoirs in the subbasin with over 1,000 acre-feet storage capacity. Taylor Park Reservoir has a capacity of 106,200 acre-feet. Water from this reservoir is used for irrigation on lands in the Uncompahgre project. Lake San Cristobal was originally developed for power purposes. At the present time it is used exclusively for recreation. Total capacity is approximately 9,800 acre-feet, most of which is contained



Cattle grazing crop aftermath
Gunnison River Basin



Meadow hay lands - Gunnison River Basin

in the natural lake basin. In addition, a few small reservoirs, serving private irrigation developments, constitute the remainder of the water storage facilities in this subbasin.

Except for the limited streamflow regulation provided by the reservoirs mentioned above, the entire water supply for the Upper Gunnison Subbasin comes from the natural flow of the principal streams of the subbasin. This usually is more than adequate to meet all needs for the subbasin during the spring snowmelt season. Large volumes of water are discharged downstream during this period, but once the snowmelt runoff has occurred, the streamflows rapidly diminish until many areas of the Upper Gunnison Subbasin are faced with water supplies that are not adequate to meet the irrigation requirements during the latter part of the irrigation season. There are a number of water development possibilities in the subbasin that would serve to reduce or eliminate the water-supply shortages resulting from the reduced streamflows during late summer. These project possibilities will be discussed in a succeeding section of the report.

The Tomichi Creek and Cochetopa Creek drainage areas are located in an area of apparent precipitation shadow, northeast of the high San Juan Mountains. These areas have the lowest precipitation of the entire Upper Gunnison Subbasin, and concomitantly the lowest unit runoff yield of the subbasin. Water shortages are more severe in these drainages and frequently exceed 50 percent of requirements. The common late-season deficiencies in water supply severely restrict the production of the area. There are several project possibilities that would augment the water supply, either by storage within the drainage areas or by importation of water from better supplied streams elsewhere in the subbasin.

In the Ohio Creek drainage, late-season requirements are often in excess of available streamflows. The frequency and severity of the resulting shortages is not as great as in the Tomichi Creek and Cochetopa Creek drainage areas. There are several alternate possibilities for project developments that would fully meet all the late-season water requirements for this part of the subbasin.

Considerable volumes of water are exported from the subbasin to the Uncompahgre Subbasin. In addition, small amounts of water are exported outside of the Gunnison River Basin to the headwaters of the Rio Grande and the Arkansas River Basins. A small ditch near Crested Butte, which formerly imported limited amounts of water from the Roaring Fork River Basin, has been inoperative for several years and it is doubtful if there will be any future importation of water into the subbasin.

The undepleted water supply of the Upper Gunnison Subbasin is summarized in table 7.

Table 7. - Water supply, Upper Gunnison Subbasin, 1943-60 average ^{1/}

Direct flow average	1,189,400 acre-feet
Cimarron Ditch	24,400 acre-feet
Transmountain Diversions	400 acre-feet
Upper basin consumptive use	<u>57,281</u> acre-feet
Subbasin Total	1,271,481 acre-feet

^{1/} Including Cimarron Ditch and Uncompahgre Tunnel diversions, which comprise part of the water supply for the Uncompahgre Subbasin.

Present Water Use

The dominant present use of water within the subbasin is for irrigation. Climatic conditions limit the crops grown to those adapted to short-growing seasons and cool weather, primarily grass hay and meadows. Industrial installations consist of a few coal mines and small saw mill operations, and the uranium processing plant at Gunnison. Industrial consumptive use is negligible. Gunnison and Crested Butte are the only towns of any size.

Net consumptive use by crops on irrigated lands and consumptive uses on adjacent water using areas incidental to use and development of the lands have been estimated by the Blaney-Criddle procedures. Minor uses, including municipal, domestic and livestock use and reservoir evaporation, have been estimated from tabulations from appropriate sources. Direct exports of water from the Gunnison River Basin to the Rio Grande River and Arkansas River Basins have averaged near 400 acre-feet annually. Exports from the Upper Gunnison Subbasin to other subbasins have not been considered as water use in the Upper Gunnison Subbasin.

Estimates of the present water-supply depletions in the subbasin are summarized in table 8.

Table 8. - Present water use, Upper Gunnison Subbasin, 1943-60 average

Net crop consumptive use <u>1/</u>	46,806 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands and incidental areas	5,848 acre-feet
Municipal, domestic and livestock use, reservoir evaporation and recreation	4,627 acre-feet
Transmountain diversions <u>2/</u>	<u>400</u> acre-feet
Subbasin Total	57,681 acre-feet

1/ 72,000 acres

2/ Not including within-basin exports from subbasin.

Agricultural Economy

Cattle ranching dominates practically the entire agricultural industry in the Upper Gunnison Subbasin. Sheep ranching occupies a minor role. The area is ideally located for the production of livestock. Large tracts of land in the upper reaches of the Basin provide excellent summer grazing. Meadow hay is produced in the valleys for winter feed and irrigated pasture supplements the intermediate areas for spring and fall grazing.

Sources of agricultural production data and procedures have been discussed on page 17. In addition, data from two ranch interviews in the subbasin have been used.

Agricultural Production

Annual data for crop acreages, production, and values were compiled for the 1943-60 period because satisfactory water supply data were available for that period only. Averages for 1943-49 and 1950-56 show trends within the 1943-60 period (table 9).

All hay acreage averaged about 70 percent of the total irrigated land for the 1943-60 period and irrigated pastureland averaged about 29 percent. Alfalfa and small grains comprised a very small acreage because of the high altitude, short growing season, and the general severity of the climate. Average irrigated acreage of the Upper Gunnison Subbasin for the 1943-60 period has been estimated at 72,000 acres.

Table 9.- Average acreage, total production, and gross value of crops harvested in Upper Gunnison Subbasin, Colorado, 1943-49, 1950-56 and 1943-60

Crops	Unit	1943-49		1950-56		1943-60	
		Average	Percent of total	Average	Percent of total	Average	Percent of total
All hay							
Harvested	Acres	53,418	71.24	47,564	69.39	49,710	70.00
Production	Tons	74,422		62,627		67,893	
Value	Dollars	1,053,447		1,342,942		1,227,835	
Other crops ^{1/}							
Harvested	Acres	927	1.24	544	.79	626	.88
Value	Dollars	39,526		20,413		25,761	
Total crops							
Harvested	Acres	54,345	72.48	48,108	70.18	50,336	70.88
Value	Dollars	1,092,973		1,363,355		1,253,596	
Other land irr.	Acres	20,632	27.52	20,437	29.82	20,675	29.12
Total land irr.	Acres	<u>2/74,977</u>	100.00	<u>2/68,545</u>	100.00	<u>2/71,011</u>	100.00

^{1/} Includes corn, small grains and potatoes.

^{2/} Excludes irrigated land not harvested and not pastured.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agri.

Currently there are 87 Forest Service permits for cattle. Cattle number 17,797 head and usually graze from June 15 to September 30 for a total of 60,365 animal-unit months. Sheep ranches have 30 permits to graze 27,541 sheep from July 10 to September 15 for a total of 12,123 animal-unit months.

Bureau of Land Management permits total 114 for cattle ranches headquartered in the subbasin, with 37,944 animal-unit months of grazing. Sheep permits number 11 for ranches headquartered in the subbasin, with 3,389 animal-unit months of grazing.

Number of cattle, tons of all hay, and acres of irrigated pasture are a few of the items presented in table 10 for census years 1944-59. Cows and heifers that have calved remained fairly constant in numbers from 1944 to 1959. Milk cows decreased from 1,112 in 1944 to 400 in 1959, thus increasing the number of range cows by about 10 percent. Tons of all hay and acreage of irrigated pasture decreased from 1944 to 1959, but there is still more than adequate feed for the livestock and some hay is sold outside the subbasin.

A comparison of the value of farm products sold by source and value of crops harvested can be made from table 10. The greatest spread in value of farm products sold and value of crops harvested occurred in 1949 followed by 1959 when prices of cattle and calves were relatively higher than all hay prices. All hay constituted more than 95 percent of the value of all crops harvested. Sale of livestock and livestock products, other than poultry and poultry

Table 10.- Cattle numbers, value of farm products sold by source, value of crops harvested, and other selected items, Upper Gunnison Subbasin, Colorado, census years 1944-59

Item	: Unit	: 1944	: 1949	: 1954	: 1959
Cattle and calves	Number	<u>1</u> /34,447	<u>2</u> /34,495	47,261	44,482
Cows and heifers					
that have calved	Number	<u>1</u> /20,339	<u>2</u> /18,886	22,036	21,350
Milk cows	Number	<u>1</u> / 1,112	<u>2</u> / 980	696	400
All hay harvested	Acres	54,428	57,338	46,332	45,308
Production of all hay	Tons	75,510	72,466	63,637	65,359
Irrigated pasture	Acres	22,660	19,692	21,608	20,298
Total irrigated land <u>3</u> /	Acres	77,782	77,940	68,510	65,776
Value of farm products sold by source:					
Field crops	Dollars	85,113	118,929	106,266	146,835
Vegetables	Dollars	1,452	466	0	0
Fruits and nuts	Dollars	0	0	0	0
Forest products and hort. specialties	Dollars	1,091	1,624	9,586	5,362
Poultry and poultry products	Dollars	11,260	7,844	7,167	1,896
Dairy products	Dollars	77,203	62,826	37,390	38,813
Livestock and livestock products <u>4</u> /	Dollars	1,574,222	2,976,481	2,136,929	3,079,633
Total farm products	Dollars	1,750,341	3,168,170	2,297,338	3,272,539
Value of crops harvested	Dollars	970,271	1,087,544	1,280,145	1,459,029
Value per acre	Dollars	18	19	27	32
Crop acreage harvested	Acres	55,122	58,248	46,902	45,478
Total farms	Number	295	237	253	186
Average size of farms and ranches	Acres	921	1,324	1,402	1,544
Value of land and buildings per farm	Dollars	16,895	53,879	81,017	106,190
Proportion irrigated farms of all farms	Percent	NA	94	94	96
Average acreage irrigated per farm	Acres	264	329	271	354
Proportion of tenancy	Percent	10	5	4	4

1/ January 1, 1945.

2/ April 1, 1950.

3/ Excludes irrigated land not harvested and not pastured.

4/ Exclusive of poultry and poultry products and dairy products.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agriculture.

products and dairy products, comprised 90 percent or more of all farm products sold. Even in 1954 and 1944 it was profitable to market the meadow hay through range cattle, thereby utilizing irrigated pasture and making nonirrigated grazing permits more valuable.

Value per acre of crops harvested has increased since 1944 while crop acreage harvested has decreased. Total farms decreased from 295 in 1944 to 186 in 1959. Average size of farms increased from 921 acres in 1944 to 1,544 acres in 1959, and value of land and buildings per farm increased from \$16,895 to \$106,190. The average acreage irrigated per farm increased from 264 in 1944 to 354 in 1959, while proportion of tenancy decreased (table 10).

Markets and Transportation

Most of the cattle are sold as calves from the Upper Gunnison Subbasin. They are sold to contract buyers who ship them by truck primarily to the Midwest for feeding. No calves are fed out locally because the winters are too severe at elevations of 7,000 to 9,000 feet and economical gains would be impossible under normal conditions.

Relationship Between Irrigated Lands and Rangelands

Most of the cattle ranchers are dependent upon national forest lands and the national land reserve for their dry range. Most ranchers with grazing permits have the same number of beef cows for their breeding herd as their permitted number on the national forest. On the average, cattle are grazed on meadow from May 15 to June 15, on nonirrigated range from June 16 to September 30, and on meadow and field residue from October 1 to November 30. They are dry fed on permanent meadow from December 1 to May 15.

Comparison of Acreage Irrigated and Water Supply

Water supply refers to the total annual water resources of the subbasin rather than the direct seasonal supply needed for irrigated land. Most of the water has not been available for direct irrigation when needed because of lack of reservoir storage and consequent regulation of streamflow. However, for comparative purposes, acreage irrigated was collated with water supply.

Two consecutive 7-year periods, 1943-49 and 1950-56, were selected for comparison. Acreage irrigated in 1950-56 averaged 91 percent of the 1943-49 period, while water supply in 1950-56 averaged 68 percent of the 1943-49 period (combine table 9 and figure 2). A general relationship existed between acreage irrigated and water supply for the two periods, even though there were greater relative annual fluctuations in water supply. Acreage of irrigated crops averaged less in 1950-56 as compared with 1943-49, but acreage of irrigated pasture remained constant.

Direct Agricultural Benefits Anticipated from Water Resource Development

Two ranchers in the Upper Gunnison Subbasin were interviewed to determine the benefits which might be expected from storage of late season water. One of the ranchers built two storage reservoirs which provide adequate water for the entire season, even in drought years. He built one reservoir in 1950 on Los Pinos Creek and the other on an off-channel site in 1954.

Flow of water in the creek usually drops to a negligible amount by about July 1. During years of ample water he has noticed no difference in meadow hay yields, but during the drought years of 1951-56, he feels very little, if any, hay could have been harvested without the supplemental water provided by the reservoirs. An additional 100 acres of meadow hay has been planted since the second reservoir has been installed and total production of meadow hay increased from 750 tons average before reservoir construction to 1,200 tons average after construction. He attributes this increase to better water control and use of fertilizer where needed. Grass starts earlier in the spring with fall irrigation and requires less water, because shade retards direct evaporation from the soil. Additional pasture in the fall has also been made available.

The other rancher interviewed farms on Hot Springs (Juanita) Creek. Prior to construction of the reservoir, water ran out by July 1 in normal years and by June 15-20 in dry years. There has been no shortage of water since construction of the reservoir in 1958. He reported the supplemental water has increased meadow hay yields from 1 ton per acre before construction of the reservoir to 1½ tons per acre afterwards, and has tripled pasture yield by providing additional fall and early spring pasture. Control of the water is possible now and the fall irrigation gives earlier growth in the spring. Before the reservoir was constructed, he irrigated continuously while water was available. Now it is possible to irrigate in accordance with crop needs.

Potential Water Requirement

There are a number of potential water development project opportunities in the Upper Gunnison Subbasin. The two most important are the Ohio Creek-Castle Creek and the Tomichi Creek-Quartz Creek projects, both currently under investigation by the Bureau of Reclamation. These projects would provide a full water supply for much of the land now having only a short season supply and for additional acreages of new irrigated land. There are additional smaller projects within the subbasin which would supplement the water supply for most of the remaining lands currently needing additional late season water, and for a small acreage of new lands. These additional projects appear to warrant further investigation to determine economic feasibility, and are discussed in more detail in a succeeding section of this report. The water supply in the subbasin is adequate to meet the potential project requirements. Full development of the potential projects, if economically feasible, would fulfill the water requirements for essentially all of the present and approximately 13,350 additional acres of proposed irrigated lands of the Basin.

COMPARISON OF CUMULATIVE ACREAGES OF CROPS HARVESTED AND IRRIGATED PASTURE WITH WATER SUPPLY, UPPER GUNNISON SUBBASIN, COLORADO 1943-1960



FIGURE 2

The Curecanti project, a major water and power development for the Upper Colorado River Basin project, is currently under construction by the Bureau of Reclamation within the subbasin. This project will furnish major regulation for the flows of the Upper Gunnison River and will provide for the generation of a substantial block of electrical energy. It is anticipated that completion of this project and its reservoirs will have a major impact on the economy of the Gunnison River Basin, especially the recreation use of Basin lands.

The Curecanti project will consist of several dams and power plants located along the Gunnison River and will form a series of reservoirs extending downstream from near the town of Gunnison to a point about midway through the Black Canyon. The water storage and streamflow regulation provided by the reservoirs will make increased water supplies available for use within the Uncompahgre and lower subbasins as required, and through exchange will permit the use in the Upper Gunnison Subbasin of additional water now reserved for downstream users having higher water right priority. About 3,450 acres of presently irrigated land in the Upper Gunnison Subbasin will be flooded by the upper reservoir of the Curecanti project.

Total net crop consumptive use requirements for full potential project development within the subbasin has been estimated by the Blaney-Criddle procedures. Overlapping or duplication between possible project areas has been resolved and acreages of presently cropped lands which will be flooded by authorized or potential projects have been deleted. Increases in municipal and domestic uses, evaporation from authorized or proposed reservoirs, expanded recreation, fishing and wildlife activities, and other minor uses have been estimated. It has been assumed that the transmountain diversions outside of the Basin will remain relatively constant.

Total potential water requirements, or water-supply depletions in the subbasin are summarized in table 11.

Table 11. - Potential water requirement, Upper Gunnison Subbasin ^{1/}

Net crop consumptive use ^{2/}	66,858 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands and incidental areas	6,932 acre-feet
Municipal, domestic and livestock uses, reservoir evaporation and foreseeable recreation development	27,992 acre-feet
Transmountain diversions ^{3/}	<u>400</u> acre-feet
Subbasin Total	102,182 acre-feet

^{1/} Exclusive of industrial requirements.

^{2/} 85,350 acres, including potential project development.

^{3/} Not including within-basin exports from subbasin (Cimarron Ditch, Gunnison Tunnel and proposed Soap Park-Fruitland Mesa diversion).

