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THE VALE RANGELAND REHABILITATION PROGRAM: THE DESERT REPAIRED IN SOUTHEASTERN OREGON

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The authors wish to express their appreciation to personnel of both the Vale, Oregon, District and others in the Bureau of Land Management and to the Pacific Northwest Forest and Range Experiment Station. Many persons in both organizations enthusiastically contributed to this study. This report will be used as a case study in the United Nations Environment Program on Desertification.

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THE VALE RANGELAND REHABILITATION PROGRAM: THE DESERT REPAIRED IN SOUTHEASTERN OREGON

Reference Abstract

Heady, Harold F., and James Bartolome.
1977. The Vale rangeland rehabilitation program: The desert repaired in southeastern Oregon. USDA For. Serv. Resour. Bull. PNW-70, 139 p., illus. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Discusses the initiation, execution, and outcome of an 11-year program of range rehabilitation on public domain lands in southeastern Oregon. Initiated primarily to benefit the livestock industry, the investment of $10 million in range improvements also profoundly affected other multiple uses. The analysis of this large and successful program should serve as a useful guide for monitoring other range programs.

KEYWORDS: Range management, range development, rehabilitation, revegetation, environment, economics (rangeland).

RESEARCH SUMMARY

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This report evaluates the large-scale rangeland rehabilitation program in the Vale, Oregon, District of the Bureau of Land Management. Sagebrush in combination with two grasses, the native perennial bluebunch wheatgrass and the introduced annual cheatgrass, dominates the vegetation on 90 percent of the 60- by 175-mile (100- by 180-km) area of the district. Cold winters and dry summers characterize the climate; annual precipitation averages from 7 to 12 inches (180 to 300 mm). About 24,000 persons live in the district but they are concentrated in a small region of irrigated croplands. More than half the 419 ranchers in the district had grazing permits on Federal lands in 1975.

The history of livestock use and human settlement, beginning with the arrival of the fur trappers in the early 1800's, is discussed. Major impacts came from travelers along the Oregon Trail, mining after 1863, and exploitive livestock grazing and homesteading from 1880 until 1934. Passage of the Taylor Grazing Act in 1934 initiated management of the public domain lands. The destruction of the vegetation and soil was related to the types of use. The nature of the climax vegetation, the pattern of destruction, and present range condition are inferred.

Congress appropriated approximately $10 million over an 11-year period beginning in 1963 to halt erosion, stabilize the livestock industry, and benefit other land uses. The money was used to control brush on 506,000 acres (205,000 ha), to seed 267,000 acres (108,000 ha) to desirable forage species, and to build over 2,000 miles (3 330 km) of fence, 1,600 water developments, and 463 miles (741 km) of pipelines. Supervision and management of the land uses were large parts of the Vale Program.

The major sagebrush control practices used either disk plows or aerially applied 2,4-D. Absence of native forage species necessitated seeding of introduced species, primarily crested wheatgrass. Attempts at reseeding without site preparation usually failed. Burning as a land treatment was not seriously considered.

Extensive sampling of treated areas revealed that most attempts at land rehabilitation succeeded. Treatments reduced brush, yet rarely were all brush plants killed. Reinvasion of sagebrush occurred in almost all areas, especially shortly after treatment. Where perennial grass stands were dense, cheatgrass was usually absent, and big sagebrush only reinvaded to about 25 percent cover. Under proper management, stands with brush no more than a quarter of the total cover should last indefinitely.

Livestock management formed an integral part of the Vale Program from its beginning. Currently, several hundred pastures are used in a myriad of different patterns of seasonal and rotational use. Of 144 pastures examined, 15 percent were grazed at the same time every year; 33 percent were rotated during the growing season and every year after seed had ripened. Systems emphasized deferment until seed ripening rather than no grazing for a whole year. The original plan to use crested wheatgrass primarily for the spring turnout pastures gradually changed during the course of the Vale Program. Crested wheatgrass seedings are now managed in the same patterns as the native bluebunch wheatgrass range. The Vale Program has increased the district's estimated grazing capacity from 285,000 animal unit months (AUM's) in 1962 to 438,000 AUM's in 1975. As only 8 percent of the total district was treated with brush control and seeding, most of the increase in grazing capacity resulted from improvement of native range.

Use values other than for livestock increased because of the project. The nearly 2,500 wild horses are rapidly increasing. Pronghorn antelope and bighorn sheep have increased, if not because of improved range conditions, at least along with the rehabilitation. Other wildlife species exhibited varied responses in relation to their particular habitat requirements, but none seems to have been damaged permanently by the land treatment. Water developments for livestock benefited waterfowl, and new fisheries were established. Range restoration, stimulated by the need for livestock production and made necessary by past abuses in livestock management, favorably served other range users as well. Except for soil damage from off-road vehicles, accelerated erosion has been essentially eliminated.

An economic analysis of the overall program reveals that at the current $1.51 fee for an AUM costs exceed benefits by about $5 million. At the $3 market value of an AUM in the region, costs exceed benefits to livestock by only $500,000. Many continuing costs are associated with upkeep of the physical improvements, especially water developments. Users, such as hunters, campers, rockhounds, and fishermen, have benefited from the project to an amount which probably exceeds the difference between livestock income and costs. We believe the nonmarket values of the Vale Program to society, including restoration of abused and exploited natural resources, exceed even the $5 million not covered by livestock grazing at the $1.51 fee per AUM.

Contents

Introduction

This report evaluates a large-scale rangeland rehabilitation program on lands administered by the Vale, Oregon, District of the Bureau of Land Management (BLM). Analysis goes beyond a biological-physical characterization because the program cannot be fully understood without knowledge of the many factors surrounding its initiation. The report presents the history of land use in the district, some practical politics of land management, multiple use relationships, impacts of range rehabilitation on many parts of the rangeland ecosystem, community reactions to the program, and economics of rangeland rehabilitation. The Vale Program exemplifies these national land use issues. Program evaluation should be useful in a broader context than just Malheur County, Oregon. We have two principal objectives in this report: (1) to make the lessons learned in the Vale Program available for land rehabilitation programs elsewhere and (2) to present a large and practical example of successful cooperation among land users of different kinds, including their supporting political and social institutions.

A resource management program, such as the Vale Program, aims to accomplish good deeds. The kinds of products which are good, the quantities of each, and where they arise may be indicated in the plans for the program; but society, economics, and political necessities change. Competition and controversies develop, so the managers of public lands must answer changing multiple use questions as time goes on. The public now asks for more consideration of environmental impacts, deeper analysis of alternatives in land use, better informed resource allocation, and more multiple resource planning on a long-term basis than was considered when the program started. Congress has established by law a long-term planning process in the Forest and Rangeland Renewable Resources Act of 1974. Although the program planning part of that act does not apply to the lands administered by BLM, additional resource planning on those lands will probably be required. This case history of the Vale Program should be helpful in future planning efforts both locally and on other districts.

The Vale Program started without full inventory and analysis of the landscape conditions. Little or no continued monitoring of effects was done beyond estimates and evaluations needed for further on-the-spot decisions. Therefore, the data base for this report varies in accuracy and quantity. File materials, mimeographed reports, opinions of persons interviewed, and early photos have been used. Data were obtained from other agencies and we collected considerable measurements of vegetation in the many treated areas. Therefore, our conclusions are based on a variety of sources and impressions gained on a part-time basis extending from April 1975 to September 1976.

Several terms are defined briefly to clarify their use within this work. Rangeland refers to the land and its resources of soil, vegetation, and wild animals. Rangeland management means land management for all purposes. Livestock management principally concerns the movement and husbandry of domestic animals. Wildlife includes game, fish, and other wild animals. Animal unit month (AUM) refers to a mature cow, with or without a calf, grazing for 1 month, or its equivalent in other kinds and classes of livestock. Any cow or horse over 6 months old is counted as an animal unit (AU) by BLM. We use "program" throughout to encompass the whole operation and "project" to be specific, as the "Chicken Creek seeding project."

The Vale District

LOCATION AND EXTENT

The Vale District of the Bureau of Land Management occupies the southeastern corner of Oregon, approximately within latitudes 42 and 44 degrees north, and longitudes 117 and 118 degrees west. The boundaries of Malheur County, Oregon, nearly coincide with those of the district. In addition, a small area in Idaho southwest of the Owyhee River and another piece to the south in Nevada are included in the district. At the time the Vale Program was begun in 1962, the district enclosed 6.5 million acres (2.6 million ha). Several boundary adjustments resulted in a shift in location and a slight reduction in area. The Vale District forms a rough rectangle approximately 175 by 60 miles (280 by 100 km) (fig. 1). To avoid extensive redrafting, the maps presented in this report are based on boundaries as they existed in the 1960's.

PHYSIOGRAPHY

As shown in figure 2, elevations in the district range from 2,000 to nearly 8,000 feet (600 to 2 400 m). The higher elevations in the Trout Creek Mountains to the southwest and the upper reaches of Bully Creek in the northwest drain toward the Snake River along the northeastern edge of the district. Main drainages are the Malheur River which flows from the west and the Owyhee River which flows northward through the district from its origins near the corner of Oregon, Idaho, and Nevada.

The most extensive land form is a gently sloping to rolling lava plateau with elevations above 4,000 feet (1 200 m). This plateau has been extensively dissected into canyons with vertical cliffs by branches of the Owyhee River and Succor Creek (fig. 3) (Kittleman 1973). Mesas of several thousand acres, the remnants of earlier plateaus, are important as topographyic features and as management units. The variety of physiographic prominences such as the rugged Owyhee Breaks along the east side of the Owyhee Reservoir and the Rome Colosseums, Mahogany Mountain, and Three Finger Rock contrast with the broad flat expanse of Barren Valley in the west-central region of the district. Numerous closed basins indicate the existence of ancient lakes. Recent lava flows, some probably between 500 and 1,000 years of age, in the central region still remain devoid of soil and vegetation. The Jordan craters and caves in the lava flows appear as if they were formed only yesterday. The older lava has varying degrees of soil development. Basaltic and rhyolitic lava and tuffs, ranging in age from Miocene to Recent, underlie extensive areas in the district.

CLIMATE

The semiarid climate of the Vale District is in a transition zone between continental and Pacific coastal types, with wide variations in rainfall and temperature between seasons. The district typifies the Great Basin region and is called a cold desert. Most of the district receives an average of 7 to 12 inches (180 to 300 mm) of precipitation annually (fig. 4). Average annual precipitation strongly correlates with elevation, but only the higher mountains receive more than 15 inches (380 mm).

Figure 1.--The Vale District occupies the southeastern corner of Oregon.

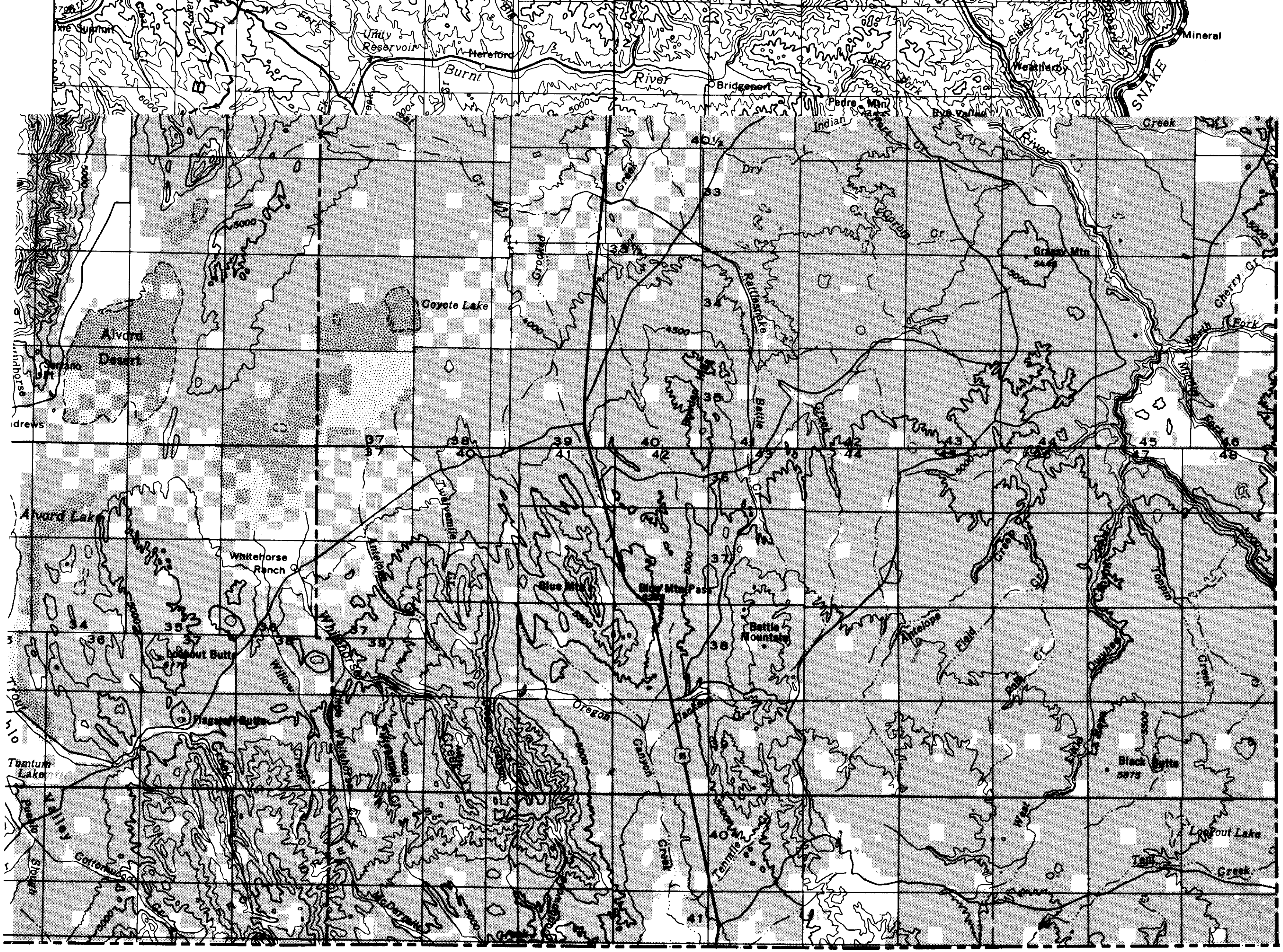

Figure 2.--Physical, topographic, cultural features, and land ownership of the Vale District.