Table 12. - Projects that appear to have P. L. 566 project possibilities, Upper Gunnison River Subbasin, Gunnison River Basin. *

Name	Location	Approximate Drainage :		Approximate Size	Potential water: Potential land to be stored :	Remarks
		Area - Acres	Structure :			
Long Branch Reservoir	Sec. 28, T48N, R5E Gunnison County	14,600	52,600	1,600-2,000 acre-feet	Could be used on 2,000 acres of presently irrigated and new land on Tomochi Creek between Long Branch and Quartz Creek	Local interest inactive at present time. Site would be inundated by Bureau of Reclamation proposed Monarch Reservoir. Private individuals appear willing to sponsor this project if B/R project is abandoned.
Needle Creek	Sec. 8, T47N, R4E	7,600	30,900	750-1,000 acre-feet	Could be used on 1,000 acres new land and/or 2,500 acres presently irrigated land	An organized group of water users appears willing to sponsor this project. Not currently active - may be waiting on B/R project activity in the Gunnison Basin.
Pass Creek	Sec. 33, T14S, R87W	4,700	7,600	600-900 acre-feet	1,200 acres on Pass Creek and Ohio Creek lands	May be affected by proposed Castle Creek project. Private individuals appear willing to sponsor project.
Castle Creek	Sec. 9, T15S, R87W	10,300	42,800	1,000-3,000 acre-feet	Could be used on 3,000 acres of new land along Ohio Creek and/or 3,000 acres presently irrigated land	An organized water users' group appears willing to sponsor this project. Also known as the Ohio Creek Bureau of Reclamation project. This smaller project is an alternate to the Bureau of Reclamation project.
Brush Creek	W½ Sec. 23, T13S, R85W	16,400	18,700	1,500-3,000 acre-feet	Supplemental irrigation water for 3,400-6,000 acres along East Gunnison River	An organized group appears willing to sponsor this project. Tentative plans being prepared.
Farris Creek	W½ Sec. 3, T14S, R85W	3,500	7,500	1,200-1,500 acre-feet	950 acres supplemental, 300 acres new land	Two or more private individuals appear to be willing to sponsor the project.
Henson Creek	T43N and T44N, R4-5-6W, Hinsdale County	-	52,200	-	-	The purpose of this proposal is flood protection for the town of Lake City and the surrounding area of private land. Land status: 5,160 acres private, 29,500 acres B.L.M. and 17,540 acres Forest Service. Has good recreation possibilities.

* Determined by reconnaissance surveys, review of existing data and field interviews.

Opportunities for Developments Through Watershed
Protection and Flood Prevention and Other USDA Authorities

Possible P. L. 566 Projects

The Department of Agriculture is interested in determining opportunities where P. L. 566 and/or other USDA authorities can contribute toward the solution of the Basin's water and related land resource problems. Many of the problems in the Upper Gunnison Subbasin are of such a nature that P. L. 566 project-type action appears suitable.

Seven prospective projects are listed in table 12. In addition to the projects in the table, other P. L. 566 water development opportunities do exist. Some of these would involve reorganization of group irrigation systems, application of agricultural water management practices, and the construction of small irrigation storage reservoirs. Group type action has not been initiated and the nature of proposed projects will depend on the needs and desires of a qualified sponsoring group.

Project Development Opportunities Under Other USDA Authorities

In addition to the P. L. 566 project type opportunities mentioned above, many other group type water development possibilities are apparent. These projects generally are smaller in size and are of a type that could be assisted through the use of USDA programs and authorities other than P. L. 566. Assistance could include cost-sharing through use of ACP pooling agreements, FHA group water facility loans and group enterprise technical assistance through SCS. Ten of these prospective projects in this subbasin could store an aggregate of approximately 3,000 acre-feet of water. This water would be available to supply supplemental irrigation water to 1,600 acres of presently irrigated land and a full supply for part of the 2,800 acres of available new land. Some of these projects are identified as: Lost Canyon Creek, Alder Creek, Marshall Creek, Means Site on Tomichi Creek, Colemans, West Pass Creek, Cochetopa-Stewart Creek and others. More detailed studies will undoubtedly reveal additional project possibilities.

SMITH FORK-CRYSTAL SUBBASIN

Physical Description of Subbasin

The Smith-Fork Crystal Subbasin comprises the drainage area of the Smith Fork, Iron Creek and Crystal Creek. Elevations range from 5,500 to 12,000 feet.

Soils

Four of the major soil groupings are recognized in this subbasin:

1. Desert-Sierozen, 2. Brown-Chestnut, 3. Mountain Prairie-Chestnut, and 4. Gray Wooded-Brown Podzolic-Mountain Prairie.

The Brown-Chestnut soil grouping has the largest acreage (18,500 acres) of irrigated land in this subbasin. Most of this land is in the Bureau of Reclamation Smith Fork project. Also, most of the area in the proposed Bureau of Reclamation Fruitland Mesa project is in this grouping. Acreage of the great soil groups within the major groupings and distribution of this acreage, by irrigated land and vegetative types, is given in table 13.

Land Use, Cover Condition and Management

The Smith Fork-Crystal Subbasin has 19,000 acres of irrigated land within its boundaries. This amount represents 7.2 percent of the irrigated land in the Gunnison Basin. The remaining land is used for livestock range, wood products, recreation and maintenance of the wildlife resources.

The irrigated land generally has topography that is steep and rolling. Climate is typically high altitude with a frost-free season varying from 110 days to 145 days in the areas where irrigation farming is practiced.

Irrigated farming has been quite restricted due to the effects of climate and distribution of irrigation water. Alfalfa and legume grass, hay or pasture and small grain have been the principal crops grown. These crops are used as a feed base to support a livestock operation. Yields have been low due to shortage of late season irrigation water. Most land and irrigation improvements have been limited as development is not feasible without a firm season-long water supply.

When presently proposed projects are completed, the land operators will need assistance in additional land development, such as limited land leveling, irrigation system improvement and waste water disposal. Farm operators will need to have additional assistance available to improve irrigation water management, crop rotation, fertilizer application, and time of hay cutting for best feed value. Cost sharing, technical and loan assistance will probably be required to carry out many improvements. Generally, operators are in good financial condition because many of them adjust their cost of operations and living standards in accordance with present yields and incomes. About 3,000 acres of phreatophytes could be replaced by usable forage.

The national forests and national land reserve provide forage for a large cattle industry. A few bands of sheep also use the area.

The Smith Fork Subbasin has roughly 300 million board-feet of timber growing and ready for cutting within its boundaries. All of this is within the Gunnison National Forest, which has about 38,000 acres of operable timber producing lands within the subbasin. Fifteen million board-feet of federal timber is presently under contract and is ready to cut. The present timber harvest is being hauled to Montrose with a little going to Hotchkiss for the local market. Ten thousand acres of the Smith Fork-Crystal Creek unit could be made productive forest by tree planting.

Cover conditions over the Smith Fork-Crystal Subbasin vary by great soil groups. Generally the vegetative cover is fair to poor in the spruce-fir, ponderosa pine-oak brush vegetative zone. The vegetative cover is sagebrush-grass, oakbrush-grass, conifer and aspen. Nearly all of these higher areas have an understory of grass or duff, thick enough to protect the soil from erosion. The lower elevation areas, which are predominantly the pinyon-juniper and the desert-shrub type vegetation, have cover ranging from poor to very poor in range condition. These areas have sheet and gully erosion and are adding sediment to irrigation storage reservoirs and irrigation systems, and the runoff is causing damage to irrigated land. Steps should be taken to manage the deteriorating areas to improve cover conditions.

Irrigation ditches, particularly in the Iron Creek drainage, have eroded to the place where many have abandoned one or more locations. The past practice has been to use natural drainageways for ditch location. These drainageways were not vegetated sufficiently to withstand irrigation ditch velocities. The resulting gullies have added sediment to reservoirs and irrigated lands below. Generally, the irrigation ditches are below the national forest boundary.

Most of the runoff comes from the high elevation lands in the national forest. This runoff is usually low in sediment; however, high water does some damage to irrigation ditch headings. Flash floods in the lower areas, particularly in the pinyon juniper and desert shrub zones, produce very little total volume of water but account for the majority of sediment. Considerable sediment will be trapped in the Crawford Reservoir and will not enter the Gunnison River.

Recreation

Outdoor recreation activity in the Smith Fork-Crystal Subbasin is light. Other than the Black Canyon of the Gunnison River, the subbasin has no unique areas of interest to attract large numbers of visitors from outside the Gunnison River Basin. Recreation use is mostly by local residents for general sightseeing, hunting, fishing and picnicking. However, some tourists from outside the Gunnison River Basin travel through Crawford to reach the north rim of the Black Canyon of the Gunnison National Monument.

At present, the Forest Service has one recreation development within the subbasin--the Smith Fork Campground on the Gunnison National Forest. The

National Park Service has developed several recreation areas, including picnic grounds, camp grounds and overlook spots for visitors to enjoy the spectacular Black Canyon of the Gunnison National Monument.

The Crawford Dam now under construction will create the 420-acre Crawford Reservoir. This will be the largest body of water in the subbasin and will attract additional visitors for boating, picnicking, fishing and sightseeing.

Current recreation use, including that for hunting and fishing, is estimated to be about 10,000 man-days annually. It is anticipated that this use will triple by the year 2000.

Land Status

Table 14. - Land ownership, Smith Fork-Crystal Subbasin, Gunnison River Basin

Class of Ownership	Acres	Percent
Federal		
National Forest ^{1/}	67,209	26.5
National Land Reserve ^{1/}	60,962	24.0
National Park	6,206	2.5
Private	118,966	47.0
Total	253,346	100.0

^{1/} Bureau of Reclamation withdrawal lands included.

Water Supply

Water supplies for the subbasin are derived from the natural runoff of the Smith Fork and Iron Creek, and diverted flows from Crystal Creek that are imported into the Basin and in part regulated by the Gould Reservoir. This reservoir is located on the Iron Creek drainage area and is currently the only irrigation reservoir in operation in the subbasin. It has a capacity of approximately 8,436 acre-feet and furnishes water to land on Fruitland Mesa.

With the exception of the storage provided by Gould Reservoir, there has been no streamflow regulation available in this subbasin and all irrigation water has accordingly been diverted from the natural stream flows. These streams drain watersheds in the West Elk Mountains and are largely fed by melting snows. Historically, available water has been in excess of requirements during the early part of the runoff season, but after the snowmelt has taken place the streamflow has diminished until it has been inadequate to meet the irrigation requirements of the subbasin. As a result, most of the lands



Sheep grazing on Gunnison National Forest lands.



Meadow hay harvest near Gunnison, Colorado.

have been subject to water-supply deficiencies of varying severity which have limited the production and restricted the choice of crops that could be grown. Economic development of the subbasin has been adversely affected.

The undepleted water supply of the subbasin is summarized in table 15.

Table 15. - water supply, Smith Fork-Crystal Subbasin ^{1/} 1943-60 average ^{2/}

Smith Fork ^{3/}	34,800 acre-feet
Iron Creek ^{4/}	6,100 acre-feet
Crystal Creek ^{5/}	<u>25,900</u> acre-feet
Subtotal, present supply ^{6/}	66,800 acre-feet
Proposed import from Upper Gunnison Subbasin ^{7/}	<u>47,000</u> acre-feet
Total ultimate supply	113,800 acre-feet

- 1/ Includes subbasin contributions to basin water supplies. Does not include main river flow adjacent to subbasin, local return flows, or direct accretions to main river flow, if any.
- 2/ Does not include potential increase by proposed project diversion from Soap Park in Upper Gunnison Subbasin.
- 3/ Includes Saddle Mountain, Gove and Pilot Rock Canals.
- 4/ Excluding return flow and irrigation waste, and imported water.
- 5/ Includes Dyer Fork and Crystal Valley ditches.
- 6/ Partly estimated by correlation.
- 7/ Proposed Fruitland Mesa Project.

Present Water Use

Present net consumptive use by crops has been estimated by the Blaney-Criddle procedures, with due allowance being made for seasonal water shortages. Estimates of acreages of riparian vegetation and other nonbeneficial phreatophytes were taken from the generalized soil and associated vegetation inventory. The consumptive use of these and other water using areas incidental to use and development of the lands were estimated. Estimates of use for municipal, domestic and livestock purposes, reservoir evaporation and recreation, fishing and wildlife were developed from appropriate sources.

Estimates of present water-supply depletions in the subbasin are summarized in table 16.

Table 16. - Present water use, Smith Fork-Crystal Subbasin, 1943-60 average.

Net crop consumptive use <u>1/</u>	20,948 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands and incidental areas	7,257 acre-feet
Municipal, domestic and livestock use, reservoir evaporation, and recreation	<u>572</u> acre-feet
Total	28,777 acre-feet

1/ 19,000 acres.

Agricultural Economy

Livestock farming is the dominant type of agriculture in the Smith Fork-Crystal Subbasin. Range cattle account for the major share of the livestock industry while sheep raising, dairying and hog raising are of minor importance. Most of the crops grown are for livestock feed.

Sources of agricultural production data and procedures have been discussed on page 17. In addition, data were used from the USDA report, "Reappraisal of Direct Agricultural Benefits and Project Impacts, Smith Fork Project, Colorado, May 1958."

Agricultural Production

Annual data for crop acreages, production and values were compiled for the 1943-60 period because satisfactory water supply data were available for that period only. Averages for 1943-49 and 1950-56 show trends within the 1943-60 period (table 17).

All hay acreage averaged about 40 percent of the total irrigated land from 1943-60 and irrigated pastureland averaged about 39 percent. Acreage of corn and small grains comprised most of the remaining 21 percent. Alfalfa hay acreage accounted for the largest percentage of individual crops harvested, amounting to about 32.5 percent of the total irrigated acreage. Average irrigated acreage of the Smith Fork-Crystal Subbasin for the 1943-60 period has been estimated at 19,000 acres.

Table 17.- Average acreage, total production and gross value of principal crops harvested in Smith Fork-Crystal Subbasin, Colorado, 1943-49, 1950-56 and 1943-60

Crops	Unit	1943-49		1950-56		1943-60	
		Average	Percent of total	Average	Percent of total	Average	Percent of total
Corn							
Harvested	Acres	1,336	7.00	1,332	7.64	1,346	7.35
Production	Bushels	56,513		59,923		68,489	
Value	Dollars	77,480		109,947		96,902	
Wheat							
Harvested	Acres	725	3.80	454	2.60	532	2.90
Production	Bushels	20,085		13,517		15,821	
Value	Dollars	33,583		26,448		27,873	
Oats							
Harvested	Acres	1,020	5.35	931	5.34	899	4.91
Production	Bushels	42,731		40,478		39,011	
Value	Dollars	33,119		35,240		31,330	
Barley							
Harvested	Acres	1,051	5.51	761	4.36	891	4.86
Production	Bushels	41,962		31,497		37,716	
Value	Dollars	47,002		38,404		40,678	
Potatoes							
Harvested	Acres	157	.82	38	.22	82	.45
Production	Bushels	33,092		11,892		19,349	
Value	Dollars	45,295		14,092		24,882	
Alfalfa hay							
Harvested	Acres	(6,192)	(32.45)	(5,421)	(31.08)	(5,973)	(32.61)
Production	Tons	(15,518)		(14,467)		(15,446)	
All hay							
Harvested	Acres	7,695	40.33	6,772	38.83	7,362	40.19
Production	Tons	17,922		16,901		17,812	
Value	Dollars	289,558		362,476		335,409	
Other field crops ^{1/}							
Harvested	Acres	29	.15	20	.11	23	.13
Value	Dollars	590		424		504	
Total crops							
Harvested	Acres	12,013	62.96	10,308	59.10	11,135	60.79
Value	Dollars	526,627		587,031		557,578	
Other land irr.	Acres	7,068	37.04	7,133	40.90	7,182	39.21
Total land irr.	Acres	<u>2/19,081</u>	100.00	<u>2/17,441</u>	100.00	<u>2/18,317</u>	100.00

^{1/} Includes rye and sorghum.

^{2/} Excludes irrigated land not harvested and not pastured.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agri.

Currently there are 22 Forest Service permits for cattle. Cattle number 2,385 head and usually graze from June 15 to September 30, for a total of 8,127 animal-unit months. Sheep ranches have five permits to graze 3,545 sheep from July 1 to September 15 for a total of 1,668 animal-unit months.

Bureau of Land Management permits total 18 for cattle ranches headquartered in the subbasin, with 1,652 animal-unit months of grazing. Sheep permits number 9 for ranches headquartered in the subbasin, with 1,416 animal-unit months of grazing.

Number of cattle, tons of all hay, and acres of irrigated pasture are a few of the items presented in table 18 for census years 1944-59. Numbers of cows and heifers that have calved increased from 4,376 in 1944 to 5,070 in 1959. During the same period milk cows decreased in number from 1,455 to 991. Beef cows and heifers that have calved increased in number from 2,921 head in 1944 to 4,079 in 1959, while tons of all hay produced remained about the same. Irrigated pasture acreage increased from 6,158 acres in 1944 to 7,847 acres in 1959. There usually is ample hay to meet the dry feed requirements after Federal permits, irrigated pasture, and field residue have furnished part of the feed supply.

A comparison of the value of farm products sold by source and value of crops harvested can be made from table 18. The greatest spread in value of farm products sold and value of crops harvested occurred in 1959, followed by 1949, 1954 and 1944. Prices for cattle and calves were relatively higher than all hay prices in the same sequence by census years. All hay constituted over 60 percent of the value of all crops harvested. Sale of live-stock and livestock products, other than poultry and poultry products and dairy products, comprised about 73 percent of all farm products sold. Field crops sold amounted to about 12 percent of all farm products sold and dairy products accounted for about 9 percent. Farmers with range permits had greater profits in 1959 and 1949 than they did in 1954 and 1944. However, in 1954 and 1944 it was more profitable to sell feed crops through the range cattle than to sell them outright. By feeding livestock the irrigated pasture was more fully utilized and better use made of the poorer quality feeds.

Value per acre of crops harvested increased from 1944 to 1959, but crop acreage harvested decreased. Total farms decreased from 174 in 1944 to 126 in 1959, while the average size of farms increased from 428 acres to 706 acres. Value of land and buildings per farm increased from \$10,389 in 1944 to \$43,119 in 1959 and irrigated acreage per farm increased from 109 acres to 154 acres. Thus, fewer farmers in 1959 were operating larger farms with more irrigated acreage and much larger capital value than farmers did in 1944. The proportion irrigated farms are of all farms has remained at about 96 percent but proportion of tenancy has decreased from 20 percent in 1944 to 10 percent in 1959 (table 18).

Markets and Transportation

Sale of beef calves is the principal source of income in the Smith Fork-Crystal Subbasin. Most are trucked to market. A few of the calves are

Table 18.- Cattle numbers, value of farm products sold by source, value of crops harvested, and other selected items, Smith Fork-Crystal Subbasin, Colorado, Census years 1944-59

Item	: Unit	: 1944	: 1949	: 1954	: 1959
Cattle and calves	Number	<u>1</u> /9,154	<u>2</u> /9,212	11,079	11,563
Cows and heifers that have calved	Number	<u>1</u> /4,376	<u>2</u> /4,196	4,805	5,070
Milk cows	Number	<u>1</u> /1,455	<u>2</u> /1,355	1,185	991
All hay harvested	Acres	8,330	6,670	7,185	8,093
Production of all hay	Tons	19,311	17,248	16,758	18,888
Irrigated pasture	Acres	6,158	8,362	6,969	7,847
Total irrigated land <u>3</u> /	Acres	18,900	19,600	17,141	19,356
Value of farm products sold by source:					
Field crops	Dollars	121,268	179,569	179,533	215,414
Vegetables	Dollars	0	0	0	0
Fruits and nuts	Dollars	0	0	0	0
Forest products and hort. specialties	Dollars	25,958	11,773	28,811	8,042
Poultry and poultry products	Dollars	72,534	64,585	47,195	28,396
Dairy products	Dollars	109,792	116,581	129,652	139,231
Livestock and livestock products <u>4</u> /	Dollars	665,621	1,225,174	846,958	1,573,312
Total farm products	Dollars	995,173	1,597,682	1,232,149	1,964,395
Value of crops harvested	Dollars	481,877	486,325	539,784	632,964
Value per acre	Dollars	38	43	52	55
Crop acreage harvested	Acres	12,742	11,238	10,172	11,509
Total farms	Number	174	170	149	126
Average size of farms and ranches	Acres	428	538	555	706
Value of land and buildings per farm	Dollars	10,389	20,147	25,883	43,119
Proportion irrigated farms of all farms	Percent	NA	97	94	96
Average acreage irrigated per farm	Acres	109	115	115	154
Proportion of tenancy	Percent	20	14	12	10

1/ January 1, 1945.

2/ April 1, 1950.

3/ Excludes irrigated land not harvested and not pastured.

4/ Exclusive of poultry and poultry products and dairy products.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agriculture.

COMPARISON OF CUMULATIVE ACREAGES OF CROPS HARVESTED AND IRRIGATED PASTURE WITH WATER SUPPLY, SMITH FORK-CRYSTAL SUBBASIN, COLORADO, 1943-1960

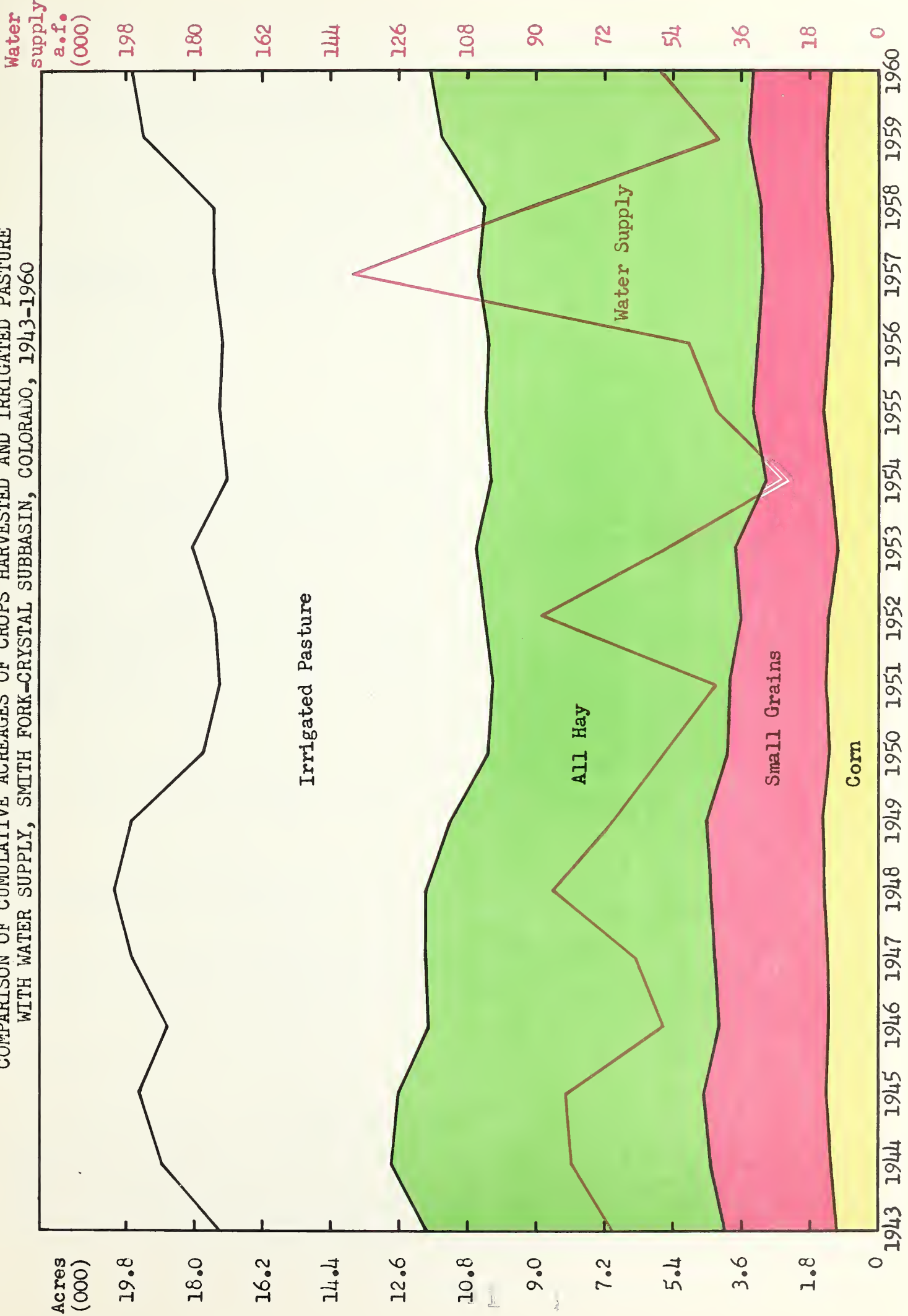


FIGURE 3

wintered in the area and sold the next spring and a few are sold to feeders in western Colorado, Utah and Arizona.

Dairy products are trucked to Delta and Grand Junction for further processing. Transportation facilities are adequate for the marketing of agricultural products in the subbasin.

Relationship Between Irrigated Lands and Rangelands

Most of the cattle ranchers are dependent upon national forest lands and the national land reserve for their dry range. Some of the ranchers depend upon private range and State-owned land, and still others run beef cows and dairy cows together on the irrigated land year-round.

Comparison of Acreage Irrigated and Water Supply

Water supply refers to the total annual water resources of the subbasin rather than the direct seasonal supply needed for irrigated land. Most of the water has not been available for direct irrigation when needed because of lack of reservoir storage and consequent regulation of streamflow. However, for comparative purposes, acreage irrigated was collated with water supply.

Two consecutive 7-year periods, 1943-49 and 1950-56, were selected for comparison. Acreage irrigated in 1950-56 averaged 91 percent of the 1943-49 period, while water supply in 1950-56 averaged 71 percent of the 1943-49 period (combine table 17 and figure 3). There were greater relative annual fluctuations in water supply than in acreage irrigated, but a close relationship existed between them. The Smith Fork-Crystal Subbasin had less water supply per acre irrigated than any other subbasin in the Gunnison River Basin (compare figures 1-6).

Acreages of small grains, potatoes and hay were larger in 1943-49 than in 1950-56. Acreage of irrigated pasture averaged about the same for the two periods (table 17).

Direct Agricultural Benefits Anticipated from Water Resource Development

In May 1958, the U. S. Department of Agriculture completed a report of "Reappraisal of Direct Agricultural Benefits and Project Impacts on the Smith Fork Project, Colorado." The study showed annual net direct benefits of \$8.67 per acre on 8,240 acres, after discounting for the development period.

Potential Water Requirements

Two proposed Bureau of Reclamation projects are within the Smith Fork-Crystal Subbasin. Of these, the Smith Fork project is under construction, with the Crawford Reservoir and associated works being the principal features. This project will essentially provide full regulation and an adequate water supply for project lands which lie adjacent to the Smith Fork River.

The other project comprises the lands of Fruitland Mesa, including those that have heretofore been served by water diverted from Crystal Creek and stored in Gould Reservoir. Present sources of water within the subbasin are not sufficient to provide a full supply for present and proposed new lands; however, the proposed project would provide for the importation from the Upper Gunnison Subbasin of substantial amounts of additional water through the new facilities to be constructed, the improved operation of water storage facilities at Gould Reservoir and the construction of a new reservoir at Soap Park. This will provide an adequate supply to meet the irrigation requirements of the project land.

With the completion of these two projects, essentially all of the readily available water sources will have been developed and the most suitable lands will have received a sufficient water supply. There are no other feasible projects known within the subbasin.

Potential water requirements have been estimated in the same manner as present water uses, with due allowances being made for increased uses under full irrigation supplies. Adjustments were made for the cultivated acreage that will be inundated, additional evaporation from new and enlarged reservoirs and increased domestic and livestock, fishing, wildlife and recreational uses. About 16,420 acres of additional irrigated land will be developed by the two proposed projects.

The potential water requirements or water supply depletions in the Smith Fork-Crystal Subbasin are summarized in table 19.

Table 19. - Potential water requirement, Smith Fork-Crystal Subbasin ^{1/}

Net crop consumptive use ^{2/}	53,300 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands and incidental areas	13,500 acre-feet
Municipal, domestic and livestock uses, reservoir and lake evaporation and foreseeable recreation development	<u>2,209</u> acre-feet
Subbasin Total	69,009 acre-feet

^{1/} Exclusive of industrial requirements.

^{2/} 35,420 acres, including potential project development.

Opportunities for Development Through Watershed
Protection and Flood Prevention and Other USDA Authorities

Completion of the presently authorized Bureau of Reclamation projects in the subbasin completes all known project-type irrigation water development opportunities. Other programs within the subbasin should be directed toward control of erosion. A particularly critical area is east of Iron Creek and south of the Smith Fork River. Sheet erosion from frequent small local floods and gully erosion from unstabilized irrigation canals produce troublesome amounts of sediment. In this area, there is also a special need for improvement in on-farm irrigation systems and in the use and management of irrigation water. Most of these critical areas are privately owned and acceleration of the present soil and water conservation programs should alleviate the situation.

NORTH FORK SUBBASIN

Physical Description of Subbasin

The North Fork subbasin includes the drainage area of the North Fork of the Gunnison River and its tributaries plus the LeRoux, Carrant, Surface and Tongue Creeks drainages.

Soils

Soils of this subbasin range in elevation from 5,500 to 12,000 feet and consist of four major soil groupings: 1. Desert-Sierozem; 2. Brown-Chestnut; 3. Mountain Prairie-Chestnut; 4. Gray Wooded-Brown Podzolic-Mountain Prairie.

The largest acreages of irrigated land in this subbasin are in the Brown-Chestnut grouping (45,900 acres) and the Desert-Sierozem grouping (10,000 acres). Acreage of the great soil groups within each major soil grouping, and distribution of this acreage by irrigated land and vegetative types, is given in table 20.

Land Use, Cover Condition and Management

The North Fork subbasin has about 61,900 acres of irrigated land. This amount represents 23.5 percent of the irrigated lands in the entire Gunnison River Basin. The remaining land is used for livestock range, timber production, recreation and maintenance of wildlife.

In 1961 over 300 elk and nearly 4,000 deer were harvested from this area by approximately 4,000 hunters. Use of this area by hunters and fishermen will continue to increase.

The majority of the irrigated land is located on mesas that are quite sloping. The high mountain meadows are on wet alluvial bottoms and open park areas in the sagebrush, oakbrush and aspen vegetative zones. Other irrigated land lies along the Gunnison River and its tributaries and below the adobe hills.

The frost-free season in the irrigated area is about 146 days. The elevation above sea level is high, but due to the protection from Grand Mesa and good air drainage, the climate is adapted to fruit production on slopes with southern exposure.

Some irrigated areas near Cedaredge are considered as being water-short areas. Several projects are under various stages of investigation and/or construction to help correct this condition.

When water supplies have been improved, farm and ranch operators can apply conservation practices such as land leveling, irrigation system improvement, and waste water disposal. Many management practices such as irrigation water management, crop rotation and fertilizer application can be improved with on-site technical assistance.

The area of national forest-commercial timber land, accessible enough to be operable, is estimated at 214,000 acres. At present, the small amount of timber being cut in the North Fork subbasin is sold entirely on the local market. The subbasin lands have an estimated one billion board-feet of timber growing on them.

Much forest land in this unit should be planted to commercial tree species to provide a more useful and productive cover. Foresters estimate that nearly 50,000 acres within the subbasin should be reforested.

This subbasin has little of the alpine zone which includes alpine meadow vegetation and snow fields. There are some raw rock peaks which collect heavy snow and shed practically all as water. The vegetation varies with elevation, starting with the highest Engleman spruce and alpine fir, and continuing down through ponderosa pine, aspen, oakbrush, sagebrush to desert shrub and grasses. Sagebrush, in combination with grass, is scattered through the open areas up into the ponderosa pine-oakbrush zone. Aspen is quite extensive in this subbasin.

The cover density is described as poor to fair over most of the area and poor in the desert shrub zone. Phreatophytes such as cottonwood and willows along ditches and in the irrigated lands amount to about 7,100 acres. Water could be put to a more profitable use by controlling phreatophytes.

Sediment yields within this subbasin are high. There are many raw shale slide areas in the Wasatch formations above the pinyon-juniper zone. Most of these slides are above the Paonia Reservoir, which will trap the sediment before it gets into the North Fork or the main Gunnison River. Runoff from other drainages carry little sediment from the high elevations. Sediment will be quite heavy from the pinyon-juniper and desert shrub zones. These stream loads will result from spring runoff, sheet and gully erosion.

Recreation

The Grand Mesa area, with many lakes nestling in the cool, green forests of spruce and fir timber, is a popular and heavily used recreation area; particularly for fishing, family camping and picnicking. There are many summer cabins and resorts on Grand Mesa which are filled during the summertime with visitors spending their weekends and vacation periods. The Forest Service has developed many recreation sites for camping and picnicking which are usually filled. Additional sites are being developed and more are planned to meet future demands. Hunting in the fall, and skiing in the winter, add substantially to recreation use.

It is anticipated that the Paonia Reservoir will attract many visitors for camping, picnicking, boating, and fishing. Some of this increased recreational use will probably extend to adjacent national forest lands.

As in the other subbasins, the trend for outdoor recreation use is upward. Current use is estimated at 580,000 man-days annually, and is expected to increase five times by the year 2000. Water development in the subbasin should complement plans for increase in water-oriented recreation use.

Land Status

Table 21.- Land ownership, North Fork Subbasin, Gunnison River Basin

Class of ownership	Acres	Percent
Federal		
National forest <u>1/</u>	435,069	54
National land reserve <u>1/</u>	103,114	13
Private	264,023	<u>33</u>
		100

1/ Bureau of Reclamation withdrawal land included.

Water Supply

The North Fork subbasin is a complex water-supply area. Irrigation development within the area has reflected the diversity both of water source areas and of suitable irrigable lands. Climatic variations within the subbasin have been important in determining the dominant cropping patterns and development of the different irrigated areas.

Part of this subbasin has the most intensely developed water-supply systems of the entire Gunnison River Basin. Approximately 160 lakes and reservoirs, largely on Grand Mesa, have been constructed or rehabilitated to store water for late-season use. Some of the larger reservoirs and their storage capacity are listed below:

<u>Reservoir</u>	<u>Source of Water</u>	<u>Capacity Acre-feet</u>
Fruitgrowers	Surface & Currant Creeks	4,832
Overland <u>1/</u>	Cow Creek	4,600
Park	Surface Creek	3,883
Leon Lake <u>2/</u>	Leon Creek	2,504
Eggleston Lake	Kiser Creek	2,290
Deepward Lake	Ward Creek	1,610
Island Lake	Ward Creek	1,594
Barron Lake	Kiser Creek	860
Cedar Mesa	Surface Creek	908

1/ Storage capacity as restricted by state engineer.