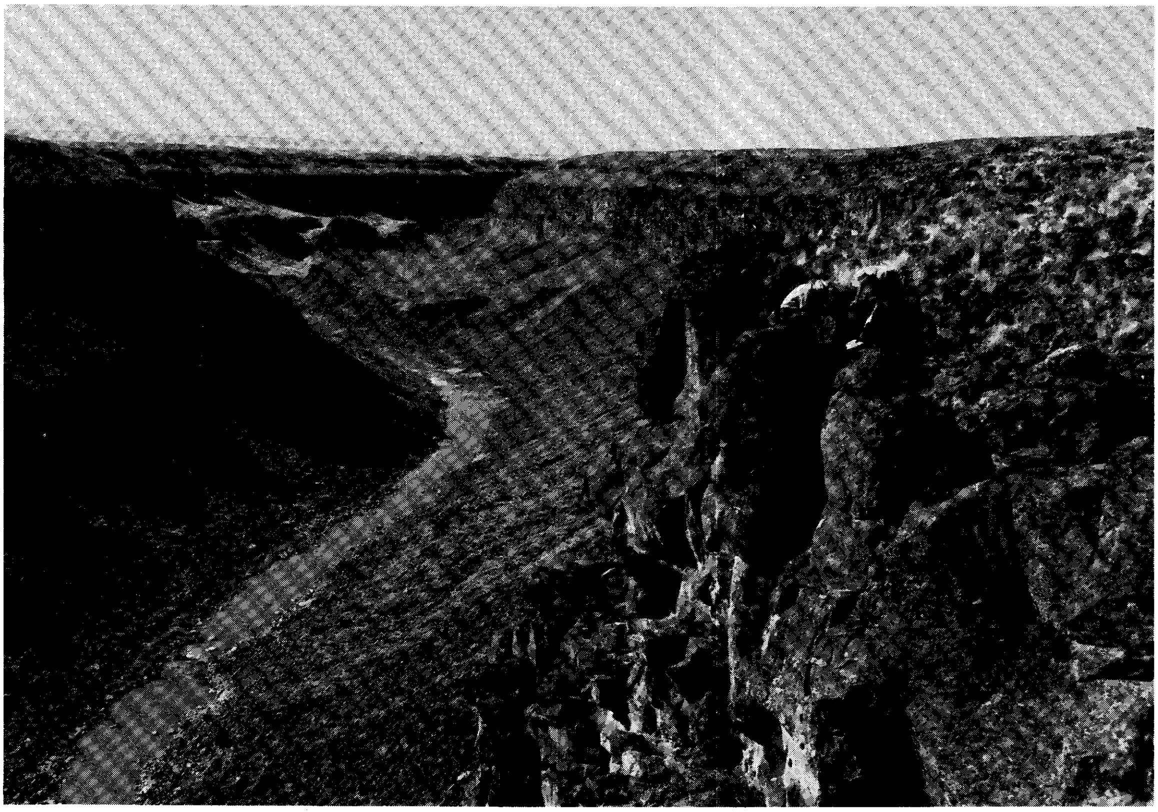

Figure 3.--The Owyhee River and its branches cut this and other canyons across the Vale District (Bureau of Land Management photo).

Most precipitation falls during the winter (November-March) in the form of snow; however, May is the wettest month of the year (fig. 5). Thunderstorms contribute rain in early summer, but significant moisture for plant growth comes almost entirely in winter precipitation. At Vale, Oregon, the crop year precipitation varied as much as 70 to 140 percent of the 22-year average of 9.3 inches (236 mm) from 1955 through 1976 (table 1). During the 11 years (1962-72) of major vegetational manipulation in the Vale District program, 7 received more than average precipitation and only 1 year was exceptionally dry in the spring.

Temperatures vary greatly by season and are markedly influenced by elevation. Danner, Oregon, at 4,000-foot (1 200-m) elevation near the center of the district, showed a range of mean monthly temperatures from 68.5 °F in July to 25.6 °F in January (20.3 to -3.7 °C). All mean monthly temperatures for November through March were below 40 °F (4.6 °C) (fig. 5).

The cold winters and lack of summer moisture limit the actual growing season to a short period in spring and early summer. The frost-free season is less than 90 days in areas above 4,500-foot (1 375-m) elevation, which limits agriculture to the harvesting of hay in valleys south of the Malheur River. The low-elevation lands along the Malheur and the Snake Rivers produce sugar beets, onions, potatoes, feed grains, hay, and many other crops under irrigation. Grazing use is restricted by the ephemeral nature of watering places as well as the short green-feed season. Little permanent, undeveloped water exists over much of the district, especially outside of patented land. Water development for livestock has been a major range management practice.

SOILS

Soils of the Vale District fall into five of the great soil groups (fig. 6). Of the mapped groups, only three, numbers 2, 3, and 5, are of major importance on rangeland.

Group 1 soils are deep alluvial sierozem calcisols which underlie the irrigated cropland in several areas of the Vale District, mainly in the northeast on low-elevation terraces and flood plains of the Snake and Malheur Rivers. These soils are only used as grazing land where they cannot be irrigated.

Group 2 soils of the sierozem desert group were formed from alluvial deposits. They constitute a significant portion of the rangeland soils on the Vale District. These soils occur on old fans and as high terrace remnants. They are loamy, well-drained soils with cemented hardpans about 10-20 inches (250-500 m) below the surface. The texture varies from gravelly loam to silt loam. A coarse gravel and cobble pavement characterizes many soils of the group. Native vegetation is dominated by big sagebrush (*Artemisia tridentata*),[1/] low sagebrush (*Artemisia arbuscula*), bud sage (*Artemisia spinescens*), rabbitbrush (*Chrysothamnus* spp.), saltbush (*Atriplex* spp.) needlegrasses (*Stipa* spp.), Sandberg bluegrass (*Poa secunda*), and squirreltail (*Sitanion hystrix*) (Lovell et al. 1969).

Soils in Groups 3 and 5 differ primarily in type of volcanic origin; Group 3 soils developed from rhyolites and Group 5 from basalts of Miocene age. Soils on both are lithosols or brown chestnuts, and they occur on gently sloping to rolling lava plateaus. Typically these soils are fine loamy to clayey, light colored, very stony, and usually less than 20 inches (0.5 m) above bedrock. Often a thin silica-cemented hardpan is present just above bedrock. Areas of Group 3 and 5 soils with 18 inches (45 cm) or more of soil depth are major areas for rangeland reseeding. Native vegetation is bluebunch wheatgrass (*Agropyron spicatum*), Sandberg bluegrass, big sagebrush, and low sagebrush. Idaho fescue (*Festuca idahoensis*) is present on more mesic sites (Lovell et al. 1969).

Soils of Group 4 are lithosols confined to a small area in the extreme northwest of the district. They developed from granitic parent material and have little potential for range production.

VEGETATION

Brush dominates Vale District vegetation (table 2). Of the six vegetational types in figure 7, big sagebrush is by far the most common (fig. 8). The species occurs in all the other types. Vegetation of the whole district has a strong shrub component.

The map in figure 7 was generalized from Range Reconnaissance Surveys made in 1963-64, shortly after the rehabilitation program was started. The type numbers and names follow the system of standard symbols used in that survey.

1/ **Common and scientific names follow Hitchcock and Cronquist (1973).**

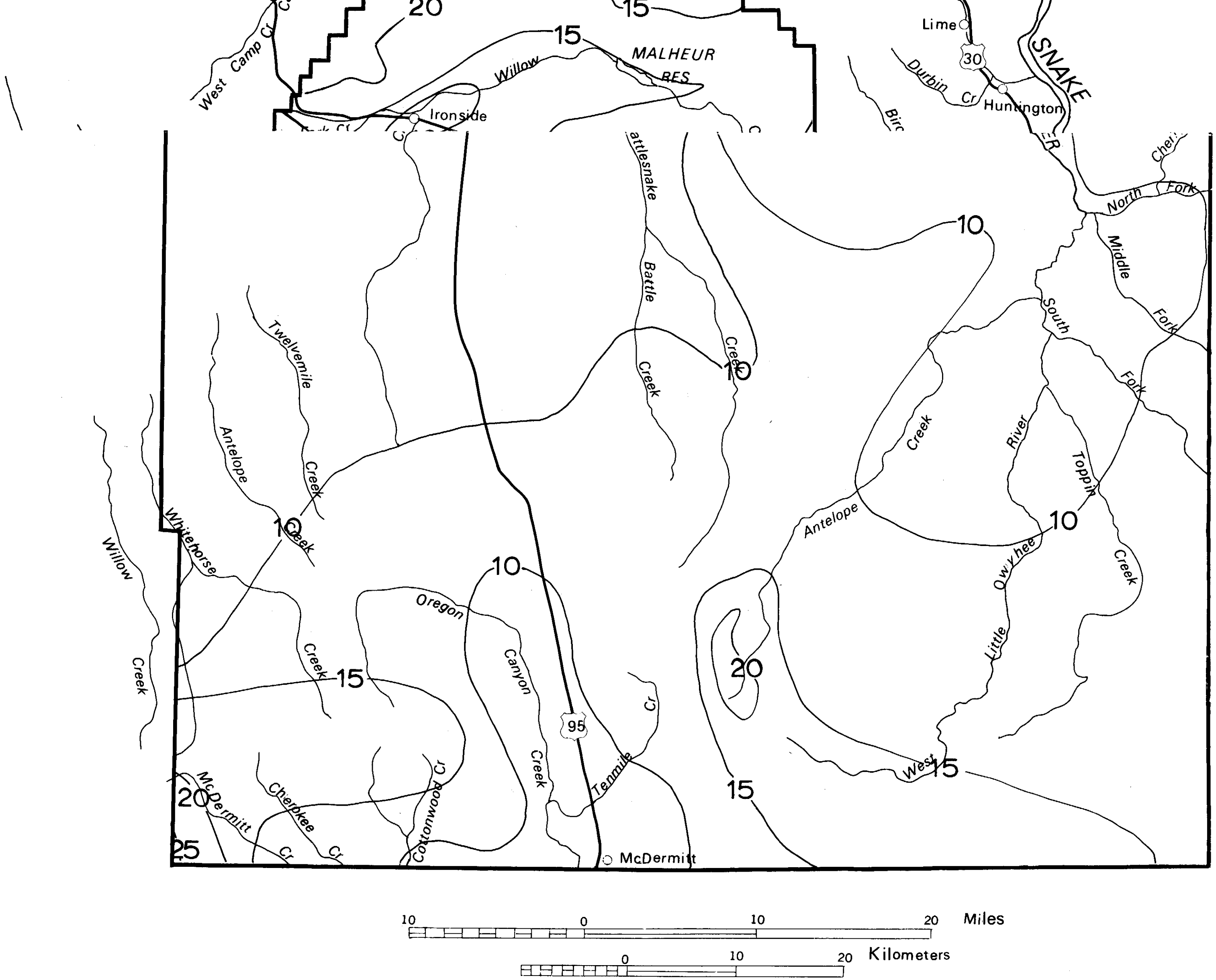

Figure 4.--Isohyets of equal average annual precipitation in inches, Vale District.

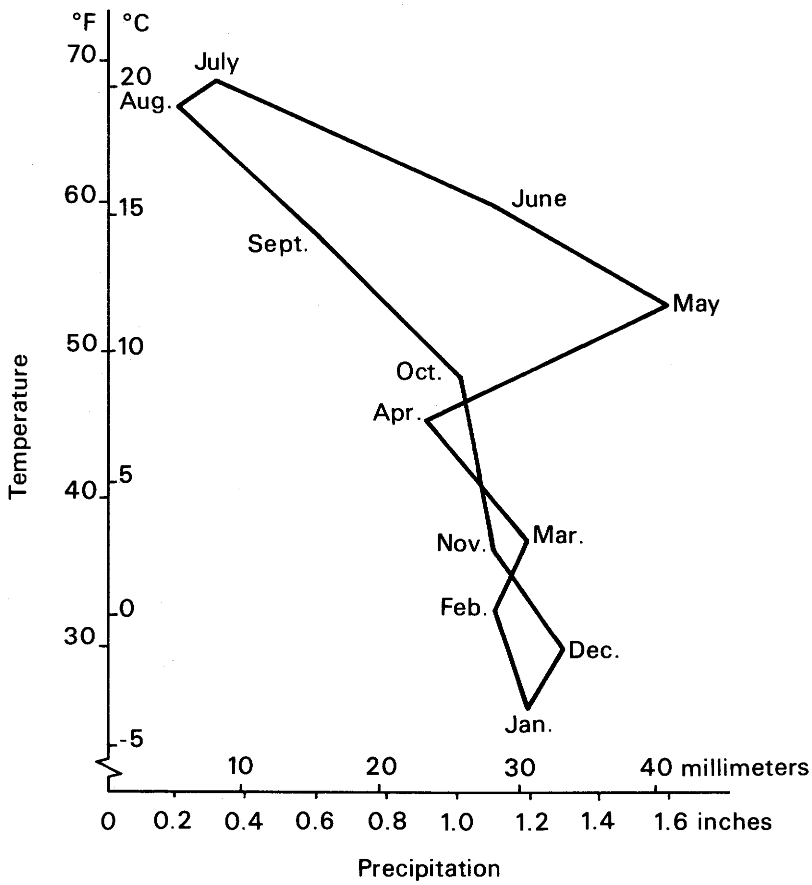

Figure 5.--20-year mean monthly temperature and precipitation for the Danner, Oregon, Weather Station, 1944-63. Danner is approximately 15 miles (24 km) west of Jordan Valley. Yearly mean was 11.5 inches (290 mm) (U.S. Weather Bureau. Climatological Data, Oregon).

Table 1--*Precipitation at Vale, Oregon, on a crop year basis, July 1-June 30, 1955-76*[1/]

Year ending	Total	July-December	January-June
		Inches	
1976	8.98	5.69	3.29
1975	9.44	3.40	6.04
1974	6.98	4.11	2.87
1973	7.29	4.19	3.10
1972	7.91	4.16	3.75
1971	9.80	5.52	4.28
1970	10.27	3.54	6.73
1969	12.59	5.90	6.69
1968	6.79	2.63	4.16
1967	11.13	5.37	5.76
1966	6.57	4.36	2.21
1965	10.12	5.43	4.69
1964	11.19	4.12	7.07
1963	10.54	5.40	5.14
1962	9.39	4.38	5.01
1961	7.68	4.56	3.12
1960	10.96	4.39	6.57
1959	6.23	1.99	4.24
1958	10.74	2.75	7.99
1957	12.47	4.68	7.79
1956	10.01	4.90	5.11
1955	8.01	3.01	5.00
Mean	9.31	4.28	5.03

Source: U.S. Weather Bureau.

1/ To convert inches to millimeters multiply by 25.4.

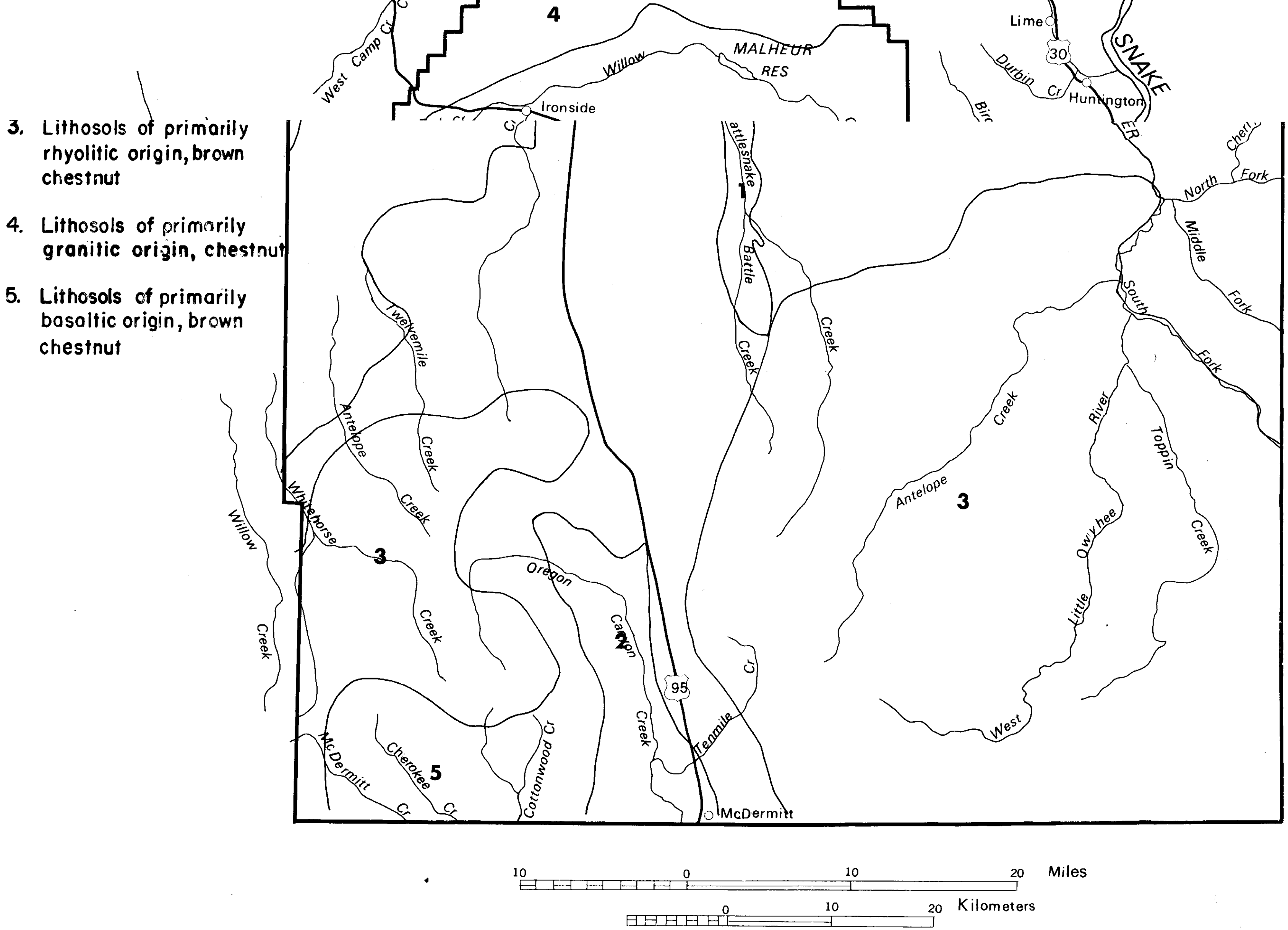

Figure 6.--Soil groups in the Vale District.