2/ Water diverted into Basin by tunnel.

The Fruitgrowers Dam and Reservoir was constructed in 1938 as a Bureau of Reclamation project. The other reservoirs were all built as part of non-Federal irrigation systems.



Irrigation reservoirs and lakes on Grand Mesa.



Peach crop - North Fork Subbasin

Valley lands in the vicinity of Austin and Delta that are irrigated by direct diversion from the Gunnison River have had essentially an adequate water supply for all their requirements. In general, the remaining lands within the sub-basin have had varying degrees of deficient water supplies. The development of the extensive reservoir system on Grand Mesa helped to equalize the water supplies in the George Creek-Surface Creek-Currant Creek areas in the vicinity of the town of Cedaredge, but has not provided for the full seasonal requirements of the irrigated lands in this area. Late-season flows available to canal systems heading directly in the North Fork River or tributaries generally have not been adequate to fully meet the irrigation requirements.

Total water resources of the subbasin are more than sufficient for all requirements of the present and potential irrigated lands. Regulation of early-season high flows by reservoir storage would eliminate the existing late-season water-supply shortages, provides ample water for the remaining suitable lands, and permit full development of the subbasin.

The undepleted water supply for the North Fork subbasin is summarized in table 22.

Table 22.- Water Supply, North Fork Subbasin, 1/ 1943-60 average

	Acre-feet
North Fork near Somerset	318,100
Minnesota Creek and tributaries	16,900
Hubbard, Terror, Jay and Roatcap Creeks	21,700
LeRoux Creek	32,900
Currant Creek	4,600
Surface Creek, including Milk Creek	31,900
Young, Kiser, Cottonwood, Ward and George Creeks	31,800
Oak and Doughspoon Creeks	4,000
Incidental Areas	2,000
City of Delta export	2,000
Overland Ditch import	<u>5,400</u>
 Total <u>2/</u>	 469,300

1/ Includes subbasin accretions to Basin water supplies. Does not include main river flow entering subbasin, local return flows, or direct accretions to river flow, if any.

2/ Partly estimated by correlation.

Present Water Use

Of the 61,900 irrigated acres in the North Fork subbasin, about 31,200 acres, or more than half, has had insufficient water supplies to provide full crop production. An additional 7,200 acres on the average has been cropped to small grain which has a short-growing season and accordingly has generally

Agricultural Economy

The North Fork subbasin is particularly well adapted to the production of fruit, especially apples. Peaches, cherries, pears, and other fruits are produced in the more protected areas. The acreage of land used for the production of fruit is determined largely by local air drainage, or freedom from frost, during the growing season and the adequacy of the water supply during the late summer months. Areas not adapted to fruit are generally used in the production of livestock feeds.

Sources of agricultural production data and procedures have been discussed on page 17. In addition, data were used from the USDA report, "Reappraisal of Direct Agricultural Benefits and Project Impacts, Paonia Project, Colorado, April 1957."

Agricultural Production

Annual data for crop acreages, production, and values were compiled for the 1943-60 period because satisfactory water-supply data were available for that period only. Averages for 1943-49 and 1950-56 show trends within the 1943-60 period (table 24).

Fruit acreage averaged 13 percent of the total acreage irrigated in 1943-60, while gross value of fruit harvested amounted to about 64 percent of the gross value of all crops harvested. (Irrigated pasture was not considered part of cropland harvested in determining gross crop values.)

All hay acreage comprised about 33 percent of the irrigated acreage as in 1943-60, but accounted for less than 20 percent of gross crop values. Corn, small grains, potatoes, beans, and sugar beets constituted smaller proportions of irrigated acreages and gross values than all hay and fruit. Alfalfa hay acreage accounted for the largest percentage of individual crops harvested, amounting to about 23 percent. Average irrigated acreage of the North Fork subbasin for the 1943-60 period has been estimated at 61,900 acres.

Currently, there are 58 Forest Service permits for cattle. Cattle number 8,327 head and usually graze from June 15 to October 15 for a total of 33,739 animal-unit months. Sheep ranches have 49 permits to graze 35,318 sheep from July 1 to September 20 for a total of 18,263 animal-unit months.

Bureau of Land Management permits total 58 for cattle ranches headquartered in the subbasin with 6,149 animal-unit months of grazing. Sheep permits number 9 for ranches headquartered in the subbasin with 7,964 animal-unit months of grazing.

Number of cattle, tons of all hay, and acres of irrigated pasture are a few of the items presented in table 25 for census years 1944-59. Numbers of cows and heifers that have calved increased from 10,565 in 1944 to 12,050 in 1959. During the same period milk cows decreased in numbers from 3,403 to 2,303. Therefore, beef cows and heifers that have calved increased from 7,162 head in 1944 to 9,747 head in 1959, while all hay produced in 1959 was 5,000 tons less than produced in 1944 but still ample to meet the dry feed requirements of livestock.

Table 24.- Average acreage, total production and gross value of principal crops harvested in North Fork Subbasin, Colorado, 1943-49, 1950-56 and 1943-60

Crops	Unit	1943-49		1950-56		1943-60	
		Average	Percent of total	Average	Percent of total	Average	Percent of total
Corn							
Harvested	Acres	4,542	7.74	4,503	8.86	4,555	8.38
Production	Bushels	193,427		234,185		234,065	
Value	Dollars	265,396		377,104		331,266	
Wheat							
Harvested	Acres	1,931	3.29	1,094	2.15	1,346	2.48
Production	Bushels	53,208		33,171		39,870	
Value	Dollars	99,996		63,294		73,863	
Oats							
Harvested	Acres	3,210	5.47	2,967	5.84	2,830	5.21
Production	Bushels	137,357		131,109		124,847	
Value	Dollars	106,381		113,997		100,276	
Barley							
Harvested	Acres	3,549	6.05	2,529	4.98	2,959	5.44
Production	Bushels	144,832		106,219		126,192	
Value	Dollars	162,489		129,828		136,979	
Potatoes							
Harvested	Acres	316	.54	40	.08	145	.27
Production	Bushels	55,190		10,267		27,438	
Value	Dollars	74,277		11,596		35,370	
Beans							
Harvested	Acres	1,252	2.14	780	1.54	989	1.82
Production	Cwt.	15,047		10,947		13,001	
Value	Dollars	102,967		67,245		84,584	
Alfalfa hay							
Harvested	Acres	(13,589)	(23.17)	(11,089)	(21.82)	(12,713)	(23.39)
Production	Tons	(35,914)		(30,351)		(33,890)	
All hay							
Harvested	Acres	19,019	32.43	16,195	31.86	17,854	32.84
Production	Tons	44,146		38,804		42,075	
Value	Dollars	705,665		833,495		788,230	
Sugar beets							
Harvested	Acres	509	.87	423	.83	453	.83
Production	Tons	6,780		6,090		6,620	
Value	Dollars	71,528		69,856		73,869	
Other field crops ^{1/}							
Harvested	Acres	97	.17	67	.13	74	.14
Value	Dollars	2,020		1,433		1,644	
Fruit							
Harvested	Acres	7,720	13.16	6,684	13.15	7,066	13.00
Value	Dollars	3,134,176		2,850,230		2,873,975	
Total crops							
Harvested	Acres	42,145	71.86	35,282	69.42	38,271	70.41
Value	Dollars	4,724,895		4,518,078		4,500,056	
Other land irr.							
Acres		16,503	28.14	15,545	30.58	16,087	29.59
Total land irr.							
Acres		2/58,648	100.00	2/50,827	100.00	2/54,358	100.00

^{1/} Includes rye and sorghum.

^{2/} Excludes irrigated land not harvested and not pastured.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agri.

A comparison of the value of farm products sold by source and value of crops harvested can be made from table 25, also. The greatest spread in value of farm products sold and gross value of crops harvested occurred in 1959 followed by 1949 and 1954. Gross value of crops harvested exceeded gross value of farm products sold in 1944. Feeding crops to livestock was unprofitable that year. Likewise, gross value of farm products sold in 1954 did not exceed gross value of crops harvested in sufficient amount to give a fair value for range permits, irrigated pasture, and field residue if other feeds and labor were priced at market value. In 1954 and 1944 value of fruits sold were at their highest for the four census years, while in 1949 and 1959 they were at their lowest. Value of livestock and livestock products sold, other than poultry and poultry products and dairy products, was the opposite. Relative prices received for fruit in relation to prices received for livestock were high during 1954 and 1944 and low during 1949 and 1959. Farmers producing both had less risk of failure than those producing either one alone. Fruit sales have amounted to about 43 percent of gross farm sales in the four census years while livestock and livestock products sales have accounted for about 42 percent.

Value per acre of crops harvested was highest in 1954 and lowest in 1949. Crop acreage harvested was highest in 1944 and lowest in 1954.

Total farms decreased from 1,123 in 1944 to 815 in 1959, while average size of farms increased from 170 acres to 273 acres. Value of land and buildings per farm increased from \$6,956 in 1944 to \$27,113 in 1959, and irrigated acreage per farm increased from 52 acres to 67 acres. Proportion of irrigated farms to all farms has averaged about 96 percent, but proportion of tenancy has decreased from 17 percent in 1944 to 8 percent in 1959.

Markets and Transportation

Fruit is the most important agricultural product shipped from the North Fork subbasin. Apples and peaches move by truck to New Mexico, Oklahoma, and western Texas. Only the better grades are shipped that far because they can stand the cost of shipping and arrive in more salable condition. Several fruit processing plants are located throughout the fruit area where cleaning, grading, packaging, and storage facilities prepare the fruit for shipment. Fruits of this area are unusually high in quality because of the rigid grading.

Sale of beef calves rates next in importance to fruit in agricultural products sold. Most of the calves are trucked to market. A few are wintered in the area and sold the next spring and still others are sold to feeders in western Colorado, Utah, and Arizona. Some calves are sold through the local livestock auctions before being shipped further away. Rail and highway transportation is adequate for the marketing of agricultural products from the area.

Relationship Between Irrigated Lands and Rangelands

Most of the cattle and sheep ranchers are dependent upon national forest lands and national land reserve for their dry range. Practically all ranchers with grazing permits have the same number of beef cows for their breeding herd as

Table 25.- Cattle numbers, value of farm products sold by source, value of crops harvested, and other selected items, North Fork Subbasin, Colorado, Census years 1944-59

Item	: Unit	: 1944	: 1949	: 1954	: 1959
Cattle and calves	Number	<u>1</u> /22,456	<u>2</u> /21,721	26,086	27,616
Cows and heifers that have calved	Number	<u>1</u> /10,565	<u>2</u> / 9,839	11,166	12,050
Milk cows	Number	<u>1</u> / 3,403	<u>2</u> / 3,141	2,695	2,303
All hay harvested	Acres	20,366	16,612	17,259	19,144
Production of all hay	Tons	47,827	41,762	37,969	42,820
Irrigated pasture	Acres	14,581	19,185	14,710	16,938
Total irrigated land <u>3</u> /	Acres	58,117	59,297	49,089	54,659
Value of farm products sold by source:					
Field crops	Dollars	314,880	460,584	457,536	572,954
Vegetables	Dollars	0	0	0	0
Fruits and nuts	Dollars	2,203,518	1,127,416	4,106,961	2,246,170
Forest products and hort. specialties	Dollars	39,365	24,934	74,323	17,627
Poultry and poultry products	Dollars	161,462	142,508	88,063	57,080
Dairy products	Dollars	268,321	282,755	308,059	318,189
Livestock and livestock products <u>4</u> /	Dollars	1,509,083	2,750,428	1,845,396	3,504,915
Total farm products	Dollars	4,596,629	4,788,625	6,880,338	6,716,935
Value of crops harvested	Dollars	5,308,668	3,239,924	6,120,410	4,346,822
Value per acre	Dollars	122	81	178	115
Crop acreage harvested	Acres	43,536	40,112	34,379	37,721
Total farms	Number	1,123	1,104	943	815
Average size of farms and ranches	Acres	170	202	206	273
Value of land and buildings per farm	Dollars	6,956	12,418	16,225	27,113
Proportion irrigated farms of all farms	Percent	NA	98	94	96
Average acreage irrigated per farm	Acres	52	54	52	67
Proportion of tenancy	Percent	17	13	11	8

1/ January 1, 1945.

2/ April 1, 1950.

3/ Excludes irrigated land not harvested and not pastured.

4/ Exclusive of poultry and poultry products and dairy products.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agriculture.

their permitted number on the national forest. Most of the sheepmen depend on the desert of western Colorado and eastern Utah for their winter range. The irrigated lands and rangelands complement each other to a greater degree for cattle feed than they do for sheep feed.

Comparison of Acreage Irrigated and Water Supply

Water supply refers to the total annual water resources of the subbasin rather than the direct seasonal supply needed for irrigated land. Most of the water has not been available for direct irrigation when needed because of lack of reservoir storage and consequent regulation of streamflow. However, for comparative purposes acreage irrigated was collated with water supply.

Acreage irrigated in 1950-56 averaged 87 percent of the 1943-49 period (combine table 24 and figure 4). Water supply in 1950-56 averaged 82 percent of the 1943-49 period. There were greater relative annual fluctuations in water supply than in total acres irrigated, but a close relationship existed between them.

Acreages of small grains, potatoes, beans, hay, sugar beets, fruit and irrigated pasture were smaller in 1950-56 than in 1943-49. Acreage of corn remained about the same for the two periods (table 24).

Direct Agricultural Benefits Anticipated from Water Resource Development

In April 1957, the U. S. Department of Agriculture completed a report of "Reappraisal of Direct Agricultural Benefits and Project Impacts on the Paonia Project, Colorado." The study showed annual net direct benefits of \$14.29 per acre on 14,380 acres, after discounting for a 3-year development period.

Potential Water Requirements

There are two major water development projects proposed or under construction within the North Fork subbasin. The Paonia project of the Bureau of Reclamation, comprising the Paonia Reservoir on Muddy Creek and improvements to diversion works and the Fire Mountain Canal will provide increased water supplies for Rogers and Redland Mesas and adjacent lands. Water storage for this project began in the fall of 1961 and the additional water is available for use during the 1962 irrigation season. Essentially a full supply of water will be available for project lands.

The proposed Grand Mesa Project, under investigation by the Bureau of Reclamation, would comprise the Electric Mountain Dam and feeder canals in the Muddy Creek Basin, the Grand Mesa Canal, the Gorsuch regulating reservoir on Currant Creek, and supplementary works and canals. This project would provide storage for seasonal regulation of streamflows and the importation of water into the presently inadequately supplied areas on LeRoux, Currant, and Surface Creeks, and adjacent lands. The additional water will provide a full supply for the

new lands under the project and will practically eliminate the existing shortages on presently irrigated lands. There is adequate water available within the subbasin area to meet project needs without encroaching on other existing rights.

Completion of these two projects will provide for the development of about 14,290 additional acres, essentially all of the remaining suitable lands in the subbasin, and the increased water supplies made available during the late season will meet most of the irrigation water needs of the subbasin. Only limited areas will remain with deficient water supplies. There are no other known project possibilities in the subbasin.

Estimates of potential consumptive use requirements by crops on existing and proposed new lands have been made by the Blaney-Criddle procedures based on local climatological data and cropping history and recent trends, with adjustments for cultivated lands to be inundated. Likewise, estimates of requirements for riparian vegetation, nonbeneficial phreatophyte use, seeped lands, and other water using areas incidental to use and development of the lands have been prepared. Minor water use estimates include requirements for domestic and livestock use, increased reservoir evaporation, with adjustments for use on inundated cropland, and recreation, fishing and wildlife requirements.

Total potential water requirements or water-supply depletions in the subbasin are summarized in table 26.

Table 26.- Potential water requirements, North Fork Subbasin 1/

Net crop consumptive use <u>2/</u>	115,424 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands and incidental areas	21,138 acre-feet
Municipal, domestic and livestock uses, reservoir and lake evaporation, foreseeable recreation development	<u>12,127</u> acre-feet
Subbasin total <u>3/</u>	148,689 acre-feet

1/ Exclusive of industrial requirements.

2/ 76,190 acres including potential project development.

3/ Does not include 2,000 acre-feet M & I water export to Uncompahgre subbasin for city of Delta use.