* Also includes private land area within the county

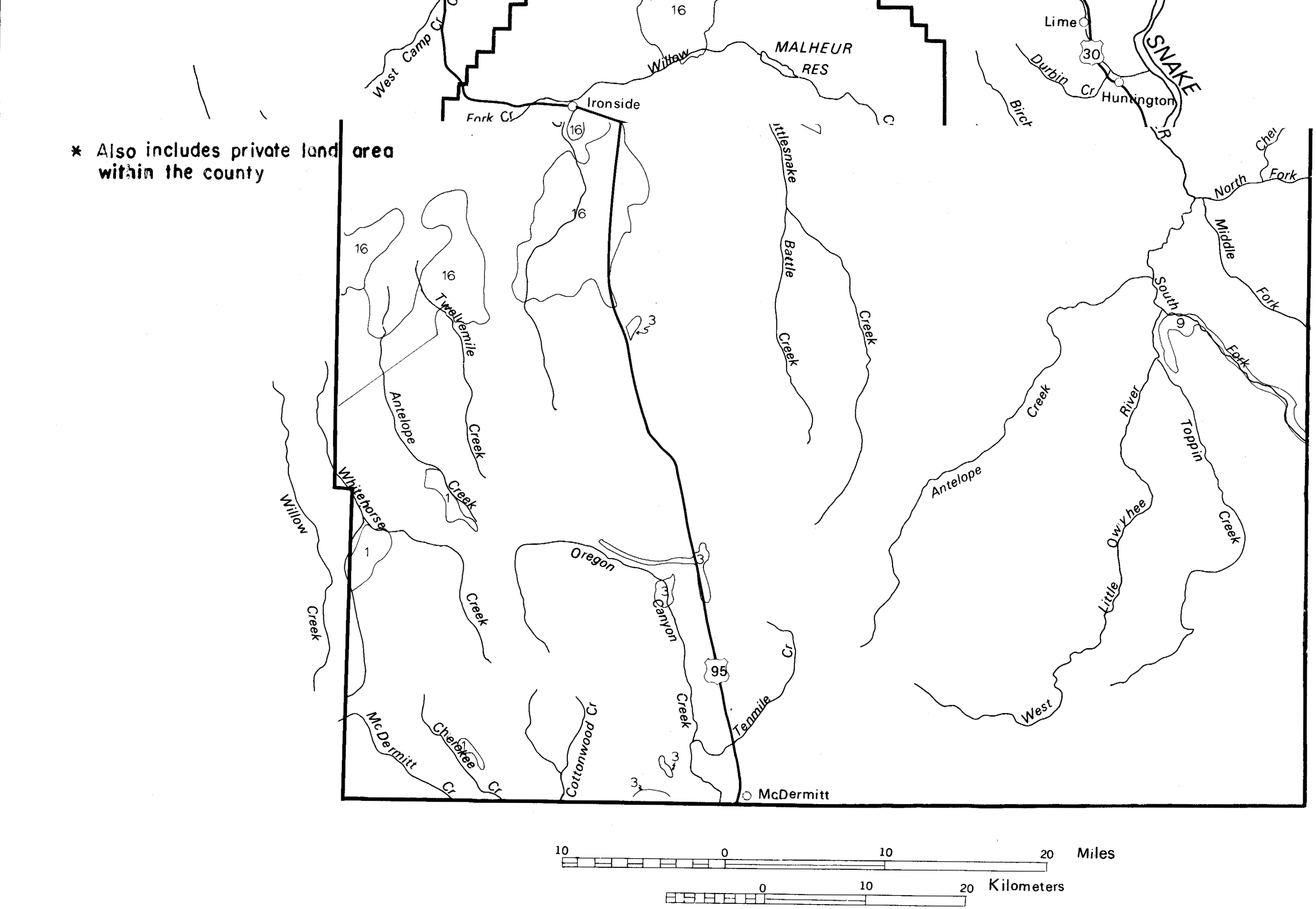

Figure 7.--Vegetation, 1961.

Figure 8--Big sagebrush with a mixture of perennial grasses characterizes a large part of the district.

Table 2--*Area of vegetational types on Federal lands administered by Bureau of Land Management, 1961-64.*

Types	1,000 acres	1,000 hectares
Grass	274	111
Halogeton and larkspur	7	3
Sagebrush-grass	4,068	1 648
Ponderosa pine	5	2
Barren, inaccessible, and waste	17	7
Juniper	53	21
Desert shrub	211	85
Total	4,635	1 877

At high elevations near the extreme northern edge of the Vale District, sagebrush-grass intergrades into the ponderosa pine (*Pinus ponderosa*) type typical of the Blue Mountains to the north. Few pine trees actually grow within the district. Western juniper (*Juniperus occidentalis*) occurs at high elevation throughout the Vale District. These areas are mapped as type 9 (fig. 7). The juniper type is essentially sagebrush-grass with the addition of scattered juniper trees. The shrubs and grasses are typical of adjacent areas without trees.

Lower elevational vegetation with rainfall of less than 10 inches (25 mm) and with alkaline soils of the sierozem desert type also intergrades with the sagebrush-grass type. Shadscale (*Atriplex confertifolia*), budsage, and spiny hopsage (*Grayia spinosa*) characterize the desert shrub, type 16 (fig. 7), in a mosaic with big sagebrush (fig. 9). Principal grasses are squirreltail and Sandberg bluegrass. This vegetation constitutes a desirable winter range on the district because of the many palatable browse species.

The vast area described as sagebrush-grass is characterized by complex, intergrading mixtures of several dominant plant species, depending on prior treatment and varying microsite. Climax vegetation of much of the region is a mosaic of sagebrush and native bunchgrasses. Forbs and the annual cheatgrass (*Bromus tectorum*) are ever present. Excellent range may contain up to 25 percent sagebrush. The mix of bunchgrasses and sagebrush at the start of the Vale Program had been strongly tipped toward high brush density and few palatable bunchgrasses as a result of a century of often exploitive grazing. In some locations, a perennial grass understory was almost absent with annuals or bare soil occurring between the shrubs. In 1961 only 1 percent of the Vale District was described as excellent, or near climax range. Ninety-nine percent reflected varying degrees of range deterioration as exemplified by a reduction in palatable perennials in the understory and an increase in brush density.

Shrub species characteristic of the sagebrush-grass type in addition to big sagebrush are low sagebrush, rabbitbrush, bitterbrush (*Purshia tridentata*) and mountain mahogany (*Cercocarpus ledifolius*) (fig. 10). Understory plants in good to excellent range are mainly bluebunch wheatgrass, giant wildrye (*Elymus cinereus*) on lowland sites, and Idaho fescue on north-facing slopes and at high elevations. Common perennials in the understory, especially where the range is in fair to poor condition, are the less desirable grasses, squirreltail and Sandberg bluegrass. Cheatgrass may be the only common understory plant, reflecting past extreme use which eliminated the perennials.

The grass type in figure 7 includes large burned areas where the sagebrush was missing and either cheatgrass, Sandberg bluegrass, or both dominated Halogeton (*Halogeton glomeratus*) and larkspur (*Delphinium* spp.) also indicate poor condition ranges and were located in small areas southwest of Rome and near McDermitt. They were much reduced in size since the map was drawn in 1963-64 because of their replacement through plant succession and range rehabilitation.

Streamside woody vegetation, too small in area to be mapped but highly important habitat for wildlife and control of erosion, includes willow (*Salix* spp.), cottonwood (*Populus trichocarpa*), hawthorn (*Crataegus* spp.), and wild cherry (*Prunus* spp.). In the alkaline areas, greasewood (*Sarcobatus vermiculatus*) dominates the riparian community.

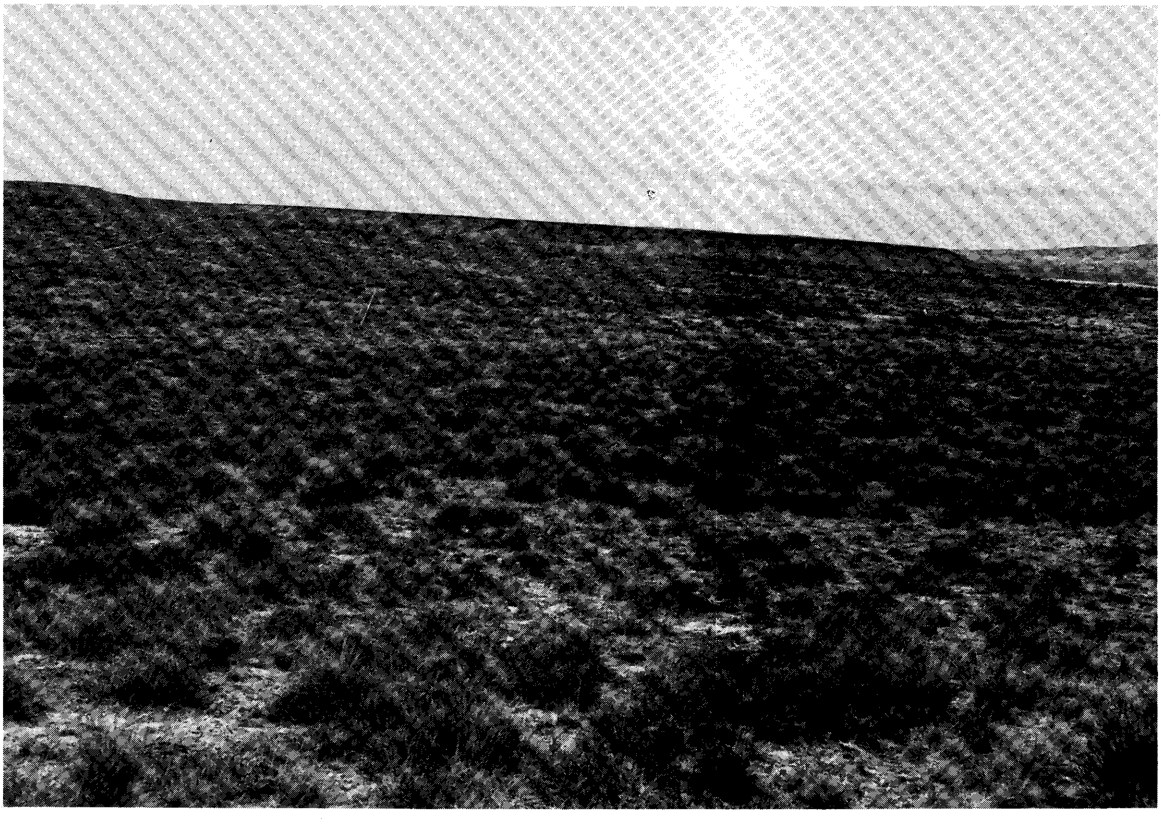

Figure 9--The low sagebrush type with scattered grasses grows on thin, rocky soils (Bureau of Land Management photo).

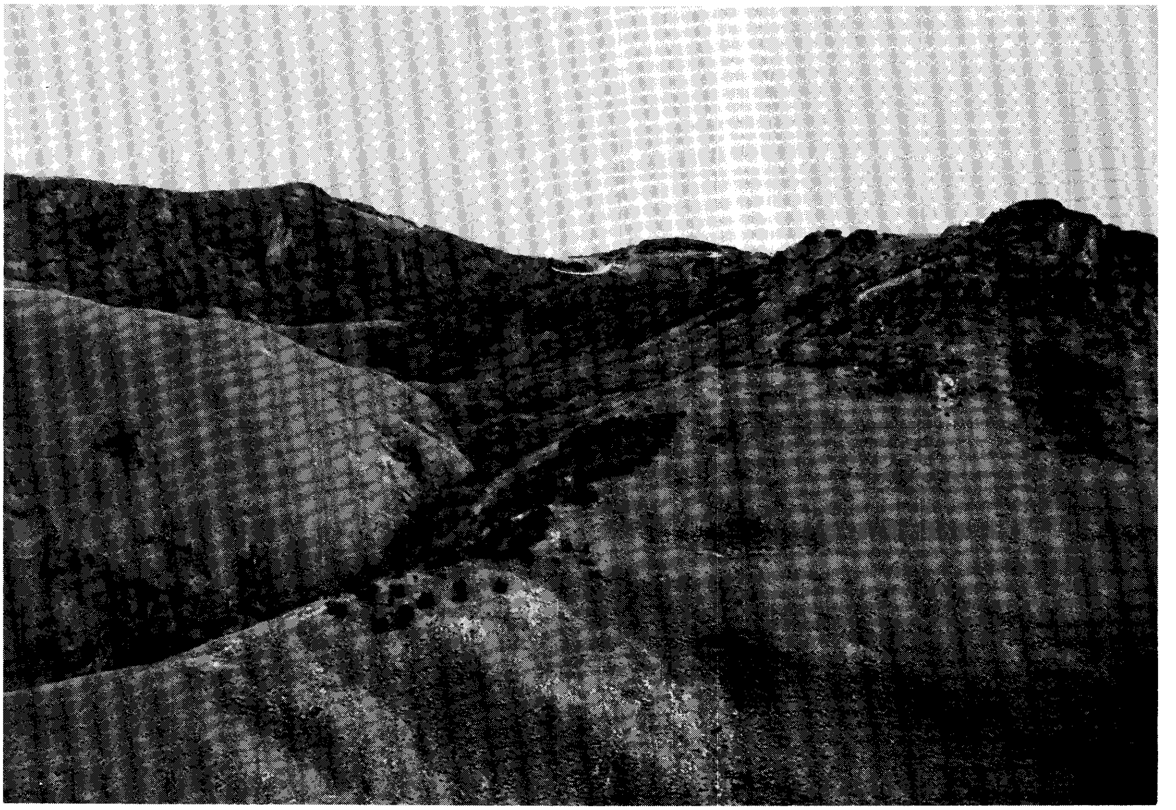

Figure 10--Bitterbrush and mountain mahogany often occupy the north-facing slopes and coves near the tops of mountains.

Demography and Economic Profile of Malheur County, Oregon

POPULATION

All but a few of Vale District permittees reside in Malheur County which is essentially the same area as the BLM District. Therefore, census data as presented here for Malheur County accurately describe the Vale District. The population of 23,380 in 1970 was highly concentrated in the irrigated crop region in the northeast. Fewer than 850 persons resided in the remainder of the county, giving that part an average density of one person per 6,000 acres (2 400 ha), and making it one of the most thinly populated areas of the United States. Total county population has remained relatively constant since 1950, showing a net increase of only 175 from 1950 to 1970. During that period, rural populations declined; the major city of Ontario grew from 4,465 in 1950, to 7,140 in 1972, and 7,710 in 1975. The number of people in the age group 20 to 40 years declined, and the number of persons older than 40 increased during 1950 to 1970. These trends in distribution and age structure approximate similar trends in the United States.

ECONOMY

The economic base of Malheur County is primarily agriculture and related industries with livestock raising, the largest single component, contributing about $15 million or 22 percent of the total annual county income. Nearly 100,000 acres (40 000 ha) of privately owned irrigated land depend on the Owyhee Reservoir for water. Additional lands are irrigated from waters in the Malheur River and Bully Creek. Other major economic inputs into the county are from hunting and other forms of recreation.

Malheur County livestock trends since 1920 typify those observed in many parts of the Intermountain West (table 3). Cattle numbers nearly tripled between 1920 and 1970 with a correspondingly dramatic decline in horse, mule, and sheep numbers. Overall forage consumption, as indicated by AUM's of livestock use in the county, was only slightly less in 1970 than in 1920. Peak forage consumption occurred in 1960 with a low in 1940 at barely half of the peak. Public lands contributed 22 to 37 percent of the total forage provided to county livestock. Approximately 64 percent of the ranchers have had grazing permits on public lands since 1934.

Ranches in the Vale District are typically small with an average herd size of 280 head in 1961 and 320 head in 1974. A trend toward consolidation into larger operations is shown by the frequency distribution in table 4. This increase in ranch size reflects a reduction in the number of ranches in Malheur

Table 3--*Numbers of livestock and forage provided by public lands in Malheur County*

Year	Cattle	Horses and mules	Sheep	County	Public land	Forage from public lands
				--- AUM's 1/ ---		Percent
1920	62,265	22,740	403,685	1,988,904	2/	2/
1930	37,149	13,608	342,264	1,430,518	2/	2/
1940	65,234	12,901	131,300	1,132,812	418,592	37
1950	114,672	7,327	50,874	1,586,086	463,935	29
1960	153,753	4,268	55,744	2,030,038	451,537	22
1970	152,352	3/	23,000	1,839,295	442,974	24

Source: Bureau of Land Management (1974).

1/ Animal unit months.

2/ Unknown before BLM District was established.

3/ Combined with cattle numbers.

County from 719 in 1964 to 419 in 1970. Sheep ranches with permits on the public lands declined from 14 in 1961 to 1 in 1975. A shortage of skilled labor in handling sheep appears to be an important cause in their decline.

Employment in Malheur County totaled 9,418 in 1970 with services and trades contributing 47 and agriculture 21 percent of the total work force. Food processing employed 19 percent of the county's workers in 1970. Increased farm mechanization, with a resulting decrease in employment directly in agriculture, has been compensated by rapid expansion of food processing. In 1950, 48 percent of the county workers were employed in agriculture with only 2 percent in food processing. Services and trades, which increased from 36 to 47 percent of the work force between 1950 and 1970 will likely continue to expand as Ontario becomes increasingly the trade center for the region.

Median income per household in Malheur County was the lowest in Oregon at $5,903 in 1971. The average payroll per worker ranked second lowest in Oregon at $5,672. Unemployment in 1970 was 6 percent in the county compared with the eastern Oregon average of 7.1 percent.

In summary, the ranching population is small and most jobs stem from crop-related industries. Malheur County has lower levels of income and higher rates of unemployment than most urban communities in the Intermountain area. Significant outmigration, except from Ontario, foretells continuing problems such as scanty social services and cultural amenities. Diversification and industrialization have little chance because the primary production depends on land, which cannot be changed. The rangeland rehabilitation program and the continuing inflow of new monies to manage the rangeland resources have helped to stabilize the community. Reconstitution of the BLM District Advisory Board to include persons with a wide spectrum of interests should further stabilize land use and community *esprit de corps.*

Table 4--*Frequency distribution of grazing licenses and permits, Vale District, Bureau of Land Management, 1961 and 1974*

Animals	No. of permittees	Percent	No. of head	Percent
	1961 GRAZING YEAR			
Cattle and horses:				
1- 25	21	6.6	418	0.5
26- 50	23	7.2	938	1.1
51- 100	62	19.5	4,994	5.5
101- 200	81	25.5	12,591	14.1
201- 350	50	15.7	13,872	15.5
351- 500	27	8.5	11,374	12.7
501- 1,000	42	13.2	27,539	30.9
Over 1,000	12	3.8	17,547	19.7
Total	318	100.0	89,273	100.0
Sheep and goats:				
1- 100	--	--	--	--
101- 250	--	--	--	--
251- 500	2	14.3	900	2.2
501- 1,000	2	14.3	1,317	3.3
1,001- 2,500	8	57.1	15,050	37.6
2,501- 5,000	1	7.2	4,810	12.0
5,001-10,000	--	--	--	--
Over 10,000	1	7.1	18,000	44.9
Total	14	100.0	40,077	100.0
	1974 GRAZING YEAR			
Cattle and horses:				
1- 25	30	12.8	466	.6
26- 50	16	6.8	636	.8
51- 100	30	12.8	2,257	3.0
101- 200	45	19.2	7,209	9.5
201- 350	40	17.0	11,466	15.1
351- 500	25	10.6	10,705	14.1
501- 1,000	37	15.7	26,116	34.4
Over 1,000	12	5.1	17,038	22.5
Total	235	100.0	75,893	100.0
Sheep and goats:				
5,001-10,000	1	100.0	8,000	100.0

History of Land Use and Its Effects

PRIOR TO 1934

When Captain George Vancouver arrived on the Washington coast in 1792, he recorded the presence of cattle, sheep, goats, pigs, and poultry belonging to Spaniards. Cattle raising spread up the Columbia and Snake River systems to Fort Boise and Fort Hall in Idaho as early as 1834. The first of a flood of people traveling by covered wagons passed through Vale and the northern part of the district beginning about 1843. All these early travelers and settlers maintained livestock, on which they depended for food, power, and clothing. Hanley and Lucia (1974) and Oliphant (1968) gave particularly good historical accounts of land use, much of it directly applicable to the Vale District.

The rush for gold in California intensified the need for animals and resulted in the beginning of an animal industry throughout the Western States. Between 1850 and 1865, every creekbed and likley geological formation was searched for gold and silver. In 1863, Michael Jordan discovered gold in Jordan Creek and others opened mines at Silver City in the Owyhee Mountains not far away to the east. People came to the area by the thousands, including miners, Chinese laborers, freighters, stagecoach operators, roadbuilders, saloon keepers, bawdy house madams, ranchers, and roustabouts. Many used the route from McDermitt to the Rome crossing of the Owyhee River and through the Jordan Valley. All needed horses for travel and beef to eat.

Occasional raids by Indian parties until 1878 restricted travel except along the roads but hardly reduced the use of extensive rangeland areas by livestock. The district, as well as adjoining regions, received many herds from 1865 onward and rapidly became fully stocked with cattle owned by a few ranchers who controlled large land areas. Between 1876 and 1882, as many as 150,000 cattle per year trailed eastward from Oregon and Washington to Denver and the northern Great Plains. It was also a time of great losses from poisonous plants, blackleg and other diseases, and dependence on the chinook winds to melt the snow so cattle could graze in the winter. The long and severe winter of 1889-90 reduced many cattle herds to near zero thus ending an era of control by the western cattle barons. Sheep were completely eliminated. In the following years, many herds and bands were brought from southern ranges to fully stock the Owyhee ranges again.

Sheep raising and farming began in the Owyhee country about 1865. Many sheep were in migrant bands which traveled over "free" range, as the land claims of the cattlemen were ignored. Homesteaders gradually fenced the water, further complicating the use of the rangeland. Although resident cattlemen, sheepmen, and farmers often remained helpful to each other, the migrants of all three types caused great conflicts. They took all the grass and water, plowed some land, and moved to greener pastures. The catastrophic winter of 1889-90 altered the balance of use toward more sheep on the rangelands. For example, the largely Basque community in the valley of Jordan Creek controlled an estimated 200,000 sheep in the 1920's and early 1930's. Cattle now dominate again; in 1975 only 7,400 sheep were permitted to graze in the whole of the Vale District.

Horses arrived in eastern Oregon about 1750, and most people who came also owned horses (Jackman and Long 1964). The well-known trappers, Donald MacKenzie in 1818 and Peter Skene Ogden in 1824-29, searched for beaver in the Owyhee, Malheur, and Snake River drainages. Each party had 30-50 men and well over 200 horses (Cline 1974). Indians stole some of the horses. Few became feral until after the last Indian war in 1878 when horse numbers increased rapidly. Thousands roamed the ranges of the Owyhee country from 1900 to the mid-1940's. During that time, gathering mustangs (from the Spanish mestengo meaning wild horse) provided income for ranchers in the area. Herds were reduced to low numbers following World War II.

No doubt exists that cattle, sheep, and horses occupied the grazing lands of the Vale District in large numbers for about 60 years beginning in 1875. Little hay or other winter feed was available so the use was yearlong. Grazing on farm-raised feeds and haying increased after the winter of 1889-90. Probably, range deterioration had reached severe proportions by 1900. Lack of livestock controls on the public domain until 1934 permitted continued rangeland deterioration and erosion.

Between 1863 and 1866, 3 alternate square miles of land were granted for building each mile of the Oregon Central Military Road from Silver City through Jordan Valley to Fort Smith and westward through central Oregon (Preston 1970). These land grants preceded similar ones for building railroads across the West some 5 or more years later. Although the road was not well constructed, the land was appropriated and shows today as a checkered landownership pattern (fig. 2).

In response to popular demand, Congress passed the Homestead Act in 1862 providing title to 160 acres (64.8 ha), if the person lived on the land and used it over a 5-year period. This act and later versions, the Desert Land Act in 1877, Enlarged Homestead Act in 1909, and the Grazing Homestead Act in 1916, influenced landownership in the district. The State of Oregon received sections 16 and 36 to support schools, an Indian reservation was established near McDermitt, and lands have been withdrawn for public reserves of various kinds. Table 5 shows the result of these factors in terms of landownership. Differences between 1961 and 1976 reflect changes in the boundaries of the Vale District and changes in ownership. Land trades and sales are gradually consolidating the crazy-quilt ownership pattern which developed before 1934. The Vale District has been approximately 75 percent Federal land since it was formed.

Table 5--*Landownership in the Vale District, Bureau of Land Management, 1961 and 1976*

Land administered by	1961		1976	
	Acres[1/]	Percent	Acres[1/]	Percent
Bureau of Land Management:				
Public lands	4,578,311	70.01	4,604,878	71.12
BLM reserved lands	6,833	.01	58,438	.90
Other Federal	53,674	.83	21,778	.34
Non-Federal	304,900	4.66	298,920	4.62
Total	4,943,718	75.60	4,984,014	76.98
Other:				
Federal lands	128,465	1.97	27,560	.42
Private and State	1,466,633	22.43	1,463,191	22.60
Total	1,595,098	24.40	1,490,751	23.02
Total	6,538,816	100.00	6,474,765	100.00

Source: Bureau of Land Management.

1/ 1 acre equals 0.405 hectare.

1934 to 1962

Until 1934, the public domain was free to be claimed by the user whether the purpose was to graze it or to "prove a claim" and actually be granted a deed or patent. The land belonged to all and yet no one was responsible for sound land use. A 1642 Virginia law, upheld for the Northwest Territory in 1792, stated: "The open woods and uninclosed grounds within the Territory shall be taken and considered as the common pasturage or herbage of the citizens thereof saving to all persons their right to fencing" (Oliphant 1968). This law was interpreted to mean free range and a lawful fence. Such practices as yearlong grazing, branding, and the cooperative roundup developed as a result. Free range and the right of transit between States without taxes favored nomadic herds of livestock, mainly sheep. These customs received sanction in an 1890 U.S. Supreme Court decision which stated that English common law did not prevail because it was ill-adapted to the nature and conditions of the country. The English law stated "that every man must restrain his stock within his own grounds, and if he does not do so, and they get upon the unenclosed grounds of his neighbor, it is trespass for which their owner is responsible."

Many conservationists, ranchers, farmers, politicians, and members of the general public recognized that rangelands were deteriorating but accepted this in order to develop the West. Livestock overgrazed, miners prospected everywhere, and homesteaders made their own choices of land to plow. They not only did these things but also were encouraged to do so by the laws of the land, court decisions, and the overall public attitude. Some activities of cattle kings, migrant sheepmen, and homesteaders were regrettable in hindsight but destructive land use was the level that was maintained at the time. In effect, political decisions directed social forces to destroy the range vegetation and to retard its recovery because of "crazy-quilt" landownership patterns. It would seem that the public as well as private interests contributed to rangeland deterioration; the Vale District was just a small example from the whole West. It would also seem appropriate as the price for opening the West for the public to shoulder a part and perhaps all of the rehabilitation of deteriorated public rangelands. The costs to repair the land and the costs of maintenance should be public costs, otherwise the bearer of the cost develops a vested interest.

With passage of the Taylor Grazing Act in 1934, a major step was taken to rectify the land use problem on the public domain. The purpose of the act was "to preserve the land and its resources from destruction or unnecessary injury, to provide for the orderly use, improvements, and development of the range." This act followed the various homestead acts, and technically marked the end of that era. Cattlemen, sheepmen, and farmers had been fighting over land for 50 years. Submission to the new law was difficult. Regulations, such as issuance of permits, determinations of grazing capacities, setting of allotment boundaries, improvements to be constructed, formulas to set grazing fees, and other administrative ground rules came in to play gradually.

Allocation of grazing privileges quickly became the principal issue. Final preference was to be given to those with commensurate property but the demand outstripped the supply of AUM's of grazing. Therefore, in practice, first priority grazing privileges went to those with commensurate property and prior use during a 5-year period before passage of the law.

The new Grazing Service depended on advisory boards elected by the permittees to set grazing capacities and priorities of use. Persons most influential in the community became board members, thus assuming positions of power. Migrant sheepmen were out; the permittee's grazing rights were not always proportionally reduced when cuts had to be made; correct data on base properties were not marshalled; Federal expenditures were supervised; and advisory boards selected and determined tenure of Federal employees. These were a few of the powers rightly or wrongly exercised by some of the advisory boards. The one in the Vale District was notable for its independence and power. Its principal purposes were to maintain the status quo of range use and lowest possible grazing fees.

An example of the dispute was described by Foss (1960) as the "Battle of Soldier Creek." Soldier Creek is a grazing unit near Jordan Valley in the central part of the district. In 1935 the commensurate base for the unit was set at 77,419 AUM's, but the advisory board set grazing capacity at 43,260 AUM's. A range survey in 1951 set the grazing capacity at 31,284 AUM's; but the permittees continued to demand 77,419 AUM's, although many fewer AUM's were being used. In 1956 a careful study that marshalled data on base property indicated an eligibility for 31,000 AUM's. After numerous meetings that number was accepted and the dispute was over. Many more details may be found in the publication by Foss (1960).

The ranchers in the Soldier Creek unit were anxious to maintain their ranges and to stay in business. They built fences, developed additional water and, in a few instances, controlled sagebrush. Migrant sheep were eliminated in 1934 and 1935. Throughout the period, the ranchers were improving their stewardship of the land as well as attempting to protect their positions in arguments with the Federal agencies over permitted livestock numbers. It is incorrect to describe either side as totally right or wrong in the "Battle of Soldier Creek."

VEGETATION BEFORE GRAZING BY DOMESTIC ANIMALS

Although a few head of horses may have grazed in the district as early as 1818 when Donald McKenzie sent trappers to follow the Owyhee River, heavy stocking probably began with the discovery of gold in 1863. Evidence from many sources, most of it circumstantial, contributed to the development of our visualization of the pristine climax vegetation in 1863.