COMPARISON OF CUMULATIVE ACREAGES OF CROPS HARVESTED AND IRRIGATED PASTURE WITH WATER SUPPLY, NORTH FORK SUBBASIN, COLORADO, 1943-1960

Water supply a.f. (000)

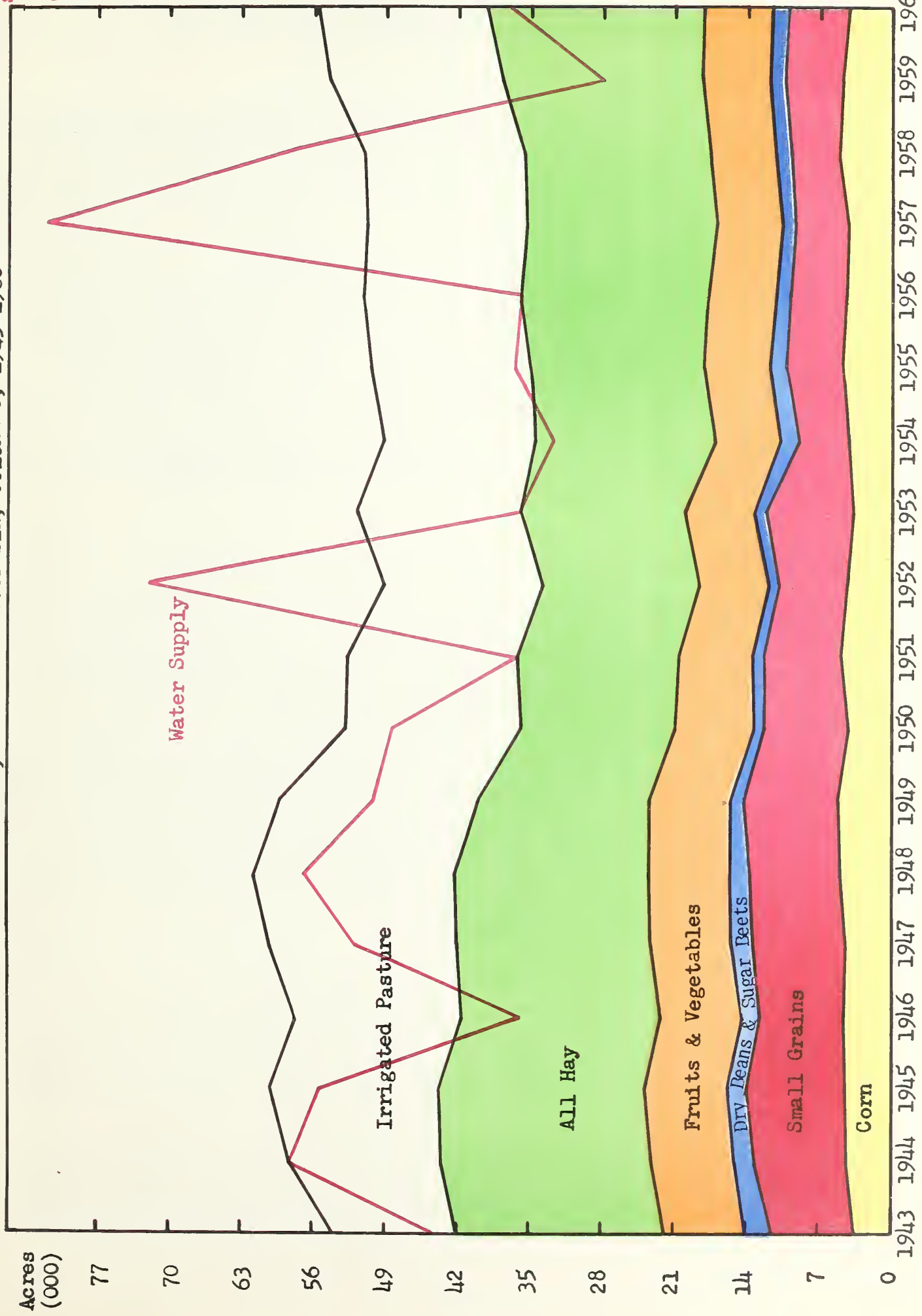


FIGURE 4

Opportunities for Developments Through Watershed Protection
and Flood Prevention and Other USDA Authorities

Possible P. L. 566 Projects

The Paonia project of the Colorado River Storage Project has been constructed by the Bureau of Reclamation. The Bureau is also completing a report on the proposed Grand Mesa Project. These two projects would utilize much of the remaining undeveloped water resource required for project-type developments in the North Fork subbasin. At various times a 7,000 acre-foot enlargement of the Bureau of Reclamation Fruitgrowers Dam has been proposed. This dam was constructed in 1938 and its enlargement has been suggested as a regular Bureau of Reclamation project, a P. L. 984 small reclamation project, and a prospective P. L. 566 project. Another small reclamation project is currently under consideration to pump water from the Gunnison River to furnish supplemental water to lands under the Fruitgrowers project. The development of this proposed pump project, together with the proposed Grand Mesa Project, may eliminate the need for enlargement of the Fruitgrowers Dam.

Several other prospective P. L. 566 projects have been suggested in the North Fork subbasin; however, none appear likely at this time.

Project Development Opportunities Under Other USDA Authorities

Much of the irrigation water for lands in the North Fork subbasin is stored in the approximately 160 lakes and reservoirs in the North Fork Drainage on Grand Mesa. During the past several years 40 of these lakes and reservoirs have been rehabilitated with technical, financial and credit assistance being furnished by programs of the Department of Agriculture. This rehabilitation work has consisted largely of enlarging the reservoirs, strengthening dam and outlet works and increasing spillway capacities. Several irrigation companies and water users organizations have plans to continue this rehabilitation program on many of the other lakes and reservoirs on Grand Mesa. Reorganization and repair of many of the irrigation systems should also be planned in connection with the rehabilitation of the storage facilities. Department of Agriculture programs, including ACP cost sharing, FHA water facility loans and SCS group enterprise technical assistance, are available to assist with this rehabilitation program.

UNCOMPAHGRE SUBBASIN

Physical Description of Subbasin

The Uncompahgre subbasin includes all of the watershed tributary to the Uncompahgre River, plus the drainage area of Roubideau Creek. Elevations range from 5,000 to 14,300 feet.

Soils

All five of the major soil groupings are recognized in this subbasin: 1. Desert-Sierozem; 2. Brown-Chestnut; 3. Mountain Prairie-Chestnut; 4. Gray Wooded-Brown Podzolic-Mountain Prairie; and 5. Alpine Meadow-Alpine Bog.

Irrigated land in this subbasin is distributed through soil groupings 1, 2 and 3. The land in the proposed Bureau of Reclamation Dallas Creek project is in the Brown-Chestnut soil grouping. Acreage of the great soil groups within the major groupings, and distribution of this acreage, by irrigated land and vegetative types, is given in table 27.

Land Use, Cover Condition and Management

This is the second largest subbasin in total area in the Gunnison River Basin, and has the largest amount of irrigated lands. The irrigated lands total 105,300 acres, or about 40 percent of the total in the Gunnison River Basin. Of these lands, 75,400 acres are served by the Uncompahgre Reclamation Project and 29,900 acres by other irrigation systems.

There are a few acres of land in some parts of the subbasin where climatic conditions permit dryland farming. The majority of these are on Log Hill Mesa above Ridgway and Colona, in Ouray and Montrose Counties. The acreage of dry farming varies from year to year, depending upon weather cycles, but it is estimated that the total acreage will seldom exceed 1,500 acres. The average amount is about 1,000 acres. Much of the abandoned dry-farmland has been seeded to range.

Climate for this subbasin is quite variable as it affects the growing season for irrigated land. The high mountain meadow portion of the subbasin appears to have a short growing season, but the nearest record shows about 123 days frost-free season near Ouray, Colorado. The season for frost-proof crops, considered the period between 28° readings, is usually 25 to 30 days longer. The other important agricultural areas are Montrose, with 152 days, and Delta with 146 days frost-free seasons. Crop reaction seems to indicate that Delta has an equal or a little longer season than Montrose.

The agricultural areas divide into approximately three divisions. The upper area includes the high mountain meadow area in Ouray County; the general farming area, which generally grows feed for livestock production; and the cash-crop farming area in Montrose and Delta Counties.

The high mountain meadow area is predominantly livestock industry, which is supported by growing legume and grass mixture for hay or pasture and small grain. Alfalfa hay is usually grown where climate and soils are suitable. The problems of the high mountain meadow areas are generally associated with poor seasonal distribution of irrigation water, gravelly soils and short-growing seasons. The result is the production of hay over an extensive area with low yields. This problem can be corrected through storage of irrigation water supplies, irrigation water management, fertilizer application, improvement of hay composition, and timing of harvesting operations to get high yields of good quality forage.

The general farming area is the fringe area of the Uncompahgre Valley. It is above the Uncompahgre Reclamation Project area, except for East Mesa, and below the high mountain area. The general farming areas outside of the Uncompahgre Reclamation Project are usually short of irrigation water. Other factors, such as low degree of land development, low fertility, and inadequate irrigation systems, which usually accompany short irrigation water supply, are also in evidence. Some of the general farming area has ample irrigation water but soil conditions limit management choices and reduce crop yields.

Most of the cash crops in the subbasin are raised with Uncompahgre Reclamation Project water on the mesa and valleys west of the Uncompahgre River. The area has some operators that are general-type farmers by choice. Principal crops in the area are alfalfa for hay, sugar beets, onions, malting barley, corn for grain or silage, dry beans, small grain and irrigated pasture. Progressive principles of irrigation and land management are in evidence, but much improvement is desirable.

The livestock industry, with grazing permits on national forest and national land reserve lands, predominates within the Uncompahgre subbasin. Private range is located in the desert shrub and pinyon-juniper zones. Cover and forage production varies from poor to fair. Generally, these lands are used for holding areas previous and subsequent to grazing on Federal land. Crop aftermath and irrigated pastures are utilized in the farming areas.

The lands above the agricultural area are used for grazing, timber production, wildlife habitat, recreation, and water production. Under the multiple use management of the national forests, none of these uses is managed to the detriment of another. The higher subbasin lands support a large summer grazing industry which is primarily cattle on the Uncompahgre plateau and sheep in the Ouray area.

Seventy-six thousand acres of the national forest land is considered to be producing commercial, operable timber stands. National land reserve and private lands also grow some timber, but in lesser amounts. The average annual cut for the last 10 years has exceeded 4 million board-feet a year. This is only a small percentage of that available under sustained yield management. The timber, mostly ponderosa pine to date, is sold entirely to local operators. The major processing point is in Montrose.

In addition, 35,000 acres of brush-covered forest lands need to be planted to commercial tree species, mostly ponderosa pine.

Table 27. - Generalized soil and vegetation, showing acreage of great soil groups, irrigated land and vegetative types - Uncompahgre Subbasin, Gunnison River Basin.

Map Number:	Name	Great Soil Groups	Irrigated:		Dry Farm Land	Vegetative Types									
			Land 1/	Acres		Grass & Willow or Sagebrush	Desert Shrubs	Oakbrush	Pinyon	Aspen	Conifer	Bare Rock			
	Name	Acres	Acres	Acres	Acres	Sedges	Cottonwood	and Grass	Grass	Juniper	Aspen	Conifer	Bare Rock		
1	Desert-Sierozem	109,410	56,550					52,860							
	Lithosol	27,353						27,353							
	Alluvial	54,705	21,950	3,900				28,855							
	Regosol	13,676						13,676							
	Misc. Land Types	68,382											68,382		
Total		273,526	78,500	3,900				122,744					68,382		
2	Brown-Chestnut	99,840	23,600	1,500				52,318		22,422					
	Chestnut	57,052						42,789	14,263						
	Lithosol	42,789						12,836		29,953					
	Alluvial	28,526	2,000	4,000				22,526							
	Misc. Land Types	57,052											57,052		
Total		285,259	25,600	1,500				130,469	14,263	52,375			57,052		
3	Mountain Prairie-Chestnut	91,176						48,471	18,235	18,235	6,235				
	Chestnut	50,654						30,392	20,262						
	Lithosol	20,261						19,261			1,000				
	Alluvial	10,131	1,200					8,931							
	Misc. Land Types	30,392						15,196					15,196		
Total		202,614	1,200					122,251	38,497	18,235	7,235		15,196		
4	Gray Wooded-Brown Podzolic-Mountain Prairie	87,743		549				7,000		10,000	70,194				
	Brown Podzolic	7,976						4,000	3,977		7,976				
	Mountain Prairie	7,977													
	Lithosol	7,976							798	4,785	2,393				
	Alluvial	7,977						2,393	798	4,786					
	Misc. Land Types	39,883						6,716	6,000	6,000	17,179		3,988		
Total		159,532		549				20,109	11,573	25,571	97,742		3,988		
5	Alpine Meadow-Alpine Bog	11,527						11,527							
	Alpine Bog	1,921						1,921							
	Misc. Land Types	24,976						14,986					9,990		
Total		38,424						28,434					9,990		
TOTAL FOR THE SUBBASIN		959,355	105,300	1,500				122,744	64,333	52,375	43,806	104,977	154,608		

1/ Irrigated land includes some areas infested with willows and cottonwood.

Cover conditions are fair in the alpine and spruce-fir zone of the upper Uncompahgre River. These areas are generally in Ouray County. Most of the water comes from these two zones, particularly the snow fields in the alpine zone. Very little sediment comes from these zones.

The ponderosa-Oakbrush zone covers the lower headwaters of the main river and most of the headwater for the side tributaries draining from the Uncompahgre Plateau. This is the highest water-yielding area from the Uncompahgre Plateau. Vegetation is spruce and douglas fir with a scattering of ponderosa pine and some oakbrush. A small acreage of irrigated meadow hay is in this zone. Cover is generally fair, but spring runoff delivers sediment through the tributaries to the Uncompahgre River.

The pinyon-juniper and desert shrub zones are high sediment producing areas which make the Uncompahgre River the largest sediment producing tributary to the Gunnison River. The cover is predominantly sagebrush-grass or desert shrub-grass, generally in poor condition. Summer thundershowers cause periodic high velocity runs in the various tributaries. Very seldom do these storms cover a wide area or add much water to the streams, but are quite damaging due to high intensities.

Return flow irrigation water from the various mesas carries heavy sediment loads. Many of these wasteways are headcutting back into the farmland.

There are about 8,000 acres of phreatophyte growth, consisting of willows or cottonwoods in hay meadows or along streams and canals. Some of this growth could be controlled and the water put to more beneficial use.

Recreation

The jagged peaks of the San Juan Mountains around Ouray, Colorado are widely known as the "American Alps." This area is the center of heavy recreation use in the Uncompahgre subbasin. Visitors are attracted to the area mainly to enjoy the spectacular mountain scenery and the thrill of exploring historic townsites and mines and mills. Many jeep cavalcades travel and explore the old mine trails and high mountain passes of this scenic area.

The Black Canyon of the Gunnison National Monument attracts many tourists to stop and view the awesome gorge. Due to its proximity to US-50, tourists use for sightseeing and overnight camping is heavy.

The Uncompahgre Plateau receives local use from the valley residents for summer drives and deer hunting in the fall. It is one of the most important deer hunting areas in the State.

Over 6,000 deer were harvested here in 1961. Elk also are an added resource in the upper drainage of the Uncompahgre River. Approximately 20 percent of the States wild turkey harvest came from this area in 1961.

Rapid increases in visitor and hunter use can be expected, particularly in the Ouray, Black Canyon and Uncompahgre Plateau areas. Present recreation use amounts to about 75,000 man-days annually and is expected to increase by at least six times by the year 2000.



Field being irrigated using siphon tubes from
concrete lined irrigation ditch.



Sweet Spanish onions - 600 sacks per acre yield -
near Delta, Colorado.

Land Status

Table 28.- Land ownership, Uncompahgre Subbasin, Gunnison River Basin

Class of Ownership	Acres	Percent
Federal		
National forest <u>1/</u>	229,435	24.0
National land reserve <u>1/</u>	254,280	26.5
National park	8,100	0.8
State of Colorado	1,700	0.2
Colorado Fish and Game	2,280	0.3
Private	463,560	<u>48.2</u>
Total	959,355	100.0

1/ Bureau of Reclamation withdrawal lands included.

Water Supply

Total direct runoff of the Uncompahgre subbasin is not adequate to meet the water-supply requirements. However, construction of the Gunnison Tunnel some 50 years ago permitted the importation of a supplemental supply from the Upper Gunnison subbasin, which has augmented the natural supplies of the Uncompahgre subbasin. Taylor Park Reservoir, with a storage capacity of 106,200 acre-feet in the Upper Gunnison subbasin, has provided streamflow regulation in recent years which has made the combined supply adequate for the irrigation of the Uncompahgre project lands.

There are additional areas of irrigated lands within the subbasin which are so situated that they cannot obtain water from the supplemental supplies, or, in some cases, from the Uncompahgre River or its larger and more dependable tributaries. These areas have instead been furnished with water supplies of varying degrees of adequacy, by several smaller locally constructed projects. Among the larger of these has been the Cimarron Ditch, which has imported water from the Cimarron River in the Upper Gunnison subbasin for use on Bostwick and Shinn Parks and in the town of Montrose. Additional developments have been made at Tierra Colorado, Log Hill Mesa, Dallas Creek, and other locations. In most cases, the available supplies have been less than requirements and in a few instances only token water supplies are available to some of the lands.

Project operations result in extensive return flow accretions to the streams of the subbasin. These essentially constitute a part of the overall water resource, since they are frequently fediverted by canals in lower parts of the subbasin. They have not been included in the water-supply tabulations, however, since they originate in the measured or estimated inflows and inclusion would result in duplication of a part of the subbasin water-supply resource.

Total undepleted water supply of the subbasin is summarized in table 29.

Table 29.- Water supply, Uncompahgre Subbasin, 1943-60 average

Uncompahgre at Colona	178,200 acre-feet
Ouray County consumptive use	24,500 acre-feet
Minor tributaries and ungaged areas	29,800 acre-feet
Roubideau above Buttermilk	<u>26,900</u> acre-feet
Total direct flow	259,400 acre-feet
Imports:	
Cimarron Ditch	24,400 acre-feet
Gunnison Tunnel	335,100 acre-feet
City of Delta	<u>2,000</u> acre-feet
Total subbasin supply <u>1/</u>	<u>2/</u> 618,900 acre-feet

1/ Return flow not included.

2/ City of Delta import included in North Fork supply total and not included here.