Oliphant (1968) cites writings of Harvey H. Hines, a Methodist minister, who stated, in 1882, that the lower Malheur River plains were covered with sage, but that was nearly 40 years after people crossed from Snake River to Vale as a part of the Oregon Trail. The surveyor-general of Idaho reported some lands in Oregon and Nevada as grazed-out in 1871. Vale (1975) reviewed 29 journals and diaries of early travelers who mainly followed river routes in the sagebrush-grass region--none of the 29 traveled extensively in the Vale District. They reported abundance of sagebrush on lower slopes and terraces and large amounts of grass at upper elevations. Hines also described the higher country south of Vale, Oregon, in 1882 as mostly covered with bunchgrass.

In addition to grazing influences, range fires were set by Indians both before and after white men arrived (Oliphant 1968). Lightning caused fire then as it does today. Introduced plants, such as Russian thistle (*Salsola kali*), Halogeton, and cheatgrass had not arrived. In the last 20 years, plant succession has moved rapidly toward climax as a result of managed grazing, according to the data now available. Exclosures, one as old as 40 years, have been studied. Plots of various ages also gave us information on successional trends. We pieced together this information as our best guess of the original climax vegetation in the Vale District. Excellent publications by Daubenmire (1970) and Franklin and Dyrness (1969, 1973) include discussions of stable vegetation as it was before the advent of Caucasian man. We found that those publications contained accurate descriptions of the vegetation in the district.

There are two major types of pristine vegetation in the Vale District. One type was dominated by big sagebrush and bluebunch wheatgrass (fig. 11). Shrub cover remained less than 25 percent and may have been near zero following fires. We have no evidence that big sagebrush can be eliminated from this

Figure 11.--Bluebunch wheatgrass and big sagebrush.

vegetation nor that it covered as much area as grass did. Other species characterized the type according to elevation, soil, and rainfall. Sandberg bluegrass and squirreltail were in dry areas; low sage replaced big sage on shallow stony soils; Idaho fescue and bitterbrush reached codominance with bluebunch wheatgrass and big sagebrush at upper elevations. This combination composed the understory in juniper and ponderosa pine. Other minor species included Thurber needlegrass (*Stipa thurberiana*), prairie junegrass (*Koeleria cristata*), needle-and-thread (*Stipa comata*), and several shrubs. This grassland with shrubs scattered or in moderately thick stands, but always variable, extended over at least 90 percent of the district. At any one time, the landscape probably showed a mosaic of sagebrush densities, with low density following fire and a gradual increase until the next fire occurred.

The second major vegetation type grew on alkaline soils and was composed primarily of shrubs. Shadscale dominated; and others included spiny hopsage (*Eurotia lanata*), budsage, and greasewood. Bluebunch wheatgrass occurred in the type but larger amounts of squirreltail and Indian ricegrass (*Oryzopsis hymenoides*) characterized the landscape. The grass dominated if the soil was sandy. This type occupied about 6 percent of the district.

We offer several other descriptive points about the pristine vegetation. Grasses occurred between widely spaced shrubs as well as under their canopies. Without grazing or fire, large amounts of litter accumulated in the centers of some of the bunchgrasses. Grazed or burned bluebunch wheatgrass plants often appeared more vigorous than those left untouched for years. The pristine vegetation, of course, did not contain several introduced species, which are present in today's climax vegetation. Riparian communities, wet meadows, lakebeds, and rocky and barren areas occupied small acreages in the district. The native grasses did not burn as readily as cheatgrass.

DESTRUCTION OF COVER

Reconstruction of the pattern of range deterioration as shown by vegetation can only be done in general terms. Exploitive grazing after 1878, and perhaps locally before that date, probably reduced the perennial bunchgrasses from the interspaces among the shrubs. Annuals may have invaded the bare ground; but one must keep in mind that Russian thistle, cheatgrass, and other introduced plants had not arrived. Therefore, the invading species probably were the unpalatables such as poinsonous species and shrubs, including big sagebrush and rabbitbrush. Many more animals were lost to poisonous plants before 1934 than afterwards. Also, the sagebrush thickened, in some examples becoming monocultures with few other plants (fig. 12). A temporary halt, or a couple of years of rest and recovery, occurred following the livestock die-off in the winter of 1889-90. The lowest point in the vegetational destruction and bare soil probably occurred between 1900 and 1920. Griffiths (1902), following his observations between Winnemucca, Nevada, and Ontario, Oregon, in 1901, reported finding large areas of bare soil and traveling 1-3 days across deteriorated ranges. Sandberg bluegrass, which matures in early spring, probably remained in the openings; but the dominant grasses were found only in the protection of shrubs and rocks. They may have disappeared altogether from sizable acreages, especially those burned. Russian thistle arrived about 1900 and was followed by mustards (*Brassica* spp., *Sisymbrium* spp.). Invasion by cheatgrass about 1915 and its spread over large areas of rangeland during the 1920's (Stewart and Hull 1949, USDA Forest Service 1914) increased ground cover and provided a flash fuel and scanty forage, but more than had been produced for a few years. Fires which were common in the 1860's to 1880's again became common. Stands of pure sagebrush burn only with high winds.

It seems to us that plant succession toward increased cover, less erosion, and at least some grass forage production was underway by 1934 and continued thereafter. Stages of succession as suggested by Piemeisel (1938, 1951) for big sagebrush-grass in the Burley BLM District in Idaho apply here. The climax appears to be similar, and the same species are present. Russian thistle is the first on bare soil. Next come the mustards and other annual forbs; cheatgrass soon follows (fig. 13). Cheatgrass and Sandberg bluegrass may last for years as pure stand where burning removes the sagebrush, or the combination may be closely associated with brush stands (fig. 14).

PATTERN OF RANGE DETERIORATION

In the Vale District, as elsewhere, ranges suffer most near water and centers of human population. The first area overgrazed occurred along the Oregon Trail, which crossed the northeast corner of the district from the mouth of the Boise River into Snake River to Vale and north to Farewell Bend of the Snake River. The trail was broad, and livestock were moved outward to find feed. Even today that belt has some of the poorest condition ranges in the district. Other points of population concentrations and high livestock pressures

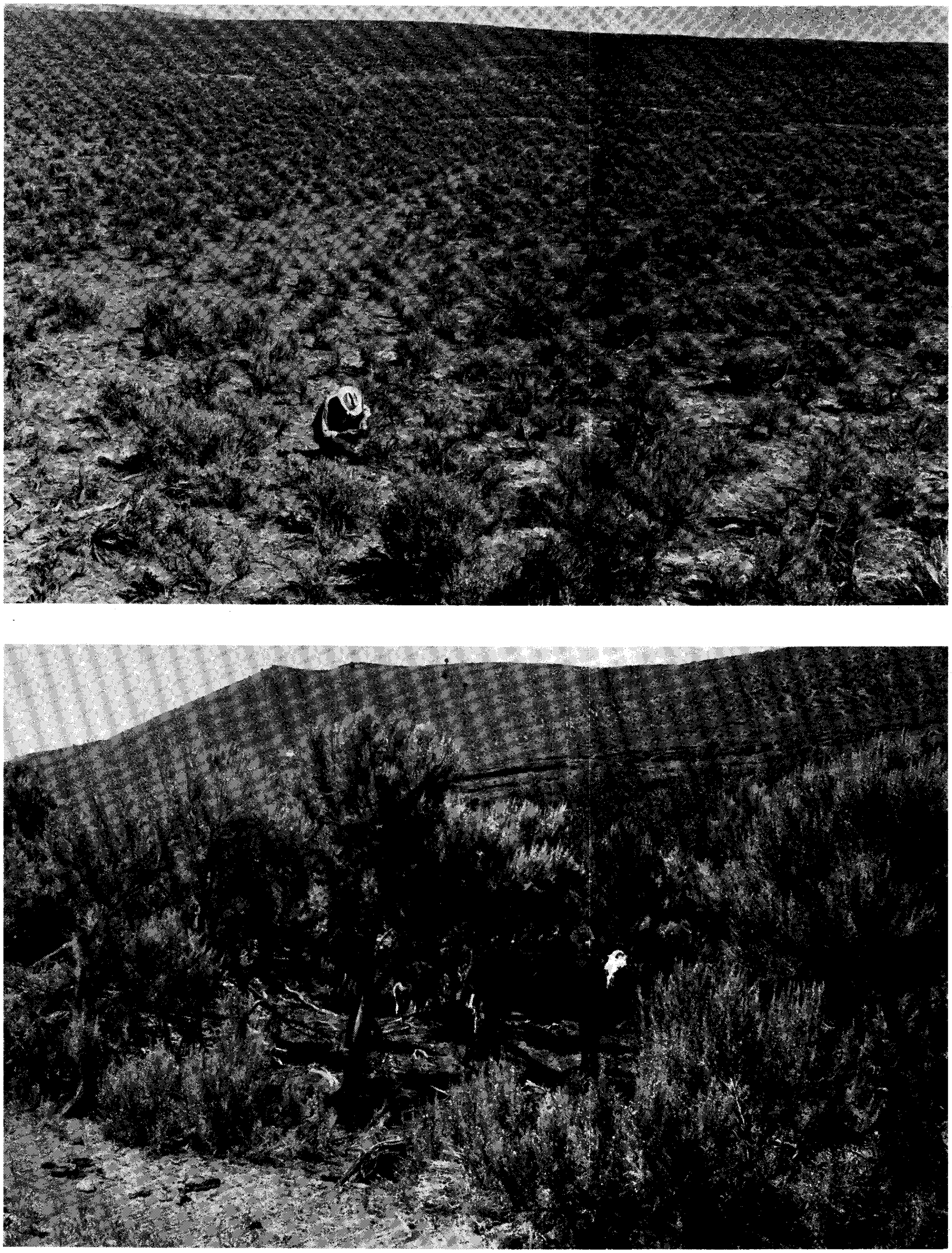

Figure 12.--Severe grazing resulted in monocultures of big sagebrush on these sites (Bureau of Land Management photos).

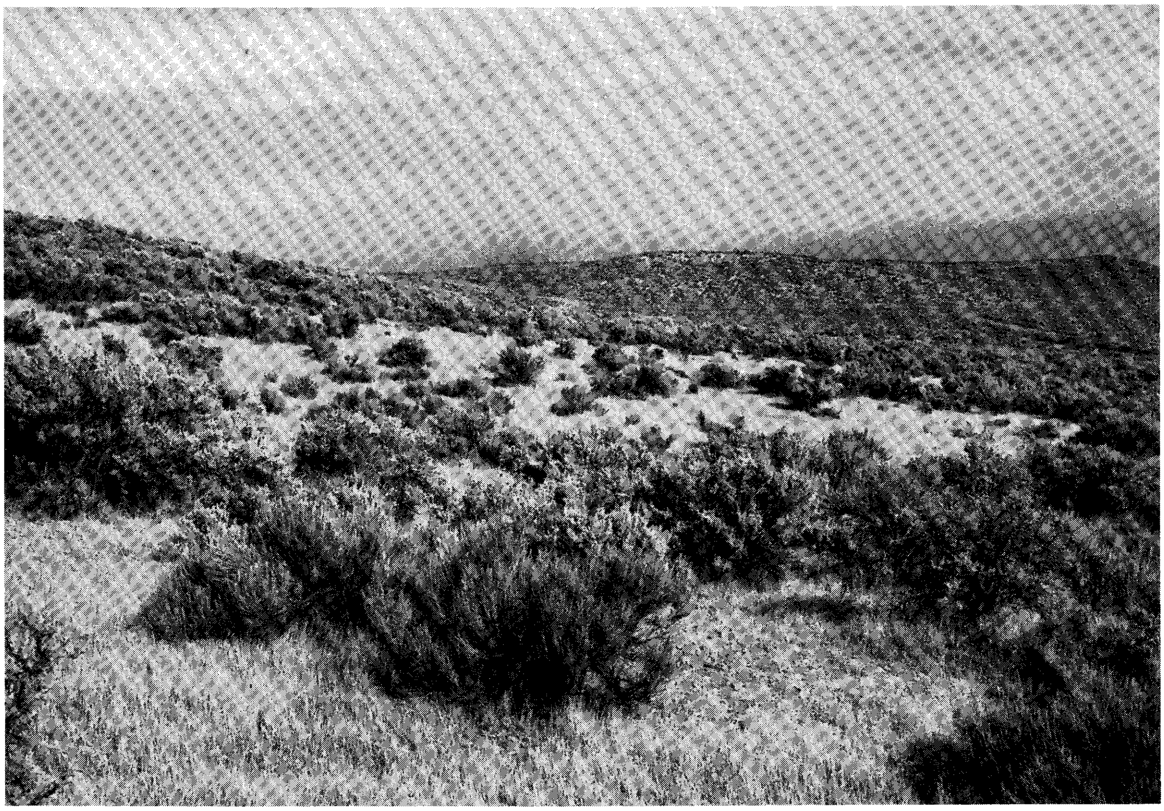

Figure 13.--Big sagebrush and rabbitbrush with a complete stand of cheatgrass.

include those around Westfall, Harper, Rome, and to a lesser extent near Jordan Valley and McDermitt. The areas where damage occurred latest and perhaps not to a serious extent because of lack of water are exemplified by bits of country near Skull Springs south of Harper and Antelope Creek northeast of McDermitt.

Until permanent stock water was developed after 1934, the remote areas were grazed in the spring and the livestock removed to the creeks, rivers, and other permanent waters as temporary water failed. Nomadic bands of sheep moved through the district, repeatedly grazing in the spring as one band followed another. In short, the uncontrolled grazing led to centers of destruction concentrated around the villages. These destroyed areas were located at the lowest elevations where temperatures were hottest, rainfall least, and the dry season longest. They remain the areas of rangeland in the district needing the greatest repair and at the same time they are the hardest to fix. Unfortunately, the destroyed areas are the first and most often seen by the population, resulting in a widely held belief that the Vale Rehabilitation Program has largely failed. As will be shown later in this report, the opposite is true.

WILD ANIMALS 1776-1962

During October 1776, Father Escalante, a Franciscan friar, led a party westward across northern Utah to Utah Lake and southward to Arizona. He made

Figure 14.--Big sagebrush and Sandberg bluegrass precedes the climax.

no mention of deer and elk, seen earlier in Colorado, and experienced difficulty in finding food (Utah State Fish and Game Commission 1948). In 1826, Peter Skene Ogden found deer in abundance along the Snake River near the mouth of the Malheur River; but they were scarce across Oregon to the west, occurring locally. Also, he reported antelope in places (Davies et al. 1961). Apparently, buffalo, antelope, elk, and deer were present near Salt Lake, in southeastern Idaho (Williams et al. 1971), and in eastern Oregon. In March 1826, Ogden's men found elk near the present site of Twin Falls in southern Idaho; but 3 months later the party was eating horsemeat during their travels along the headwaters of the Bruneau and Owyhee Rivers (Cline 1974). Clearly, the populations of elk, deer, antelope, and buffalo were small in the northern intermountain region when the fur trappers crisscrossed the Owyhee region from 1818 to 1830. Beaver, the objective of the expeditions, varied in density from stream to stream.

Wild animal species reach their highest populations in relation to abundance of food and water, which supplies individual needs, and to sufficient cover and space, where the species finds its needs for reproduction and running room (Thomas et al 1976). Preceding sections described probable vegetational characteristics in 1863 and the likely changes which followed. This section characterizes the changing food and cover for wildlife just as it does for livestock. For example, nearly all accounts of mule deer described them as scarce in the early climax vegetation and abundant in the shrub stage of succession from the 1920's to the mid-1960's. Poor or fair cattle range would provide excellent browse for deer. Sagegrouse also do well in sagebrush but antelope reach peak numbers in grasslands. Each species has its own best habitat, but these may be difficult to define.

The migrating species use selected sites and vary in density seasonally as well as by location. The trapping expeditions may have missed the migrations, but as with livestock, the centers of concentration should have been near water. Beaver were not plentiful on all streams. It seems fair to suggest that man's use of the range has affected the different species to various degrees. The habitat may have improved for some species and deteriorated for others. Causes for changes in numbers of wild animals are not clear.

Several points need to be kept in mind when wildlife is considered in references to rangeland changes brought about by livestock and rehabilitation practices. Grassland may be the best for some species, sagebrush-grass for others, and sagebrush with bare ground between plants for others. The rangeland manager must know these ideal habitats for individual wild species, know how to attain them, evaluate which species the public wants, and judge the situation long enough in advance to finish the work project. None of these four requirements can be determined sufficiently for any wildlife species on the Vale District, although the rehabilitation program has considered them. The situations for a few of the 294 animal species in the district will be given in a later section as an evaluation of the rehabilitation programs. Data on individual species numbers before 1962 are too nebulous to warrant further discussions (Bureau of Land Management [n.d.].

RANGE REHABILITATION PRIOR TO 1962

No more than 0.1 percent of the rangeland in the Vale District had received a range improvement treatment prior to 1962. This included about 30,000 acres (12 000 ha) of brush control by spraying, plowing and seeding, and seeding after wildfires. Approximately 582 livestock watering points had received attention by ranchers and BLM personnel. Several drift fences had been constructed, but pastures had not been enclosed nor seasonal grazing plans established. The scatter of the projects prior to 1962 is shown in figure 15; but at the map scale used, only groups of water developments could be shown.

The negative side or lack of management prior to 1962 needs to be mentioned in order to emphasize conditions at the beginning of the Vale Program in the fall of 1962. No grazing systems were in effect beyond stipulation of allotment boundaries and dates of grazing. Permitted numbers of livestock and AUM's of grazing may or may not have been the same as actual use because BLM personnel were too few to make effective checks on trespass livestock. Erosion control with gully plugs, firebreaks, and construction of recreational sites had not been done. Resource surveys had covered approximately 30 percent of the public land, and adjudications to determine commensurate property qualifications had been completed for less than half the permittees.

Contributions to rangeland management by the permittees was perhaps in the same order of magnitude as by the BLM. Ranchers, either cooperatively with BLM or at their own expense, constructed almost 500 miles (800 km) of fence and developed numerous watering facilities. Ranchers did the fence repairs and

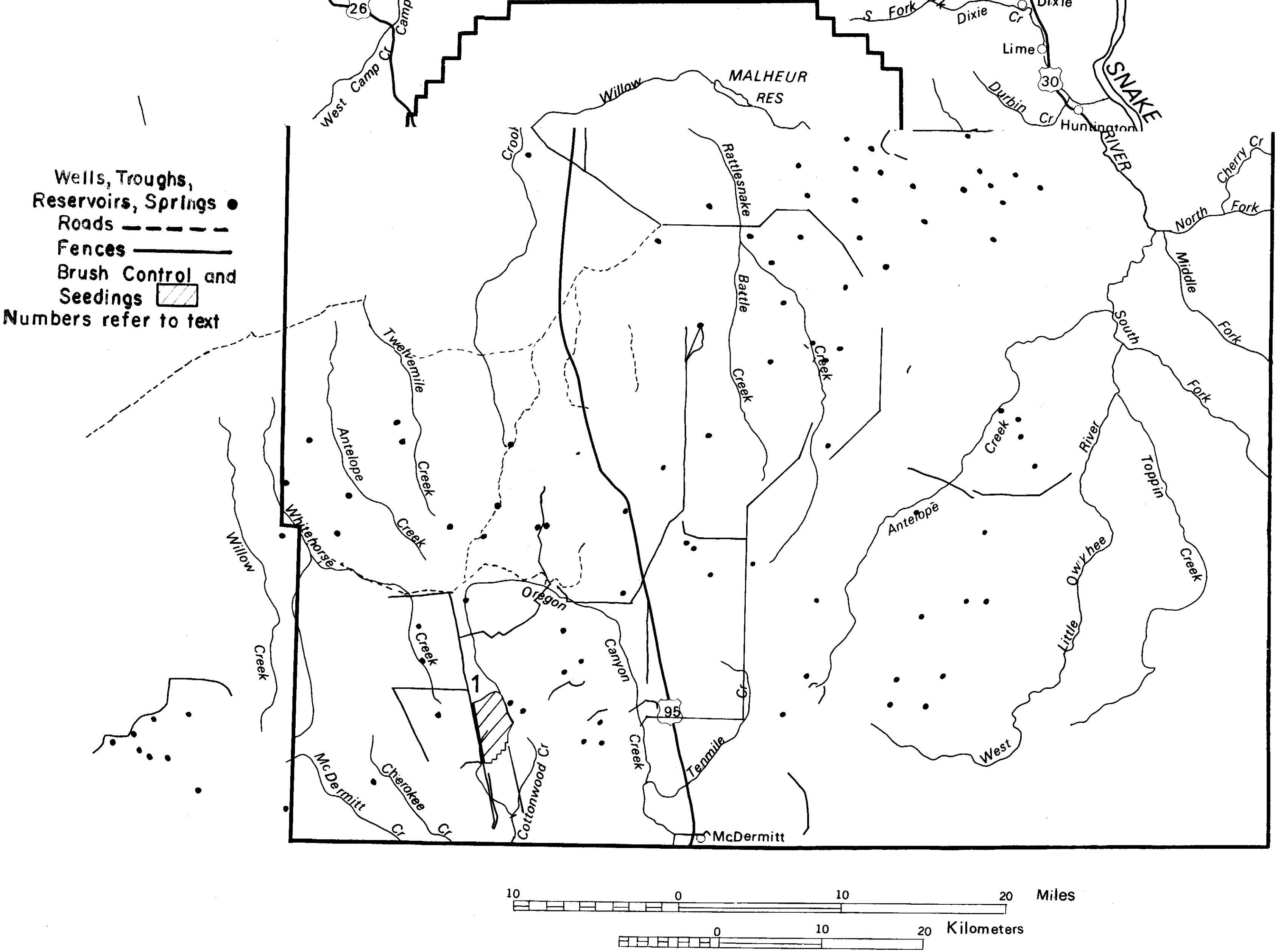

Figure 15.--Range improvements before 1961.

maintenance. The start toward range rehabilitation before 1962 came as a cooperative effort between the BLM and the permittees--contrary to many stories in the public press which condemned the ranchers for being interested only in range destruction.

Range research at the Squaw Butte Experiment Station near Burns, Oregon, and in the sagebrush-grass type added still another factor that made the Vale Program feasible. The station superintendent emphasized in talks to ranchers and BLM personnel that a twofold increase in AUM's could be attained. Six management practices were needed: (1) more water to improve animal distribution, (2) more riding to scatter the cows, (3) sagebrush control by spraying, (4) seeding of crested wheatgrass (*Agropyron cristatum* and *A. desertorum*), (5) adjustments in opening and closing dates of grazing, and (6) providing sufficient winter feed. These practices had increased annual meat production per cow on the Squaw Butte Station from 150 pounds (70 kg) in 1946 to approximately 400 pounds (180 kg) in 1960 (Bureau of Land Management [n.d.]).

Thus, the district was ready in 1961 for a range rehabilitation program: (1) Range condition was poor and, if not deteriorating, certainly not improving; (2) open controversies indicated that a new program was needed; (3) a start at cooperation had been made; (4) information on what to do and how to do it was available; (5) local people, politicians, and the BLM were anxious to accomplish a land management program in place of wasting resources on disagreements over adjudication of grazing permits. The need for funds forced all parties to turn to Congress for help.

The Vale Rehabilitation Program

THE ORIGINAL PROPOSAL

The original proposal was prepared as a 28-page document by personnel of the Vale District of the Bureau of Land Management. It gave concrete suggestions for halting range deterioration in southeastern Oregon. A paragraph quoted from a letter written by three members of the Oregon State BLM Advisory Board on February 19, 1962, indicates the praise and enthusiasm by people in Oregon for the proposal:

> The Bureau has had inadequate funds to improve the range and has, therefore, been forced to evaluate carrying capacities with little hope of improvement. This plan provides for positive improvement and continuous evaluation while improvement is underway. It also provides for adjudication on the basis of actual use supported by observations of range condition and trend. These things can be accomplished with adequate money and personnel.

Contingent upon funding by Congress, the project proposal specifically offered ". . . a solution to the national problem of depleted and deteriorating public rangelands. It proposes to do so without seriously impairing the livestock industry and supporting local economies. The Vale District would be a practical demonstration of the government's ability, through the BLM and the Department of the Interior, to solve a critical national problem." The objectives were ". . . a seven-year development program with emphasis on rehabilitation measures designed to protect and improve the soil, conserve and utilize the water, and increase forage for livestock and wildlife. It also considers the needs for recreational development and construction of service roads and related measures that will strengthen and improve the local economy" (Bureau of Land Management [n.d.]).

The Vale proposal specifically listed eight objectives:

1. To correct erosion and accompanying downstream sedimentation--and prevent further soil losses.

2. To increase the forage supply for wildlife and livestock.

3. To stabilize the livestock industry at the present or an increased level of production.

4. To facilitate fire control by replacing high hazard cheatgrass and sagebrush with low hazard perennial grasses and improving detection and suppression facilities.

5. To prevent the encroachment and spread of noxious and poisonous weeds.

6. To accomplish necessary land tenure adjustments.

7. To safeguard public lands from improper recreational use.

8. To provide for the development of access roads and service roads in the vast areas of untapped recreation potential.

The procedures to carry out these eight objectives were not specifically stated, although particular methods such as brush eradication, range seeding, and water development plans were mentioned in the proposal. The proposal encouraged the development of a particular plan or project for each specific area to satisfy the objectives. The program needed to be flexible as lessons were certain to become apparent from mistakes during the first few years. In fact, the Vale Program could be a model for other land treatment programs in addition to the direct results of the program itself.

Contrary to earlier range improvement programs, this one emphasized wildlife, recreational facilities, and watershed values. People expert in these subject areas contributed to the proposal and to the individual projects from the beginning.

PASSAGE THROUGH CONGRESS

Easy passage of the Vale Program proposal through Congress resulted from the emergence of several coincidental factors. First, the early 1960's marked the end of the bulk of legal action by Federal range users to delay implementation of cuts in permits as a result of adjudication. Second, this period marked a re-emphasis on conservation by the Federal government. Third, Senator Wayne Morse of Oregon, a long-time critic of BLM policy, was a candidate for re-election in 1962. With Congressman Al Ullman, Morse became an ardent supporter of the Vale proposal. These two men guided the passage of the special appropriations bill funding the Vale Program. Local support for the proposal and little opposition gave both Morse and Ullman direction to help southeastern Oregon, an area that had been troublesome to them for several years.

Certain specific recommendations, such as seeding to crested wheatgrass and the priority of various land treatment activities raised questions. A proposal on such a large scale caused many to wonder at its feasibility, but the obvious and real local benefits of such a program were never in doubt. The unwavering support of congressional sponsors, strong local encouragement, and a clearly written and well-planned proposal for implementation made possible the passage and funding of the program as a special appropriation in the Federal budget in the summer of 1962. Some money was spent before allocation of the funds occurred in September 1962. The first large-scale projects in the Vale Program began in the Cow Creek unit in summer of 1962.

BUDGET

The original proposal for the Vale Program estimated the total cost at $16,230,460 for 7 years. Cost for the first 2 years was to be $2,505,000, but Congress appropriated $2,071,789. From the beginning, the concepts, scheduling, and funding frequently changed from the original proposal. For example, an extensive 2-year range survey to identify suitable sites for treatment was immediately modified at the requests of Ullman and Morse. They wanted more money and more efforts put immediately into land treatment than the BLM had planned. Further, congressional backing apparently was in jeopardy without immediate on-the-ground results from rehabilitation efforts. Thus the range survey extended for 3 years, and several treatments were undertaken prior to thorough site evaluations. The program extended over an 11-year period and used total funds of about $10 million.

LAND TREATMENT PROJECTS

Land treatments were accelerated early in the program, and later slowed considerably due to receipt of less funds than requested. One hundred and sixty-four land treatment projects were finished (fig. 16). Table 6 lists them by name, year, acreage, treatment, and the location number in figure 16, providing an easy reference for location of results mentioned throughout this report. At the end of the formal Vale Program in 1973, some aspects of the program goals were exceeded; others were not met (table 7).

Table 6--*Land treatment projects in the Vale District, Bureau of Land Management, 1952-73*

Year	Number[1/]	Name	Acres[2/]	Treatment
1952	1	Ten Mile seeding	2,700	Plow/seed
1955	2	Soldier Creek seeding	2,015	Plow/seed
1960	3	Mud Flat seeding	400	Plow/seed
	4	Beulah seeding	1,150	Fire/seed
1961	5	McCain Springs seeding	2,675	Fire/seed
	6	Jordan Valley seeding	1,575	Fire/seed
	7	Downey Canyon seeding	1,429	Fire/plow/seed
	8	Brickey Springs seeding	2,744	Plow/seed
	9	Gluch seeding	3,567	Spray/seed
	10	Whitehorse brush control	10,400	Spray
1962	11	Mormon Basin seeding	919	Fire/seed
	12	Tableland brush control	2,500	Spray
	13	Hooker Creek seeding	2,292	Fire/plow/seed
	14	Jordan Valley brush control	1,098	Spray
	15	Rock Creek seeding	1,800	Plow/seed
	16	Monument brush control	1,800	Spray
	17	Monument seeding	1,800	Fire/seed
1963	18	Mormon Basin brush control	360	Spray
	19	Horse Flat brush control	2,773	Spray
	20	Poverty Flat brush control	1,050	Spray
	21	Mesa brush control	4,047	Spray
	22	Drip Springs brush control	4,003	Spray
	23	Tunnel Canyon brush control	5,920	Spray
	24	Bas brush control	3,800	Spray
	25	Owyhee Butte seeding	9,265	Plow
	26	Schnable Creek seeding	2,015	Fire/plow/seed
	27	Rome seedings	7,785	Plow/seed
	28	Sheep Springs seeding	685	Plow/seed
	29	Starvation brush control	20,098	Spray
	30	Indian Canyon brush control	2,650	Spray
1964	31	Love seeding	375	Plow/seed
	32	Vines Hill seeding	1,800	Fire/seed
	33	Chicken Creek seeding	4,464	Plow/seed
	34	Page seeding	4,400	Fire/seed
	35	Warm Springs brush control	7,713	Spray
	36	Winter Springs seeding	2,222	Plow/seed
	37	Sand Hollow seeding	3,300	Plow/seed
	38	Granite Creek brush control	3,550	Spray
	39	Top brush control	9,560	Spray
	40	Rockville seeding	3,600	Plow/seed
	41	Lodge brush control	6,500	Spray
	42	Old Maid seeding	1,900	Plow/seed
	43	Sticky Joe seeding	700	Plow/seed
	44	China Gulch seeding	2,116	Fire/seed
	45	Jaca seeding	2,650	Spray/seed
	46	Chimney Creek brush control	12,180	Spray
	47	Indian Canyon seeding	2,350	Spray/seed
	48	Starvation seeding	13,910	Spray/seed
	49	Frenchman Creek seeding	1,480	Plow/seed
1965	50	Agency Ridge seeding	294	Plow/seed
	51	Hope Butte seeding	2,622	Plow/seed
	52	N.G. Creek seeding	4,593	Plow/seed
	53	Harper seeding	1,155	Plow/seed
	54	North Chicken Creek Maintenance seeding	1,000	Follow up seeding
	55	Cottonwood seeding	4,465	Plow/seed
	56	Lower Clover Creek seeding	1,459	Plow/seed
	57	Lava Ridge seeding	1,000	Plow/seed
	58	Juntura seeding	589	Plow/seed

continued

See footnotes at end of table.