Present Water Use

Lands served by the Uncompahgre project have had a generally adequate water supply. Within-basin seasonal regulation of water supplies is needed to insure proper distribution and most effective use of available supplies. Crop consumptive use estimates for the project lands reflect the essentially full water supply. Estimates made for present consumptive use on other lands within the subbasin are related to the varying levels of water-supply deficiencies that have applied to these lands. There is very limited industrial consumptive use of water in the Basin, mostly in connection with municipal services that are separately estimated.

Estimates of present water-supply depletions in the subbasin are summarized in table 30.

Table 30.- Present water use, Uncompahgre Subbasin, 1943-60 average

Net crop consumptive use <u>1/</u>	158,905 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands and incidental areas <u>2/</u>	75,995 acre-feet
Municipal, domestic & livestock uses, reservoir evaporation and recreation	4,474 acre-feet
1943-60 average annual use within subbasin	239,374 acre-feet

1/ 105,300 acres.

2/ Acreage from Erickson survey of 1943 and adjustment based on local estimates.

Agricultural Economy

The Uncompahgre subbasin has a greater variety of crops grown and a larger irrigated acreage than any other subbasin in the Gunnison River Basin. Its irrigated agriculture changes from a livestock feed producing area in Ouray County on the south to general cash-crop production in central Montrose County and southwestern Delta County on the north. The subbasin includes all the irrigated land in Ouray County, the majority of irrigated land in Montrose County, and a minor part of the irrigated land in Delta County.

Sources of agricultural production data and procedures have been discussed on page 17. In addition, data were used from the Bureau of Reclamation Annual Crop Reports and Water Distribution data for their Uncompahgre project for the 1941-60 period.

Agricultural Production

Annual data for crop acreages, production, and values were compiled for the 1943-60 period because satisfactory water-supply data were available for that period only. Averages for 1943-49 and 1950-56 show trends within the 1943-60 period (table 31).

General cash crops, such as dry beans, vegetables, potatoes, fruit, and sugar beets, averaged about 13½ percent of the total irrigated acreage, but about 48 percent of gross crop value from 1943-60. All hay accounted for about 33 percent of the irrigated acreage and 25 percent of the gross crop value. Corn and small grains represented the remaining 27 percent gross crop value, while corn, small grains, and irrigated pasture comprised the remaining 53½ percent of irrigated acreage. (Irrigated pasture was not considered part of cropland harvested in determining gross crop values.) Average irrigated acreage of the Uncompahgre subbasin for the 1943-60 period has been estimated at 105,300 acres.

Currently, there are 49 Forest Service permits for cattle. Cattle number 6,035 head and usually graze from June 15 to October 15 for a total of 24,742 animal-unit months. Sheep ranches have five permits to graze 4,625 sheep from July 1 to September 20 for a total of 2,483 animal-unit months.

Bureau of Land Management permits total 48 for cattle ranches headquartered in the subbasin with 7,365 animal-unit months of grazing. Sheep permits number 43 for ranches headquartered in the subbasin with 20,369 animal-unit months of grazing. The Uncompahgre subbasin has about 61 percent of the total animal-unit months of grazing on the national land reserve in the Gunnison River Basin.

Number of cattle, tons of all hay, and acres of irrigated pasture are a few of the items presented in table 32 for census years 1944-59. Numbers of cows and heifers that have calved, increased in number from 16,271 in 1944 to 19,389 in 1959. During the same period milk cows decreased in number from 3,916 to 2,609. By subtracting milk cow numbers from total cows and heifers that have calved the number of beef cows amounted to

Table 31.- Average acreage, total production and gross value of principal crops harvested in Uncompangre Subbasin, Colorado, 1943-49, 1950-56 and 1943-60

Crops	Unit	1943-49		1950-56		1943-60	
		Average	Percent of total	Average	Percent of total	Average	Percent of total
Corn							
Harvested	Acres	6,906	6.78	7,102	7.50	7,316	7.21
Production	Bushels	284,558		343,216		349,000	
Value	Dollars	388,966		533,156		493,232	
Wheat							
Harvested	Acres	8,362	8.20	8,937	8.83	8,527	6.61
Production	Bushels	217,341		165,786		180,942	
Value	Dollars	365,815		329,265		321,370	
Oats							
Harvested	Acres	7,312	7.17	6,487	6.85	6,447	6.53
Production	Bushels	289,571		265,822		265,709	
Value	Dollars	224,515		237,359		233,317	
Barley							
Harvested	Acres	5,949	5.84	4,718	4.98	5,862	5.53
Production	Bushels	227,337		129,371		213,852	
Value	Dollars	152,233		271,212		251,066	
Potatoes							
Harvested	Acres	2,268	2.13	2,035	2.18	1,879	1.29
Production	Bushels	531,717		240,280		335,684	
Value	Dollars	736,402		288,150		422,107	
Beans							
Harvested	Acres	8,869	8.30	7,371	7.53	8,007	8.11
Production	Cwt.	109,706		105,507		112,892	
Value	Dollars	766,044		659,379		726,649	
Alfalfa hay							
Harvested	Acres	(18,896)	(18.54)	(19,151)	(20.21)	(19,413)	(19.66)
Production	Tons	(39,785)		(46,383)		(45,277)	
All hay							
Harvested	Acres	32,875	32.25	31,263	33.00	32,893	33.32
Production	Tons	59,794		43,085		64,773	
Value	Dollars	957,617		1,315,021		1,227,126	
Sugar beets							
Harvested	Acres	1,584	1.55	1,665	1.76	1,946	1.67
Production	Tons	20,266		23,870		23,874	
Value	Dollars	213,964		271,797		267,395	
Other field crops 1/							
Harvested	Acres	238	.23	131	.14	186	.19
Value	Dollars	8,164		6,617		8,639	
Fruit							
Harvested	Acres	1,144	1.12	1,062	1.01	1,003	1.02
Value	Dollars	336,570		293,935		306,618	
Vegetables							
Harvested	Acres	2,239	2.20	1,035	1.09	1,484	1.50
Value	Dollars	934,184		429,773		655,721	
Total crops							
Harvested	Acres	77,746	76.27	67,229	70.97	72,055	72.98
Value	Dollars	5,184,474		4,649,139		4,884,750	
Other land irr.							
Harvested	Acres	24,184	23.73	21,504	29.03	26,678	27.02
Total land irr.							
Harvested	Acres	2/101,930	100.00	2/94,733	100.00	2/98,733	100.00

1/ Includes rye and sorghum.

2/ Excludes irrigated land not harvested and not pastured.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agri.

Table 32.- Cattle numbers, value of farm products sold by source, value of crops harvested and other selected items, Uncompahgre Subbasin, Colorado, Census years 1944-59

Item	: Unit	: 1944	: 1949	: 1954	: 1959
Cattle and calves	Number	<u>1</u> /30,890	<u>2</u> /34,256	42,429	42,091
Cows and heifers					
that have calved	Number	<u>1</u> /16,271	<u>2</u> /16,474	19,572	19,389
Milk cows	Number	<u>1</u> / 3,916	<u>2</u> / 3,716	3,310	2,609
All hay harvested	Acres	35,443	30,752	32,378	37,496
Production of all hay	Tons	63,542	58,310	65,691	79,019
Irrigated pasture	Acres	21,449	28,732	28,670	31,491
Total irrigated land <u>3</u> /	Acres	103,609	103,468	97,871	106,515
Value of farm products sold by source:					
Field crops	Dollars	1,281,682	1,986,025	1,955,423	1,933,278
Vegetables	Dollars	602,527	396,112	233,866	290,255
Fruits and nuts	Dollars	256,707	112,885	420,345	258,625
Forest products and hort. specialties	Dollars	122,884	35,658	47,276	47,559
Poultry and poultry products	Dollars	199,635	181,660	178,453	93,417
Dairy products	Dollars	259,930	273,008	301,443	351,231
Livestock and livestock products <u>4</u> /	Dollars	2,287,685	4,217,963	3,215,736	5,357,322
Total farm products	Dollars	5,011,050	7,203,311	6,352,542	8,331,687
Value of crops harvested	Dollars	4,816,721	4,423,280	4,971,387	5,514,742
Value per acre	Dollars	59	59	72	74
Crop acreage harvested	Acres	82,160	74,736	69,201	75,024
Total farms	Number	1,831	1,784	1,633	1,342
Average size of farms and ranches	Acres	316	364	376	508
Value of land and buildings per farm	Dollars	5,499	12,815	17,341	24,485
Proportion irrigated farms of all farms	Percent	NA	96	93	95
Average acreage irrigated per farm	Acres	57	58	60	79
Proportion of tenancy	Percent	24	17	16	13

1/ January 1, 1945.

2/ April 1, 1950.

3/ Excludes irrigated land not harvested and not pastured.

4/ Exclusive of poultry and poultry products and dairy products.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agriculture.

12,355 head for 1954 and 16,780 head for 1959 (table 32). All hay produced in 1944 totaled 63,542 tons compared with 79,019 tons in 1959. Total hay production is adequate to meet the dry feed requirements of the livestock.

A comparison of the value of farm products sold by source and value of crops harvested can be obtained from table 32, also. In 1949 and 1959 the spread between value of farm products sold and value of crops harvested was greatest, but about the same relative magnitude for both. Livestockmen benefited by feeding livestock in 1954, also, but they lost by feeding crops to livestock in 1944.

As gross sales of livestock and livestock products, other than poultry and poultry products and dairy products, decreased in proportion to gross sales of farm products, the difference between gross sales of farm products and gross value of crops harvested became less. In general, gross sales of livestock and livestock products indicated the profitability of farming in the Uncompahgre subbasin during the census years studied.

Gross value of crops harvested per acre increased from \$59.00 per acre in 1944 to \$74.00 per acre in 1959, while crop acreage harvested decreased from 82,160 acres to 75,024 acres.

Total farms decreased in number from 1,831 in 1944 to 1,342 in 1959 and average size of farms increased from 316 acres to 508 acres. Value of land and buildings per farm increased from \$5,499 in 1944 to \$24,485 in 1959, while average irrigated acreage per farm increased from 57 acres to 79 acres. Even in the Uncompahgre subbasin, containing the Uncompahgre project, farm numbers have decreased 27 percent since 1944; farm sizes have almost doubled; value of land and buildings per farm has increased more than four times; and irrigated acreage per farm has increased by 39 percent.

Proportion of irrigated farms to all farms has remained fairly constant at about 95 percent, while proportion of tenancy has decreased from 24 percent in 1944 to 13 percent in 1959.

Markets and Transportation

Most of the cattle are sold as calves from the Uncompahgre subbasin. Some of the calves are sold to contract buyers who ship them East by truck to the Midwest for feeding. Some of the calves are trucked South to feed yards in Arizona, and still others are fed out in the local area, especially near Delta, Colorado. A sugar factory at Delta processes the sugar beets grown in the area and the beet pulp is a cheap, succulent feed for cattle. Corn silage, grain corn, and sorghums are reasonably priced for feeding, also.

The majority of the dry beans sold are shipped by truck to the southwestern States, including Texas. Denver constitutes the market for vegetables and potatoes, which are shipped by rail through Grand Junction. Fruit is processed in Delta for further shipment. Moravian (malting) barley is

grown for the Coors Distillery at Golden, Colorado, and the grain that does not meet malting requirements is an excellent feed for fattening cattle. Dairy products are shipped to Delta and Grand Junction for further processing.

Transcontinental U.S. Highway 50 extends through most of the Uncompahgre subbasin and U.S. Highway 550 extends to the south through Ouray County. A branch of the Denver and Rio Grande Railroad traverses the subbasin from Ridgway to Delta. Transportation facilities are very good.

Relationship Between Irrigated Lands and Rangelands

Most of the cattle and sheep ranchers are dependent upon national forest lands and national land reserves for their dry range. Forest lands are the most important to cattlemen and the majority of those who have permits run the same number of beef cows for their breeding herd as they have permitted number on the national forest. Sheep allotments provide eight times as many animal-unit months of grazing from the national land reserve as from forest lands. Even though the sheepmen have their ranch headquarters in the Uncompahgre subbasin, many of them winter graze their sheep on the desert in western Colorado and eastern Utah. For this reason the irrigated lands and rangelands of the subbasin complement each other to a lesser extent for sheep feed than they do for cattle feed. Sheep numbers are difficult to obtain and the amount of feed furnished them by the irrigated land fluctuates so greatly from year to year that a direct relationship between irrigated and rangeland is practically impossible to establish.

Comparison of Acreage Irrigated and Water Supply

Water supply refers to the total annual water resource of the subbasin rather than the direct seasonal supply needed for irrigated land. Taylor Park Reservoir supplies late-season water to about 70 percent of the irrigated acreage of the subbasin and most of the subbasin receives late-season water. However, for comparative purposes acreage irrigated was collated with water supply.

Two consecutive 7-year periods, 1943-49 and 1950-56, were selected for comparison. Acreage irrigated in 1950-56 averaged 93 percent of the 1943-49 period, while water supply in 1950-56 averaged 84 percent of the 1943-49 period (combine table 31 and figure 5). There were slightly greater relative annual fluctuation in water supply than in acreage irrigated, but a close relationship existed between them. Acreages of small grains, potatoes, hay, fruit, and vegetables were smaller in 1950-56 than in 1943-49. Acreage of irrigated pasture was larger while acreages of corn and sugar beets remained about the same (table 31).

COMPARISON OF CUMULATIVE ACREAGES OF CROPS HARVESTED AND IRRIGATED PASTURE WITH WATER SUPPLY, UNCOMPAHGRE SUBBASIN, COLORADO, 1943-60

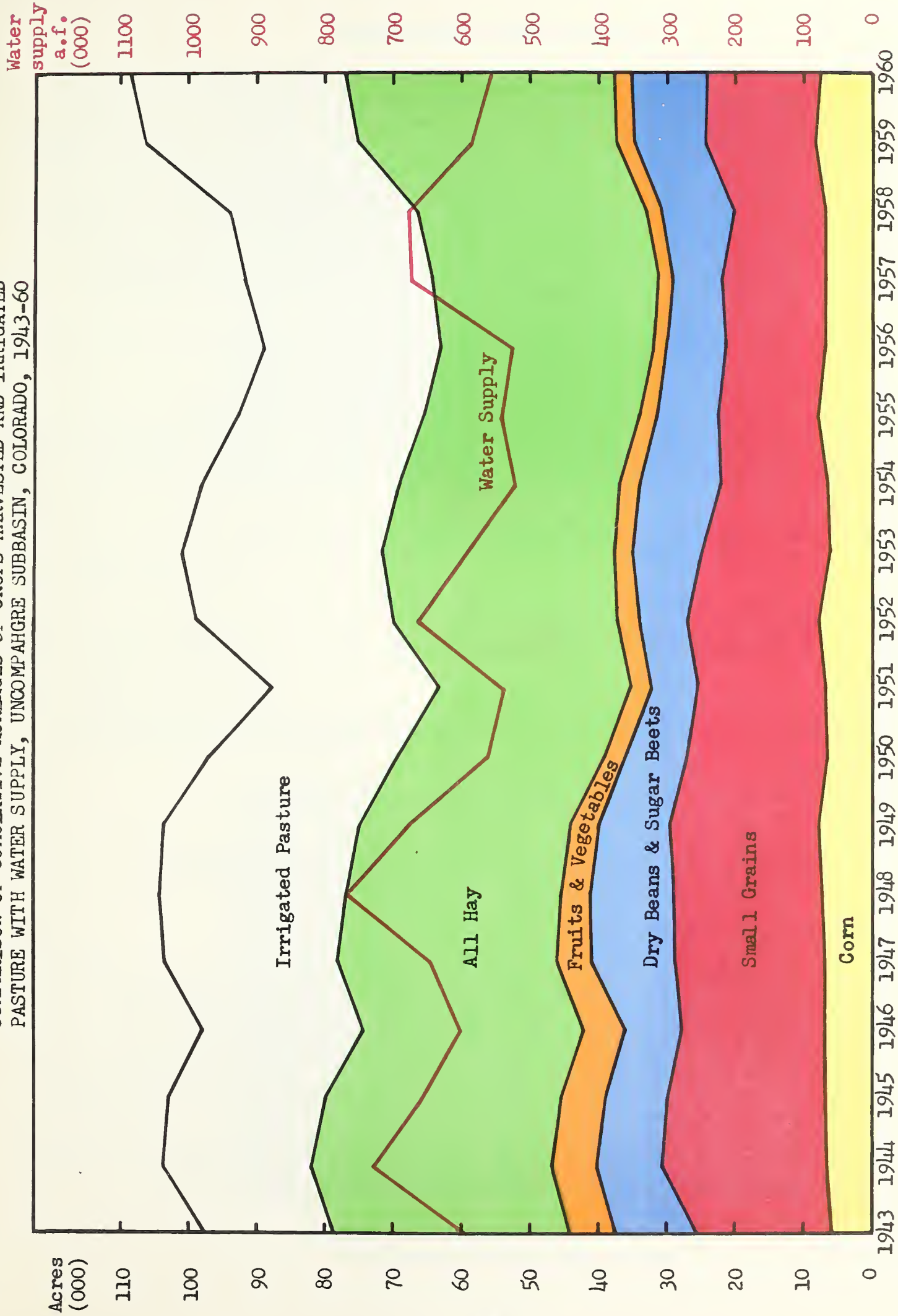


FIGURE 5

Potential Water Requirements

Principal water-development project possibilities in the subbasin are the proposed Bostwick Park and Dallas Creek projects of the Bureau of Reclamation. Both are currently being investigated by the Bureau of Reclamation and would provide adequate water supplies for most of the suitable new lands in the subbasin, and for most of the presently cultivated lands which now have insufficient water supplies. Total water supplies available for project development are adequate to fully meet project requirements. Estimates of potential water requirements reflect the approximately 15,755 additional acres that would be irrigated, and have been adjusted for acreages of presently cultivated lands that will be inundated by project reservoirs.