Table 6--*Land treatment projects in the Vale District, Bureau of Land Management, 1952-73*--continued

Year	Number[1/]	Name	Acres[2/]	Treatment
1965	59	Juniper Basin seeding	692	Plow/seed
	60	Little Valley seeding	691	Plow/seed
	61	Callahan brush control	11,070	Spray
	62	Double Mountain brush control	8,400	Spray
	63	Creston brush control	3,100	Spray
	64	Blue Canyon brush control	10,000	Spray
	65	Little Sandy seeding	2,900	Plow/seed
	66	China Gulch "B" seeding	3,700	Plow/seed
	67	Greeley seeding	4,000	Plow/seed
	68	Bull Creek seeding	3,000	Plow/seed
	69	Beber seeding	870	Plow/seed
	70	Battle Creek seeding	8,800	Plow/seed
	71	Steer Canyon seeding	6,100	Plow/seed
	72	Oregon Canyon brush control	3,186	Spray
	73	Andy Fife brush control	3,540	Spray
1966	74	Mormon Basin "B" seeding	740	Spray/seed
	75	Farewell Bend seeding	1,045	Plow/seed
	76	Bierman Springs seeding	1,440	Plow/seed
	77	Beulah seeding	460	Plow/seed
	78	Radar Hill seeding	1,005	Plow/seed
	79	Westfall seeding	340	Plow/seed
	80	East Cow Hollow seeding	800	Plow/seed
	81	Needham Well seeding	995	Seed only
	82	Slaughter Gulch brush control	12,376	Spray
	83	Mosquito Creek seeding	1,910	Plow/seed
	84	Squaw Creek seeding	980	Plow/seed
	85	Rye Field seeding	3,400	Seed only
	86	Board Corrals brush control	4,350	Spray
	87	Owyhee Canyon brush control	14,000	Spray
	88	Owyhee Butte "B" seeding	300	Plow/seed
	89	Pascoe seeding	1,950	Plow/seed
	90	Field Fire brush control	4,600	Spray
	91	Dry Creek seeding	3,195	Plow/seed
	92	Greeley brush control	2,000	Spray
	93	Rock Creek brush control	2,500	Spray
	94	Black Butte brush control	2,000	Spray
	95	Overshoe Pass seeding	7,345	Spray
	96	Sheep Corrals brush control	2,785	Spray
	97	Oregon Canyon seeding	4,950	Spray/seed
	98	Schoolhouse seeding	3,855	Spray/seed
	99	Flat Top seeding	2,864	Spray/seed
1967	100	Bully Creek seeding	691	Spray/seed
	101	Willow Creek seeding	2,180	Spray/seed
	102	Swamp Creek seeding	1,150	Plow/seed
	103	Lincoln Bench brush control	1,700	Spray
	104	Antelope Flat seeding	1,313	Plow/seed
	105	Spring Creek seeding	2,040	Plow/seed
	106	Big Ridge seeding	3,000	Plow/seed
	107	Field Fire seeding	4,600	Spray/seed
	108	Soldier Creek "B" seeding	280	Plow/seed
	109	Antelope seeding	4,500	Plow/seed
	110	Black Butte seeding	1,655	Plow/seed
	111	Basque seeding	3,200	Spray/seed
	112	Cascade brush control	7,950	Spray
	113	Mine Creek seeding	4,846	Fire/plow/seed
	114	Bretz seeding	2,631	Plow/seed
	115	Angel Canyon seeding	4,247	Plow/seed
	116	Old Jaca seeding	3,874	Spray/seed
1968	117	Hope Flat seeding	1,100	Plow/seed
	118	Meeker Flat brush control	2,520	Spray

continued

See footnotes at end of table.

Table 6--*Land treatment projects in the Vale District, Bureau of Land Management, 1952-73*--continued

Year	Number[1/]	Name	Acres[2/]	Treatment
1968	119	Saddle Butte seeding	4,106	Spray/seed
	120	Sheepheads seeding	4,392	Plow/seed
	121	Turnbull Lake seeding	7,430	Plow/seed
	122	Shellrock brush control	5,235	Spray
	123	Frank Maher Flat seeding	2,820	Spray/seed
	124	Bankofier seeding	3,610	Plow/seed
	125	Haystack Butte brush control	3,388	Spray
	126	Red Butte brush control	8,340	Spray
1969	127	Buckbrush seeding	850	Plow/seed
	128	North Harper seeding	2,687	Fire/seed
	129	Hunter brush control	10,350	Spray
	130	Quicksand Springs brush control	5,400	Spray
	131	Upper Meadow seeding	540	Plow/seed
	132	Stockade brush control	3,122	Spray
	133	West Crater brush control	11,637	Spray
	134	Spring Basin seeding	1,740	Plow/seed
	135	Spring Mountain seeding	616	Plow/seed
	136	Falen seeding	395	Plow/seed
	137	Barlow brush control	2,833	Spray
	138	Twelve Mile seeding	2,015	Plow/seed
	139	Sheepline brush control	1,345	Spray
	140	Upper Whitehorse brush control	891	Spray
	141	Lazy T Pasture brush control	1,315	Spray
	142	Rim Basin seeding	1,510	Plow/seed
	143	Arritola Reservoir seeding	400	Plow/seed
1970	144	Rufino Butte brush control	10,321	Spray
	145	Rabbit Farm seeding	2,093	Plow/seed
	146	McIntyre brush control	1,050	Spray
	147	Sulfur Springs seeding	1,437	Plow/seed
	148	Summit brush control	3,208	Spray
	149	Jackson Creek brush control	4,750	Spray
	150	Mud Springs brush control	2,013	Spray
	151	Pole Creek seeding	3,010	Spray
	152	Wildcat brush control	6,115	Spray
1971	153	Needham Well seeding	995	Reseed
	154	Freezeout Lake seeding	475	Plow/seed
	155	Carter Creek seeding	3,600	Plow/seed
1972	156	Freezeout Butte brush control	3,535	Spray
	157	Willow Butte seeding	3,310	Plow/seed
	158	Buckskin seeding	4,960	Plow/seed
	159	Fish Creek seeding	5,000	Plow/seed
	160	Boulevard seeding	175	Fire/seed
	161	Baker Creek brush control	4,760	Spray
1973	162	Brassy Mountain seeding	1,675	Fire/seed
	163	Tunnel Canyon seeding	2,500	Fire/seed
	164	Bogus Creek seeding	7,415	Fire/seed

1/ Numbers refer to locations in figures 15 and 16.

2/ 1 acre equals 0.405 hectare.

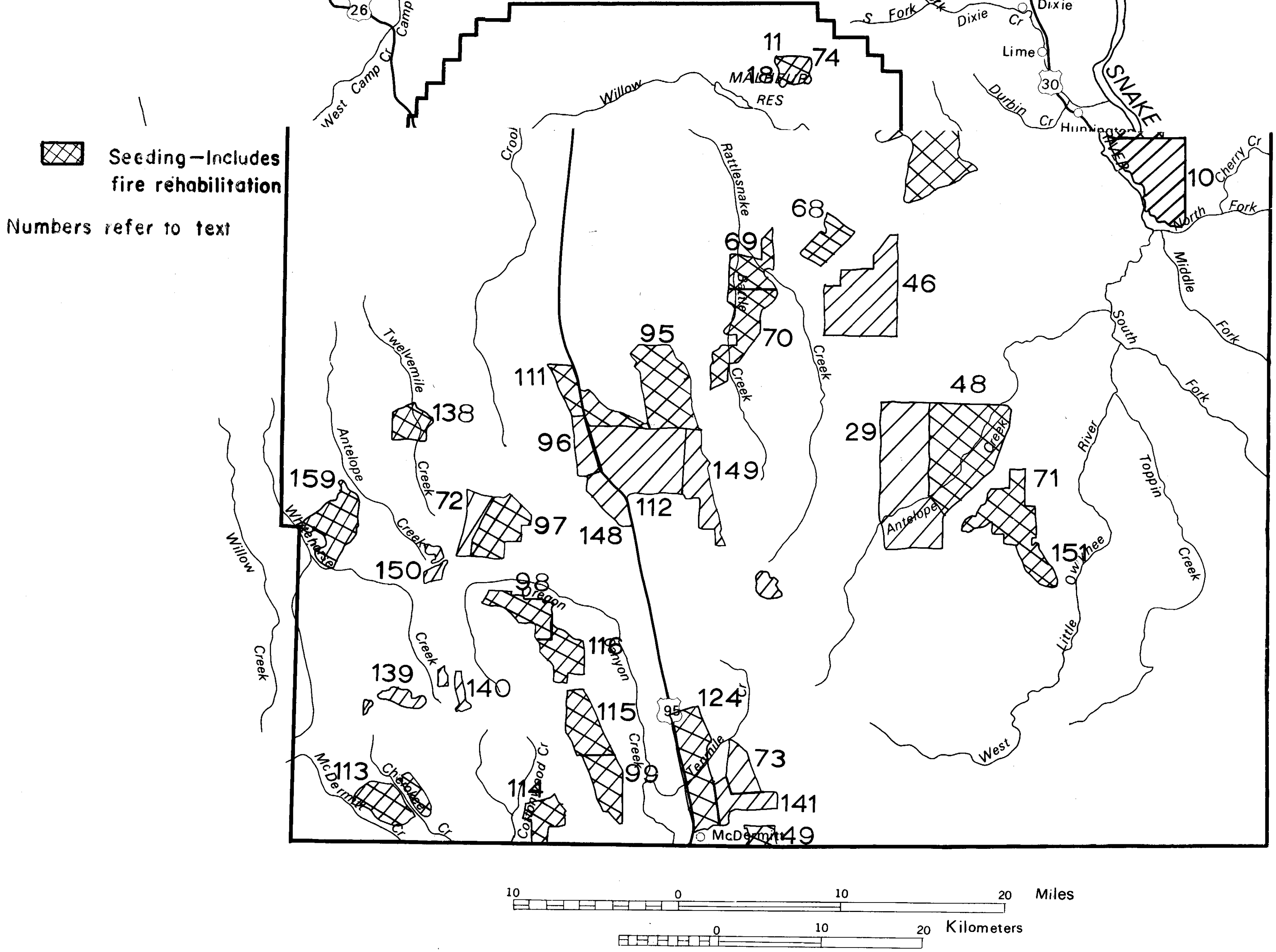

Figure 16.--Land treatment projects, 1961-75.

Table 7--*Original goals and actual accomplishments of Vale District Program, Bureau of Land Management, through 1973*

Treatment or management aid	Unit[1/]	Program goal	Units completed as of 1973	Percent of goal
Brush control	Acres	730,000	[2/]506,570	69
Seeding	Acres	410,000	267,193	65
Fencing	Miles	2,000	1,994	100
Reservoirs	Each	400	583	146
Springs	Each	500	440	88
Wells	Each	100	28	28
Pipelines	Miles	120	462.9	385
Water troughs	Each	640	538	84
Cattle guards	Each	500	360	72
Test plots and exclosures	Each	79	69	87
Costs	Million dollars	16	10	63

1/ 1 acre equals 0.405 hectare; 1 mile equals 1.6 kilometers.

2/ Total brush control acreage; 280,407 acres were control of brush only, not seeded. Some 41,000 acres were seeded without brush control.

The number of projects, acreages, miles of pipelines, number of new watering points, and magnitude of other improvements are subject to considerable interpretation. For example, a few areas underwent several treatments on the same acreage following failures. We treated these as separate projects. In other situations, we were seldom certain whether an acreage was for a pasture or for a treatment that nearly filled a pasture; or if the acreage given was the contracted rather than the completed acreage. Sometimes assumptions of size had to be made in order to evaluate costs, benefits, and grazing capacity. Wherever possible we have chosen to evaluate the overall Vale Program, thereby minimizing, but not eliminating, the importance of accurate data on individual projects. Although some of our data varies from that of others, we have selected what appears to us to be the best available.

The Rangeland Rehabilitation Operation

DISTRICT PLANNING

Planning in the Vale District contributed to the success of the program. Division of the district into three management areas, called resource areas, with separate managers spread the workload and responsibilities. The resource areas were further divided into 14 planning units, which continued to be the bases for planning. Area managers proposed and developed improvement plans, projects, and grazing systems with considerable autonomy. Thus, the mixture of management practices and land treatments differed among the three resource areas. Various differences among the divisions exist today, and they will be discussed in later sections of this report.

Area managers initiated planning and site selection which was consolidated into district plans. The final authority for the coordinated program rested with the district manager who supervised staff personnel responsible for range conservation and development, wildlife management, engineering, watershed protection, land tenure problems, administration, public information, and program coordinations. District personnel include about 75 persons on a permanent basis and another 75 during the field and fire season.

SITE SELECTION

The original program proposed a 2-year survey of 2,660,000 acres (1 000 000 ha) and improvement planning for 4,000,000 acres (1 620 000 ha) to aid in location of land treatments (Bureau of Land Management [n.d.]). Plowing, spraying, seeding, fencing, water development, and other practices were to follow careful planning. Shortly after funds became available, the congressional supporters of the program expressed alarm that the first appropriations of more than $2 million would not show in visible results on the land and that any delay in initiation of rehabilitation could jeopardize future funding. BLM responded by immediately beginning land treatments but with fears that poor site selection would generate habitat damage and ineffective treatment, concerns not supported by the results obtained. Starting in the 2d year of the program, a resource survey enabled site selection to proceed according to plan as modified by the level of funding.

Wisely, the Vale Program proposal required selection of sites for treatment based on their potential for improvement. Sites with greatest potential for improvement were treated first. As funding continued, progressively poorer sites were treated. Local needs for additional forage to satisfy obligated animal numbers did not play a major role in site selection. Likelihood of success determined site selection, not degree of range deterioration.

Although several early Vale Program reports stated that the first land treatment projects, due to pressures for immediate results, directed efforts at the most depleted ranges, records do not bear out that conclusion. Sites treated from 1962 to 1964 had an estimated grazing capacity before treatment of between 21 and 24 acres/AUM (8.5-9.7 ha/AUM), higher capacities than lands treated in later years (fig. 17). The poorest land to be rehabilitated, averaging more than 40 acres/AUM (16 ha/AUM), received treatment in 1967 and 1968. Most areas requiring seeding (preceded by plowing or spraying) and with high site potential had been treated before 1968.

An increased pretreatment grazing capacity in projects after 1968 resulted in part from improved range condition. Native perennial grasses on untreated sites recovered more rapidly than expected, reducing the need for seeding and increasing the effectiveness of spray-only treatments. Two-thirds of the pre-1969 projects (64 of 95) but only one-third (9 of 25) of the post-1968 projects included seeding. Thus, successful early treatment and improved livestock management resulted in a shift in emphasis from plow-and-seed to spray-only. Lack of suitable sites for spraying did not limit the projects from 1969 to 1972. The criteria for site selection and type of treatment changed in 1969 in response to improving range conditions.