Estimates of potential water requirements or water-supply depletions in the subbasin are summarized in table 33.

Table 33.- Potential water requirement, Uncompahgre Subbasin 1/

Net crop consumptive use <u>2/</u>	189,614 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands and incidental areas	87,365 acre-feet
Municipal, domestic and livestock use, reservoir evaporation and foreseeable recreation development	<u>10,930</u> acre-feet
Total potential requirement	287,909 acre-feet

1/ Exclusive of industrial requirements.

2/ 121,055 acres including potential project development.

Opportunities for Developments Through Watershed Protection and Flood Prevention and Other USDA Authorities

Possible P. L. 566 Projects

In appraising the opportunities for water and related land resource developments in the Uncompahgre subbasin, it appears that most of the major water storage opportunities will be developed in connection with the proposed Bostwick Park and Dallas Creek projects of the Bureau of Reclamation. Several possible P. L. 566 watershed protection and flood prevention projects, however, appear to have merit and could be developed if group-type action were taken by the local people. These projects are largely of a flood prevention nature and are listed in table 34. Cost and benefit ratios have not been computed for these prospective projects; however, it appears that they do present opportunities for project-type action. Other potential P. L. 566



Silt deposited on lawn of farm home resulting from Roatcap Wash flood.



Remains of stack of 1,200 bales of hay following Roatcap Wash flood.

projects involving reorganization of group irrigation systems, together with associated agricultural water management practices and construction of small irrigation storage reservoirs, also exist. Exact nature and location of these opportunities is dependent upon desires and action of local sponsoring groups.

Project Development Opportunities under Other USDA Authorities

Several smaller size water development opportunities also exist in the Uncompahgre subbasin. These projects are of a type that could be assisted by USDA authorities other than P. L. 566. Assistance could include cost-sharing through ACP pooling agreements, loans through the FHA soil and water conservation loan program and technical assistance through the SCS group enterprise program. Four small water storage possibilities in this subbasin could store approximately 1,800 acre-feet of water. This water could be used to furnish supplemental irrigation water for 4,200 acres of presently irrigated land and/or 200 acres of new land.

Table 34. - Projects that appear to have P. L. 566 project possibilities, Uncompahgre Subbasin, Gunnison River Basin *

Project Name	Location	Size : Acres	Land Status	Land Use	Watershed Problems	Needed Works of : Improvement	Remarks
Horsefly Creek	Creek enters Uncompahgre River approx. 12 miles south of Montrose	25,900	19,500 private 6,400 B.L.M.	24,500 ac. range 1,100 ac. irrig. crop	Water and sediment from adjacent range lands deposited on crops lands. Erosion damage on watershed lands.	Proper range use, range reseeding, floodwater retarding structures above cropland, agricultural water management on cropland.	Channel capacity restricted through croplands. Average annual runoff 2,565 acre-feet from 40 sq. mile drainage area.
Dolores Creek	Approx. 10 miles S.W. of Montrose	14,400	9,600 private 4,800 B.L.M.	12,400 ac. range 2,200 ac. irrig. crop	Sediment from range lands deposited on croplands. Deep channel through croplands.	Floodwater retarding structure above cropland. Drainage and agricultural management. Range reseeding.	Average annual runoff 880 acre-feet from 20 sq. miles drainage area.
Happy Canyon	First drainage north of Dolores Creek	18,900	7,900 private 7,000 B.L.M. 4,000 F.S.	17,000 ac. range 1,300 ac. irrig. crop 600 ac. dry crop	Occasional sediment damage from adjacent range land areas on lower lying irrig. croplands.	Floodwater retarding structures and watershed land treatment.	Average annual runoff 1,165 acre-feet from 25 sq. miles drainage area.
Spring Creek	Adjacent to south end of Shavano Valley	30,600	13,000 F.S. 12,000 private 5,600 B.L.M.	25,400 ac. range 5,000 ac. irrig. crop 200 ac. dry crop	Channel capacity limited, creek overflows banks. Channel obstructed by weeds and trees. Some damage to road and structures. Sediment damage on cropland.	Floodwater retarding structures; channel clearing and additional capacity; watershed land treatment.	Maximum recorded runoff 1921-18,000 acre-feet. Average annual runoff--7,400 acre-feet from 45 sq. miles drainage area.
Shavano Valley	West of Montrose	32,000	24,000 B.L.M. 8,000 private	27,000 ac. range 5,000 ac. irrig. crop	5 or 6 small washes converge and deposit floodwater and sediment into irrigation canal and onto irrigated cropland. County road and canal also receive damage.	Floodwater retarding structure above canal. Watershed land treatment and agricultural management.	Damage by floods in this area initiated action to form Shavano Soil Conservation District.
Dry Creek	Enters river west of Delta	82,900	56,900 ac. priv. 15,000 B.L.M. 11,000 F.S.	77,700 ac. range 5,200 ac. irrig. crop	Bank cutting; channel capacity reduced with vegetative growth; over bank water and sediment damage.	No good suitable sites for retarding structures.	14,000 acre-feet annual average runoff from 101 sq. mi. drainage area.

* Determined by reconnaissance surveys, review of existing data and field interviews.



Table 34 cont'd. - Projects that appear to have P.L. project possibilities, Uncompahgre Subbasin, Gunnison River Basin *

Project Name	Location	Size : Acres	Land Status	Land Use	Watershed Problems	Needed Works of Improvement	Remarks
Sandy Creek	Drains into Dry Creek	4,900	4,500 B.L.M. 400 private	4,500 range 400 irrig. crop	Erosion on range lands, channel cutting through irrigated crop-land.	Watershed treatment measures and flood-water retarding structures	Could be included with Dry Creek
Sumner Draw	First drainage north of Roatcap	6,500	4,300 B.L.M. 2,200 private	4,700 range 1,800 irrig. crop	Erosion on range land. Floodwater and sediment damage to adjacent crop-land heavy.	Proper range management; land treatment measures on watershed lands and floodwater retarding structures above irrigated land.	
Roatcap Wash	Southwest of Delta, Colorado	11,210	6,030 B.L.M. 3,050 private 2,130 F.S.	8,520 range 2,690 irrig. crop	Floodwater and sediment damage to canals and irrig. cropland.	Floodwater retarding structures, proper range use and land treatment measures on watershed lands.	Active P. L. 566 project. Watershed work plan in formulation stage.
Buttermilk Wash	West of Delta, Colorado	8,500	4,400 private 4,100 B.L.M.	4,000 irrig. crop 4,500 range	Floodwater and sediment damage to irrigation canals and irrigation crop-land.	Maintain channel capacity to river.	Collects water from several adjacent drainages.
Montrose-Arroya	East and south of Montrose, Colorado	10,760	6,760 private 4,000 B.L.M.	6,060 irrig. crop 4,000 range 700 Montrose City	Floodwater and sediment damage from overflow of Arroyos to City of Montrose and adjacent irrig. land.	Maintain channel capacity; construct floodwater retarding structure; watershed land treatment.	Has caused considerable damage to Montrose City.

* Determined by reconnaissance surveys, review of existing data and field interviews.



WHITEWATER SUBBASIN

Physical Description of Subbasin

The Whitewater subbasin is located in the lower reaches of the Gunnison River Basin and comprises the watershed tributary to the river from below Roubideau Creek to the Colorado River. The elevation ranges from about 4,550 to 10,000 feet.

Soils

Four of the major soil groupings are recognized in this subbasin: 1. Desert-Sierozem; 2. Brown-Chestnut; 3. Mountain Prairie-Chestnut; and 4. Gray Wooded-Brown Podzolic-Mountain Prairie.

There are only 5,800 acres of irrigated land in this subbasin and all but 500 acres are in the Desert-Sierozem soil grouping. Acreage of the great soil groups within the major groupings and distribution of this acreage, by irrigated land and vegetative types, is given in table 35.

Land Use, Cover Conditions and Management

The Whitewater subbasin has a total area of approximately 588,209 acres or 11.5 percent of the total Gunnison Basin area. Irrigated land amounts to approximately 5,800 acres, or a little over two percent of the irrigated land in the Gunnison Basin. These irrigated lands vary in elevation from 5,000 to 6,000 feet above sea level with precipitation from 8 to 15 inches. Frost-free season varies from about 120 to 190 days.

The type of farming varies by location. Some areas along the Main Stem of the Gunnison River are used to produce fruit, predominantly peaches. The irrigation water is pumped direct from the river. Another area around the town of Whitewater and along the lower Kahnah Creek is used for general agricultural farming similar to the Grand Valley. The crops are alfalfa, corn, sugar beets, and small grain. Other areas are scattered high up along creeks such as Escalante, Kahnah, East and Whitewater Creeks. These latter areas are predominantly used for grass hay.

The nonirrigated land is used for grazing, timber production, wildlife habitat and recreation. Very little grazing value is realized from the desert shrub zone, which is about one-fifth of the subbasin area. Other areas furnish summer grazing for livestock and big game. About 86 percent of the rangelands are Federally owned. These are divided about 52 percent federal land reserve and 35 percent in the national forest.

The Uncompahgre Plateau provides summer grazing for a large industry of both sheep and cattle. Parts of the Kahnah Creek drainage supplies domestic water to Grand Junction.

Although at present there is little timber harvesting activity in the sub-basin, there are 55,000 acres of operable commercial forest land on the national forests. Timber that is being cut is sold entirely to local timber operators. Tree planting should be undertaken on 22,000 acres of nonproductive forest land.

Several vegetative zones are represented in this subbasin. The lowest zone is the desert shrub and grasses, this graduates upward through the pinyon-juniper, ponderosa pine-oakbrush to the spruce-fir type. Sagebrush and aspen is associated with ponderosa pine and oakbrush.

The city of Grand Junction receives its water supply from Kahnah Creek, and the town of Fruita receives its water supply from the headwaters of Northeast Creek and the Little Dolores River, in the Fruita division of the Uncompahgre National Forest on Pinyon Mesa. Livestock grazing is restricted within these municipal watershed areas and as a result vegetative cover is relatively good.

Most of the runoff comes in spring snowmelt, with the greater portion coming from above 8,500 feet. Summer rainstorms from the sagebrush, pinyon-juniper, desert shrub area produce much silt but very little runoff. Cover conditions in these areas are quite poor. The Uncompahgre side of the subbasin has more erosion and sediment production than the Grand Mesa side.

Phreatophytes are not a serious problem within this subbasin. About 3,800 acres could be replaced with more usable forage.

Recreation

The Uncompahgre Plateau receives heavy use from deer hunters, but light visitor use otherwise. There are many one-day mountain outings taken by local people from the surrounding hot valleys to enjoy the cool drive on the plateau and the scenery viewed from its rim. Several co-operative hunter access roads have been constructed or are planned for the future to aid in properly harvesting the available big game populations.

The Kahnah Creek area is widely known for its deer hunting. In 1961 it had one of the most liberal seasons in the State. A considerable portion of national forest rangeland in this area has been designated as game range and all livestock removed.

All outdoor recreation activity is expected to increase in the Whitewater subbasin. Current use is estimated at 61,000 man-days per year, and expected to increase five times by the year 2000.

Land Status

Table 36.- Land ownership, Whitewater Subbasin, Gunnison River Basin

Class of Ownership	Acres	Percent
Federal		
National forest <u>1/</u>	199,072	34
National land reserve <u>1/</u>	306,284	52
National park land	700	--
Colorado Fish and Game	80	--
Private	<u>82,073</u>	<u>14</u>
Total	<u>588,209</u>	<u>100</u>

1/ Bureau of Reclamation withdrawal land is included.

Water Supply

The water contributed by the Whitewater subbasin to the Basin water supplies comes principally from snowmelt runoff on the west end of Grand Mesa and the northeast end of the Uncompahgre Plateau. The scattered tracts of irrigated land in this subbasin are furnished irrigation water by diversion from the Gunnison River, Kahnah, Whitewater, Escalante and East Creeks and other tributaries. Except on Kahnah Creek no large storage reservoirs have been developed in the subbasin. Most of the runoff originates in the comparatively small part of the drainage areas above 8,000 or 8,500 feet elevation. In this subbasin the proportion of annual runoff supplied by summer precipitation is somewhat higher than in the other subbasins, but still is only a minor part of the seasonal total.

Estimates of the undepleted water supply of the subbasin are summarized in table 37.

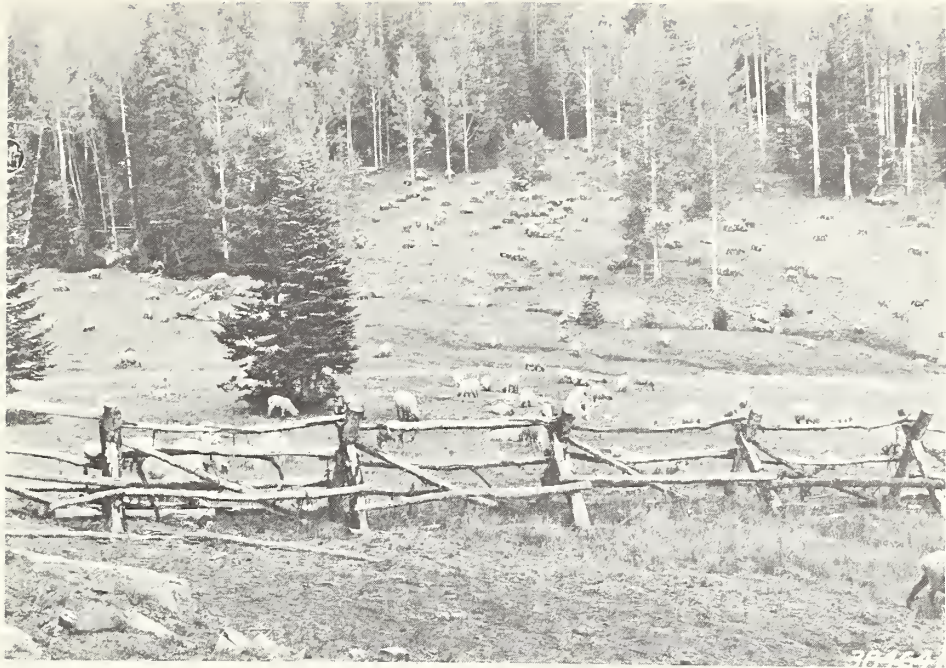
Table 37.- Water supply, Whitewater Subbasin, 1/ 1943-60 average

Kahnah Creek <u>2/</u>	30,500 acre-feet
Escalante, Dominquez and East Canyon Creeks and adjacent areas	66,600 acre-feet
Whitewater Creek, North Fork and miscellaneous unged areas	<u>8,800</u> acre-feet
Total <u>3/</u>	<u>105,900</u> acre-feet

1/ Includes subbasin contribution to Basin water supplies. Does not include main streamflows entering subbasin, unmeasured return flows from up-stream subbasins, or direct accretions to main river flow, if any.

2/ Includes city of Grand Junction diversions.

3/ Partly estimated by correlation.



Timber, forage, water production, and sheep grazing on the Uncompahgre National Forest.

MULTIPLE USE -



Stock Water Pond for Livestock.

Present Water Use

Irrigated lands in this subbasin are scattered along the main watercourses and are generally supplied by small individual irrigation systems. The largest block of irrigated land is located in the Kahnah Creek basin near the community of Whitewater at the northeast end of the subbasin. There are several separate farms located on isolated tracts within the Whitewater Canyon of the Gunnison River. In general, farms contiguous to the main river draw water supplies from the river rather than from the contributing areas. The remainder of the farms, located in the valleys of the principal tributary drainages, have somewhat less adequate water supplies available to them because of the wider fluctuations in flow which occur in the tributary drainages. Essentially, all of the suitable land has already been developed for farming. There are some additional scattered tracts of land which would be suitable for irrigation but the cost of providing the necessary water supplies has so far prevented their development.

The present water-supply depletions in the subbasin are summarized in table 38.

Table 38.- Present water use, Whitewater Subbasin, 1943-60 average

Net crop consumptive use <u>1/</u>	7,909 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands and incidental areas	9,205 acre-feet
Municipal supply exported from area to city of Grand Junction and town of Fruita	6,064 acre-feet
Other municipal, domestic and livestock use and evaporation	<u>1,844</u> acre-feet
1943-60 average annual use within subbasin	25,022 acre-feet

1/ 5,800 acres.

Agricultural Economy

The Whitewater subbasin comprises only 2 percent of the irrigated acreage in the Gunnison River Basin. The agricultural economy of the subbasin is very similar to that of the North Fork subbasin. However, average sales from livestock and livestock products exceed average fruit sales, which is just the reverse of North Fork subbasin.

Some areas along the Gunnison River and its tributaries are well adapted to fruit production because of good air drainage and a relatively long, frost-free season. Areas not adapted to fruit production are used for the production of livestock feeds.

Sources of agricultural production data and procedures have been discussed on page 17. In addition, information was used from interviews with technicians who were well acquainted with the area.

Agricultural Production

Annual data for crop acreages, production, and values were compiled for the 1943-60 period because satisfactory water-supply data were available for that period only. Averages for 1943-49, and 1950-56 show trends within the 1943-60 period (table 39).

Fruit acreage averaged less than 7½ percent of total land irrigated in 1943-60 but its gross value was 54 percent of all crops harvested. All hay acreage comprised almost 32 percent of the irrigated acreage but accounted for slightly less than 25 percent of gross value of all crops harvested. (Irrigated pasture was not considered part of cropland harvested in determining gross crop values.) Irrigated pasture acreage amounted to 31½ percent of total irrigated and combined with all hay acreage, comprised over 63 percent of the irrigated land. Alfalfa hay accounted for the largest acreage of any single crop harvested with 29 percent. Average irrigated acreage of the Whitewater subbasin for the 1943-60 period has been estimated at 5,800 acres.

Currently, there are 23 Forest Service permits for cattle. Cattle number 4,974 head and usually graze from June 1 to October 15 for a total of 21,005 animal-unit months. Sheep ranches have three permits to graze 695 sheep from July 1 to September 15 for a total of 333 animal-unit months.

Bureau of Land Management permits total eight for cattle ranches headquartered in the subbasin with 4,614 animal-unit months of grazing. Sheep permits number one for ranches headquartered in the subbasin with 300 animal-unit months of grazing. Sheep are of minor importance in the Whitewater subbasin.

Number of cattle, tons of all hay, and acres of irrigated pasture are a few of the items presented in table 40 for census years 1944-59. Numbers of cows and heifers that have calved, decreased from 1,224 in 1944 to 1,155 in 1959. All hay produced, increased from 3,555 tons in 1944 to 5,235 tons in 1959, and irrigated pasture increased from 1,373 acres to 1,829 acres.

A comparison of the value of farm products sold by source and value of crops harvested can be made from table 40, also. Value of livestock and livestock products sold, other than poultry and poultry products and dairy products, were highest in 1959 followed by 1949. Value of fruit sold was highest in 1954 and next highest in 1959. Thus, the spread between value of farm products sold and value of crops harvested was greatest in 1959, followed by 1949 and 1954. Sufficient spread existed in 1944 for cattlemen to feed livestock rather than sell their feed crops, and better utilization was made of irrigated pasture and field residue.

Table 39.- Average acreage, total production and gross value of principal crops harvested in Whitewater Subbasin, Colorado, 1943-49, 1950-56 and 1943-60

Crops	Unit	1943-49		1950-56		1943-60	
		Average	Percent of total	Average	Percent of total	Average	Percent of total
Corn							
Harvested	Acres	616	12.14	488	8.59	575	10.43
Production	Bushels	25,651		27,445		30,007	
Value	Dollars	35,035		44,286		42,444	
Oats							
Harvested	Acres	994	19.59	1,120	19.72	1,040	18.87
Production	Bushels	39,476		48,111		42,923	
Value	Dollars	30,290		43,099		34,849	
Alfalfa hay							
Harvested	Acres	(1,330)	(26.22)	(1,722)	(30.32)	(1,609)	(29.19)
Production	Tons	(3,238)		(4,839)		(4,277)	
All hay							
Harvested	Acres	1,495	29.47	1,819	32.03	1,753	31.80
Production	Tons	3,460		4,980		4,478	
Value	Dollars	56,886		109,342		87,857	
Fruit							
Harvested	Acres	432	8.52	408	7.19	406	7.37
Value	Dollars	206,187		178,326		194,055	
Total crops							
Harvested	Acres	3,537	69.72	3,835	67.53	3,774	68.47
Value	Dollars	328,398		375,053		359,205	
Other land irr.	Acres	1,536	30.28	1,844	32.47	1,738	31.53
Total land irr.	Acres	<u>1/5,073</u>	100.00	<u>1/5,679</u>	100.00	<u>1/5,512</u>	100.00

1/ Excludes irrigated land not harvested and not pastured.

Compiled from Colorado Agricultural Statistics and from the U. S. Census of Agri.

From 1944 to 1959, total farms decreased in number from 66 to 47, and average size of farms increased from 459 acres to 760 acres. In the same period value of land and buildings increased from \$11,930 to \$45,556.

Average irrigated acreage per farm increased from 76 acres in 1944 to 123 acres in 1959, for a 62 percent increase. Proportion of irrigated farms to all farms has remained at about 96 percent, while the proportion of tenancy decreased from 13 percent in 1944 to 6 percent in 1959.

Table 40.- Cattle numbers, value of farm products sold by source, value of crops harvested, and other selected items, Whitewater Subbasin, Colorado, Census years 1944-59

Item	: Unit	: 1944	: 1949	: 1954	: 1959
Cattle and calves	Number	<u>1</u> /2,289	<u>2</u> /2,515	2,902	2,515
Cows and heifers that have calved	Number	<u>1</u> /1,224	<u>2</u> /1,239	1,378	1,155
All hay harvested	Acres	1,584	1,472	1,892	2,061
Production of all hay	Tons	3,555	3,833	4,808	5,235
Irrigated pasture	Acres	1,373	1,886	2,035	1,829
Total irrigated land <u>3</u> /	Acres	4,998	5,667	5,814	5,791
Value of farm products sold by source:					
Field crops	Dollars	62,712	75,984	107,747	102,696
Vegetables	Dollars	0	0	0	0
Fruits and nuts	Dollars	185,520	108,686	216,036	200,533
Forest products and hort. specialties	Dollars	8,155	6,257	8,086	9,533
Poultry and poultry products	Dollars	14,700	13,190	18,056	15,472
Dairy products	Dollars	23,807	38,912	49,658	56,211
Livestock and livestock products <u>4</u> /	Dollars	121,725	234,673	181,314	313,875
Total farm products	Dollars	416,619	477,702	580,897	698,320
Value of crops harvested	Dollars	307,928	297,863	429,349	426,174
Value per acre	Dollars	85	79	114	108
Crop acreage harvested	Acres	3,625	3,781	3,779	3,962
Total farms	Number	66	63	61	47
Average size of farms and ranches	Acres	459	433	502	760
Value of land and buildings per farm	Dollars	11,930	19,832	27,714	45,556
Proportion irrigated farms of all farms	Percent	NA	97	96	96
Average acreage irrigated per farm	Acres	76	90	95	123
Proportion of tenancy	Percent	13	9	8	6

1/ January 1, 1945.

2/ April 1, 1950.

3/ Excludes irrigated land not harvested and not pastured.

4/ Exclusive of poultry and poultry products and dairy products.

Markets and Transportation

Calves account for the majority of cattle sales in the Whitewater subbasin. Most of the calves are trucked to feedlots in Colorado and Utah for feeding out. A small proportion of the calves go to feedlots in nearby areas of western Colorado. Fruit is trucked to Grand Junction for cleaning, grading, packaging and preparing for marketing. Some of the fruit is sold at the farms to truckers who take it south for sale in New Mexico, Oklahoma, and Texas.

Transcontinental U. S. Highway 50 and a branch of the Denver and Rio Grande railroad traverse the area and provide good transportation facilities for most of the ranchers.

Relationship Between Irrigated Lands and Rangelands

The ratio of animal-unit months of range to acres of irrigated land is three times higher in the Whitewater subbasin than in the Upper Gunnison subbasin, and five times greater than the average for the Gunnison River Basin. Most ranchers with grazing permits have the same number of beef cows for their breeding herd as their permitted number on the national forest. The irrigated lands and dry rangelands complement each other in the production of feed for range cattle.

Comparison of Acreage Irrigated and Water Supply

Water supply refers to the total annual water resources of the subbasin rather than the direct seasonal supply needed for irrigated land. For comparative purposes acreage irrigated was collated with water supply. There was no relationship between acreage irrigated and water supply in the Whitewater subbasin (figure 6).

Potential Water Requirement

There are a few areas potentially suitable for development in the subbasin. However, the costs based on present day economic considerations appear to be too great to make these developments feasible at this time. It is accordingly estimated at this time there will be little or no increase in irrigated lands or in incidental area usage within the subbasin. Some increased domestic and livestock and recreational use may be anticipated, and also increases in the amount exported for municipal purposes in the city of Grand Junction.

Estimates of the potential water requirement or water-supply depletions in the subbasin are summarized in table 41.

COMPARISON OF CUMULATIVE ACREAGES OF CROPS HARVESTED AND IRRIGATED PASTURE WITH WATER SUPPLY, WHITEWATER SUBBASIN, COLORADO, 1943-1960.

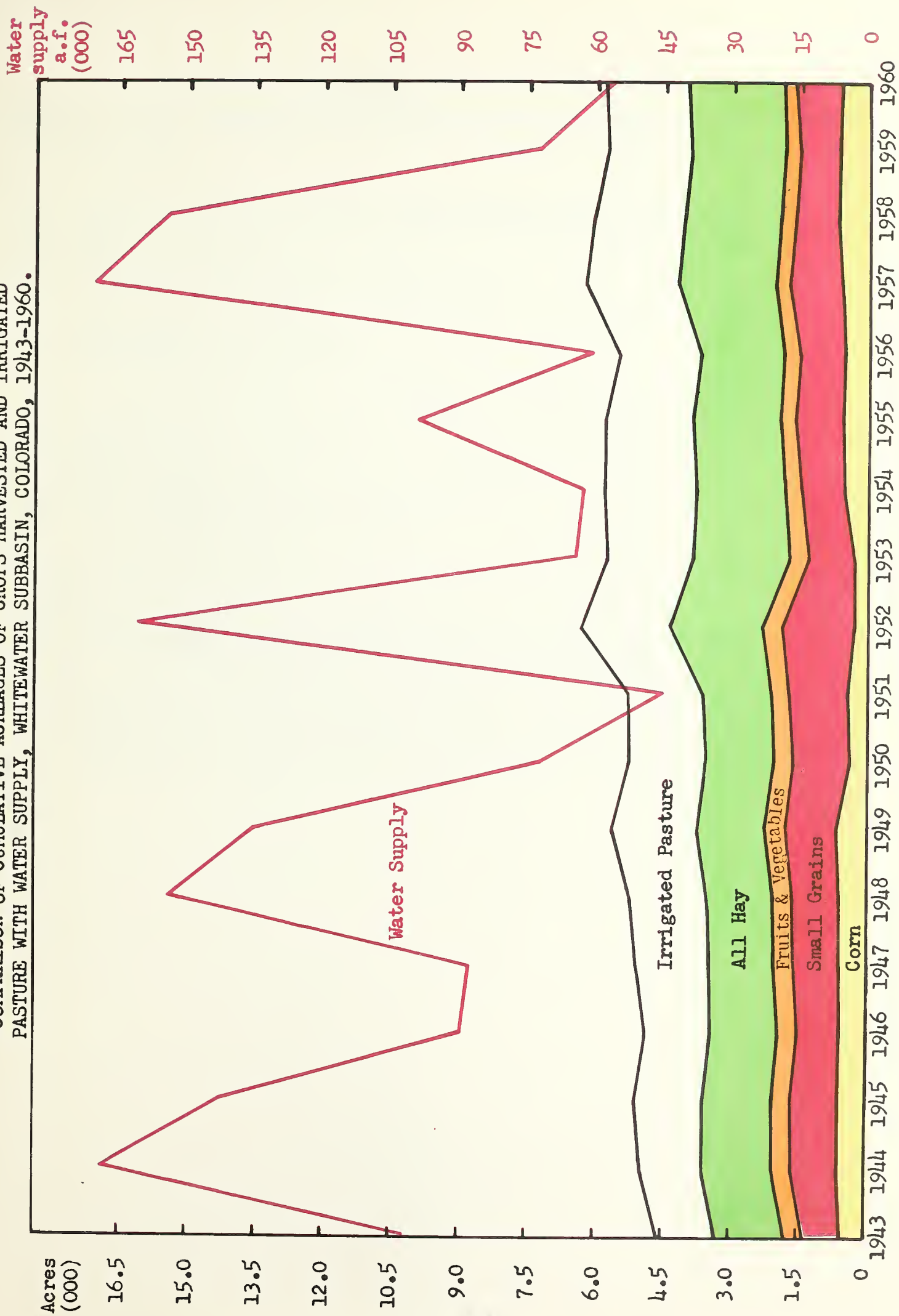


FIGURE 6

Table 41.- Potential water requirement, Whitewater Subbasin 1/

Net crop consumptive use <u>2/</u>	7,909 acre-feet
Riparian vegetation, nonbeneficial phreatophytes, seeped lands, and incidental areas	9,205 acre-feet
Municipal supply exported from subbasin to city of Grand Junction and town of Fruita	11,628 acre-feet
Other municipal, domestic and livestock use and evaporation and foreseeable recreation development	<u>2,171</u> acre-feet
Total potential requirement	30,913 acre-feet

1/ Exclusive of industrial use.

2/ 5,800 acres.

Opportunities for Developments Through Watershed Protection
and Flood Prevention and Other USDA Authorities

Very little opportunity exists in the Whitewater subbasin for project-type development. Most of the agricultural land is located in small scattered tracts along the Gunnison River, Kahnah Creek, Whitewater Creek and Escalante Creek, and is generally not suited to project-type action.

COORDINATED BASIS FOR PROJECT PLANNING

The foregoing material about the Gunnison River Basin has pointed out for each subbasin, based on information presently available:

1. The present level of land and water use,
2. Some problems connected with management and development of water and related land resources,
3. Major projects that are authorized, reported and under investigation,
4. Opportunities for projects for further development of water and related land resources under the provisions of the Watershed Protection and Flood Prevention Act, and
5. Other project-type USDA development opportunities.

These major project proposals and watershed project development possibilities are complementary to and can be carried out without conflicting with each other or with existing developments and so constitute a coordinated basis for planning further water and related land resources developments in the Basin. In accomplishing this, however, close cooperation and coordination among the several concerned State and Federal agencies is necessary. This is especially important in view of the large percentage of Federal land and the many interests and land uses involved.

U.S.D.A. WATER AND LAND RESOURCE PROGRAMS

The Department of Agriculture administers a number of programs which are directly concerned with the use and development of water and related land resources. These programs are assisting in development of the Gunnison River Basin. A brief summary of these activities follows, together with the departmental agency responsible for their administration.

The Colorado Cooperative Extension Service has primary responsibility for leadership in USDA educational programs and coordinates all educational activities of the Department. County agricultural agents disseminate to farmers and ranchers in the Basin research and other scientific, practical and useful information on subjects related to water and land. County agricultural agents serving farmers in the Basin are located in Delta, Montrose, Gunnison and Grand Junction.

County and State Committees of the Agricultural Stabilization and Conservation Service (ASCS) administer the Agricultural Conservation Program (ACP). This program provides a means of sharing the cost of carrying out certain soil and water practices. Participation may be by individual farmers and ranchers or by groups. Among the practices included are those which provide for control and more effective use of agricultural water. This program is active in all counties in the Gunnison River Basin.

Farm credit for family-type farms and rural areas is furnished by the Farmers Home Administration. Farm ownership, farm operating, farm housing, water development and soil conservation-type loans are all available to local land owners and operators. Watershed loans are available also from FHA to assist eligible organizations in meeting their share of costs of works of improvement in connection with P. L. 566 watershed protection projects. FHA maintains offices in Grand Junction and Montrose to serve farmers and ranchers in the Gunnison River Basin.

The Forest Service is charged with the responsibility for promoting the conservation and wise use of the country's forest and related range, water and other wild land natural resources. To meet this responsibility, the Forest Service engages in three main lines of work:

1. Management of the national forests and national grasslands -- these Federal lands are managed under the principles of "Multiple Use and Sustained Yield."
2. Cooperation with the State and private forest land owners -- authorized by several Acts of Congress, the Forest Service furnishes technical guidance and financial assistance through the State Forester's office for tree planting, fire control and watershed improvement work on State and privately-owned lands.

3. Forest and related range research -- the Rocky Mountain Forest and Range Experiment Station at Fort Collins conducts studies for improvement in forest and related range and watershed conditions and management within the Basin.

The Forest Service also has program responsibility for forest lands in P. L. 566 watershed projects. Forest lands from the Gunnison, Grand Mesa and Uncompahgre National Forests are located in the Gunnison River Basin. These lands are administered through the U. S. Forest Service Supervisor offices at Gunnison and Delta.

The Soil Conservation Service furnishes technical assistance to the Gunnison, Cimarron, Shavano, Uncompahgre, Delta, Glade Park and Upper Grand Valley Soil Conservation Districts in the Gunnison River Basin. This assistance is provided primarily to assist farmers and ranchers plan proper land use and apply needed soil and water conservation measures on their lands. SCS has major departmental responsibility for soil surveys, snow surveys and water-supply forecasting, watershed protection and flood prevention programs, and technical assistance responsibility for the Agricultural Conservation Program. SCS offices serving the Basin are located in Gunnison, Montrose, Delta, Paonia, and Grand Junction.

The Watershed Protection and Flood Prevention Act, P. L. 566, as amended, authorizes the Secretary of Agriculture to cooperate with qualified local organizations in planning and carrying out works of improvement for flood prevention and/or the conservation, development, utilization and disposal of water in watershed areas of 250,000 acres or less in size. The act provides for technical, financial and credit assistance by the Department of Agriculture to groups of land owners and operators and others living within small watershed areas. This project-type program helps fill the gap between farm-by-farm conservation operations and the large project-type programs available from the Bureau of Reclamation and the Corps of Engineers. The Soil Conservation Service has overall responsibility for its administration. The Forest Service is responsible for watershed treatment aspects on national forest and other forest lands. The Farmers Home Administration is responsible for making loans in connection with the program.