The selection of a specific site for treatment and the determination of treatment specifications involved a complex set of factors and criteria, many of which were never formalized or recorded. Primarily, site selection necessitated building the level of judgment by range conservationists to a degree that recommendations were correct biologically and effective managerially. Some of the value judgments that proved effective were: Adequate native perennial grasses as an understory in sagebrush required only a spraying and livestock control to

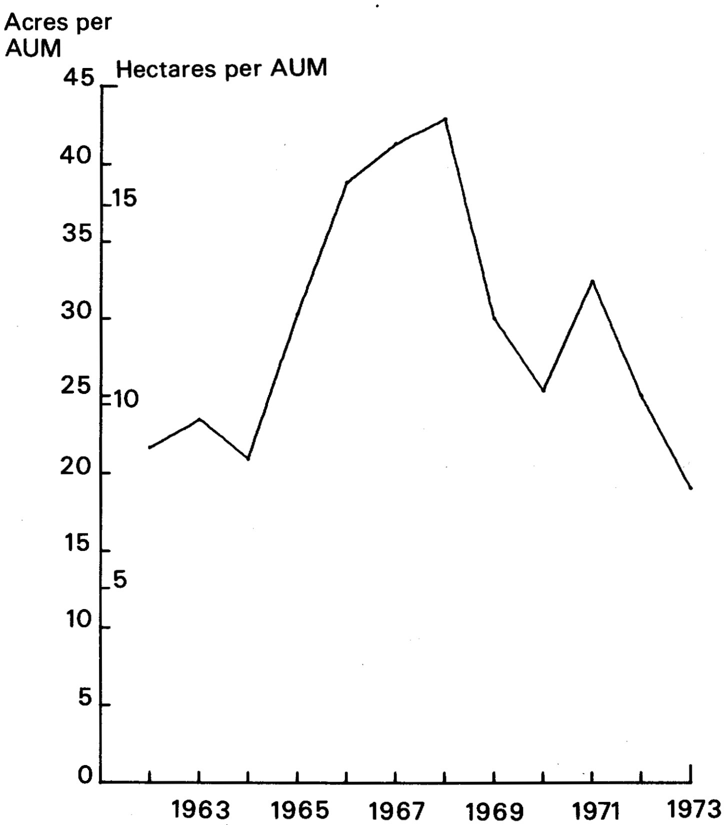

Figure 17.--Estimated grazing capacity for the project areas immediately prior to treatment (source: project site inspection reports).

improve the grass stand; but "adequate perennial grasses" was a value judgment through the early program years. Steeply sloping areas, shallow rocky soils, vegetation with substantial browse for wildlife range, and riparian vegetation were not plowed, seeded, or sprayed.

Range sites with few native perennial grasses and with big sagebrush plants over 3 feet tall indicated high site potential for plowing and seeding. Several criteria of potential success emerged from experiences in the first few projects: (1) Plowing and seeding should be done in areas where few or no perennial grasses occur and where mature big sagebrush is at least 3 feet tall. (2) Spray-only should be done where numerous perennial grasses occur in the sagebrush stands. (3) Spraying in the district should not be combined with plow-seed treatments. (4) Drilling of seed after spraying and without plowing proved effective on some rocky soils and moderately steep slopes. (5) Contract specifications for seed bed preparation are more important than stipulations for percent kill of brush.

Misapplied treatment served to establish these criteria. The native bunchgrasses returned faster than expected. Therefore, some sagebrush sites selected for plowing and seeding could have been sprayed to preserve existing native bunchgrasses. Treatments on old lakebeds frequently failed, and treatments of alkali soils proved unsuccessful.

Considerations of other possible land uses strongly influenced site selection. Beginning in 1963, all land treatment sites were evaluated by the district wildlife biologist and rehabilitation projects were approved by representatives of the Oregon State Game Commission. A few treatments were altered and 11 projects were cancelled to preserve wildlife habitats. Some projects, when executed, did not preserve small areas designated as wildlife habitat due to contractor error and inadequate supervision by BLM personnel. As the program progressed, compatibility between site selection and wildlife habitat requirements improved.

Sixty-nine test plots and exclosures, built before and during the early years of the Vale Program, played a strong role in site selection and stipulation of treatments. Some of the exclosures continue to provide useful vegetational information. Many areas, alkaline soils for example, on which plot responses to treatment were poor, did not show promise for large-scale success and were cancelled from the projects. Conversely, success in plots led to successful projects on areas originally rejected. Test-plot results did not guarantee success. Their use, however, demonstrated the value of pilot tests, a highly important lesson for any large rangeland rehabilitation program.

Uniform distribution of projects (fig. 16) over the district complemented untreated range throughout. Perhaps land treatment projects were concentrated in certain areas and years. At the beginning an extensive rehabilitation program was already underway in the Soldier Creek Management Unit, southwest of Jordan Valley. As additional funds became available in 1962, BLM concentrated its efforts in the Soldier Creek area. Units without significant improvements are Barren Valley in the west-central region of the district, and Star Valley in the remote southeastern portion of the district. Barren Valley has poor potential for improvement, being primarily winter range. The northern part of the district needs additional rehabilitation.

This program shows that rehabilitation on 10 percent or less of the area will result in rapid improvement of the untreated areas through proper management. Thus, the Vale Program dealt with improvement of the whole district, not just the areas plowed, seeded, and sprayed.

Overall, site selection in the Vale District Program was excellent. Problems with particular areas and combinations of treatments did not materially detract from the excellent job of site selection and rehabilitation. Intimate knowledge of the field situations formed the best basis for selection of land for treatment. Even areas treated in the 1st year of the project were successfully improved because of the familiarity of BLM personnel with the range.

BRUSH CONTROL

Methods to reduce the density of shrub species included plowing, spraying, burning, or some combination of treatments. Although not used as a planned treatment, the *Aroga* moth thinned extensive areas of big sagebrush through defoliation.

Plowing with a disk-plow (fig. 18) as a method of brush control became standardized early in the Vale Program, and contract specifications changed little once a few projects showed the relative effectiveness and costs of various treatments. As finalized and used, contracts required plowing to a depth of 4-6 inches (10-15 cm), and an estimated 90 percent kill of brush, which often

Figure 18.--Removing big sagebrush with a disk-plow (Bureau of Land Management photo). Inquiries concerning design and availability of the latest models of the brushland plow should be addressed to the USDA, Forest Service Equipment Development Center, San Dimas, California 91773.

required two passes over the land. Rangeland plowing generally commenced in late summer or fall immediately prior to seed-drilling time and at the direction of BLM personnel. Timing of plowing operations was not particularly important as a factor in percentage brush kill, but it may have been critical in preventing brush seedling establishment. Plowing after seed of big sagebrush had matured probably fostered big sagebrush regeneration. Primary factors in the success of plowing operations were degree of rockiness, slope percentage, and species of brush. Low sagebrush and rabbitbrush resisted plowing. Plowing contracts were closely supervised, well executed, and generally effective.

Plowing contracts went to the low bidder. If all bids were judged excessively high, budget specifications enabled direct land treatment by BLM. A successful contractor furnished labor, the power for pulling government-owned brushland plows, and all necessary maintenance of equipment. Costs of plowing varied greatly due to site and increased from the low figures during early years of the program.

Effects of spraying herbicides to control brush varied much more than plowing. Contractors applied the specified spray mixture at certain rates over designated areas (fig. 19). Although BLM personnel closely supervised most spray operations and aided in field applications, contractor compliance with specifications was less easily accomplished and policed than plowing.

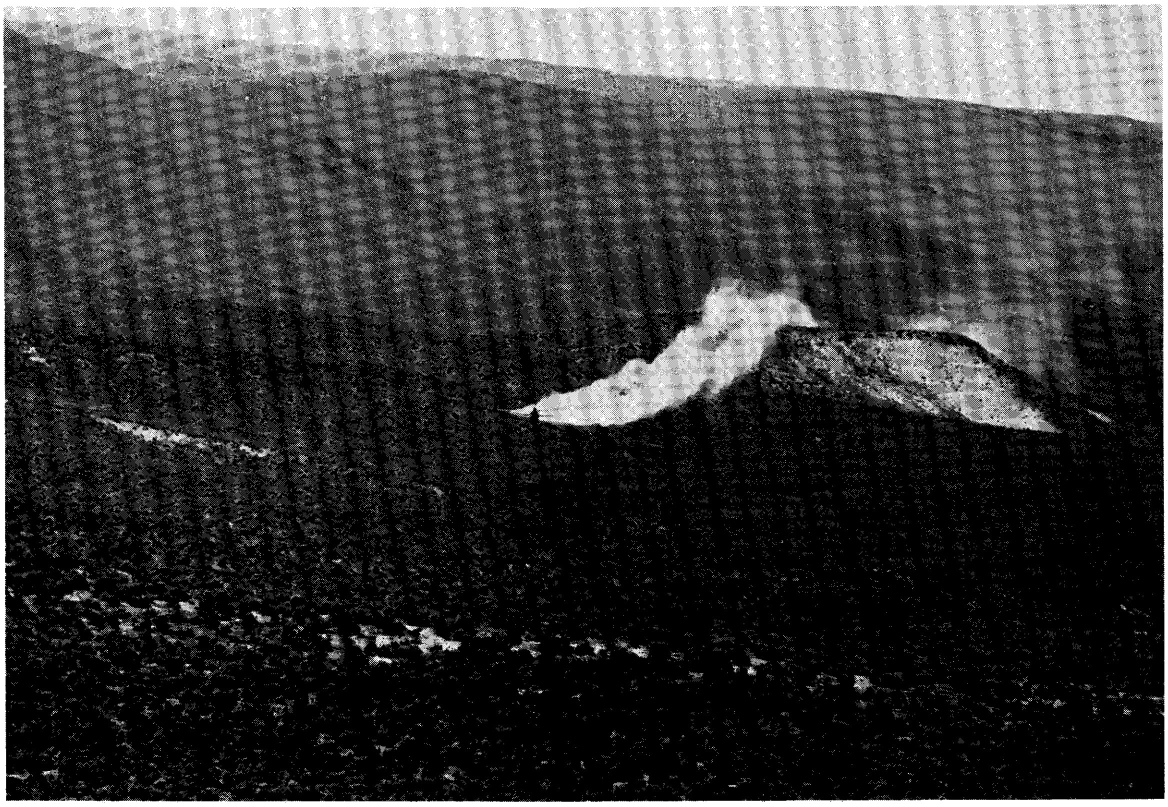

Figure 19.--Spraying long strips of big sagebrush tends to cross steep slopes and streams, which should not be sprayed (Bureau of Land Management photo).

The herbicide used, 2,4-D, and the rate, 2 lb acid equivalent per acre (2.2 kg/ha), did not change throughout the program. Many successful controls of big sagebrush had been obtained in other places, so experiments with types of herbicides and rates of application were not required. The herbicide carrier and timing of application significantly affected percentage kill and hence, the effectiveness of particular spray operations. In most cases, 2,4-D with a diesel oil carrier killed big sagebrush. Environmental considerations caused substitution of water for diesel oil in 1965, which made accurate timing of application critical. Poor kills of big sagebrush resulted from spraying in 1965 and 1966; however, the water-based herbicide killed brush even better than herbicide with diesel oil base when specifications were followed. Application of 2,4-D was usually made by fixed-wing aircraft, but occasionally by helicopter.

Every contract for spraying specified that the timing of the operations was to be regulated by BLM. Soil moisture and plant phenology, as originally recommended on the Squaw Butte Experiment Station by Hyder and Sneva (1955), were used to indicate the season for spraying. Heading of Sandberg bluegrass and rapid spring growth indicate onset of effective spraying conditions. Sufficient soil moisture (more than 8 percent) for an adequate kill of big sagebrush remains until half the bluegrass leaves have dried. The officer in charge controlled the day-to-day progress of the operation. Spraying was halted any time that winds exceeded 10 miles per hour (16 km/h). The timing of operations for maximum kill of big sagebrush often resulted in unsatisfactory kill of rabbitbrush.

Several spray projects suffered from inadequate compliance with contract specifications, such as the West Crater brush control in which inadequate overlap of spray-runs resulted in alternate strips of killed and unkilled brush.

The Lodge brush control project in 1964 serves as an example of the procedures in a spraying operation (Irons 1964). District personnel were in charge and monitored both spraying the site and loading the aircraft. Three flagmen marked the spray-runs, and they used two-way radios and four-wheel drive vehicles to keep in line. The contractor used two converted TBM torpedo bombers of World War II vintage, each capable of carrying 700 gallons (3 100 liters) of spray. He also furnished the spray mixture consisting of 2 lb acid equivalent 2,4-D in 3 gallons of diesel oil per acre (2.2 lb in 11 liters/ha). Thus, each aircraft covered approximately 233 acres (95 ha) per trip. Samples of the spray mixture were taken by BLM personnel at the airport for analysis. Each trip involved 20 minutes of flying time from the Homedale airport and 3 minutes for loading. The aircraft flew at an altitude of 50 feet (15 m), and spray-runs were 190 feet (58 m) wide. Spray extended over a strip 400 feet (120 m) wide, giving excellent herbicide overlap. This operation covered 6,500 acres (2 630 ha) between 4:45 a.m. and 4:20 p.m. on May 15, 1964, at a cost of $2.10 per acre ($5.20/ha). Winds stayed below 10 m/h (16 km/h), otherwise the operation would have been halted. Temperature rose from 29 °F (-2 °C) in the morning to 65 °F (18 °C) in the afternoon. Soil moisture was 12 percent. The resulting kill of brush was excellent.

Wildfires frequently followed land treatments, especially sprayings; and all or part of several projects were swept by fire. Burning further increased the effectiveness of brush control and left no detectable detrimental effects on forage for livestock after the 1st year. Removal of grazing for a year following treatments permitted fuel to accumulate, thus favoring fires. Wildfires which burned independently of brush control treatments also effectively killed sagebrush. Burned areas have the lowest average density of sagebrush of any treatment.

An outbreak of *Aroga* moths killed sagebrush in several areas during the early 1960's just as the Vale Program began. They did not kill significant amounts of sagebrush (fig. 20). A single project located in the Cherry Creek drainage was cancelled as a result of *Aroga* kill of sagebrush. The moth may strip parts of the brush of leaves, but kill seldom exceeds 10 percent of individual shrubs.

SEEDING

Seeding followed a variety of land treatments. All plowed land and some of the sprayed areas were seeded (fig. 21). The plowing, mostly for brush control, also reduced cheatgrass and other herbaceous competitors and prepared a seed bed. Seeding usually followed wildfire and failures from previous rehabilitation attempts without site preparation by plowing.

Decisions concerning particular practices and whether or not to seed at all depended on test plots and ocular site evaluations. Species tested in plots included crested wheatgrasses, pubescent wheatgrass (*Agropyron trichophorum*) tall wheatgrass (*A. elongatum*), western wheatgrass (*A. smithii*), yellow sweetclover (*Melilotus officinalis*), and other clovers (*Trifolium* spp.). Crested wheatgrass seldom failed in the plots, and the other plant species seldom succeeded. The standard seeding became 7 lb/acre (8 kg/ha) of crested wheatgrass with a rangeland drill--specifications not significantly modified throughout the program. The seed,

Figure 20.--The moth Aroga *seldom kills the whole bush of big sagebrush plants.*

purchased annually in large commercial lots, consisted of mixed Standard (*Agropyron desertorum*) and Fairway (*A. cristatum*) crested wheatgrass; at least that was the appearance of most stands in 1975.

Alkaline soils, shallow rock soils, and a vegetative cover of low sagebrush indicated marginal sites for seeding of crested wheatgrass. Other species of grasses and legumes were also planted on such sites. On a mud flat or dry lakebed, for example, pubescent wheatgrass at 1.5 lb/acre (1.7 kg/ha), western wheatgrass at 2.6 lb/acre (2.9 kg/ha), tall wheatgrass at 0.75 lb/acre (0.85 kg/ha), crested wheatgrass at 2 lb/acre (2.3 kg/ha), and strawberry clover (*Trifolium fragiferum*) at 0.33 lb/acre (0.37 kg/ha) constituted the seed mixture. Immediately after that treatment, the seeding contained mainly crested wheatgrass; but by 1975 pubescent wheatgrass dominated, with only about 5 percent crested wheatgrass. Nomad alfalfa (*Medicago sativa*) was seeded on 56,340 acres (22 800 ha) by air in the spring following fall drilling to crested wheatgrass (fig. 22).

Seeding practices drew heavily on methods developed during the 1950's at the Squaw Butte Experiment Station near Burns, Oregon, and limited experience in range seeding on the Vale District before the start of the Vale Program. An early seeding, the Soldier Creek project (fig. 15, number 2), which was plowed with a Wheatland disk-plow in the fall of 1955 and broadcast seeded with crested wheatgrass at a rate of 6.25 lb/acre (7.1 kg/ha) in the fall, failed because of cheatgrass competition. The area has a complex later history of burning and reseeding attempts. The Soldier Creek project cost $13.58/acre ($33.53/ha) for seeding, plowing, water development, and fencing.

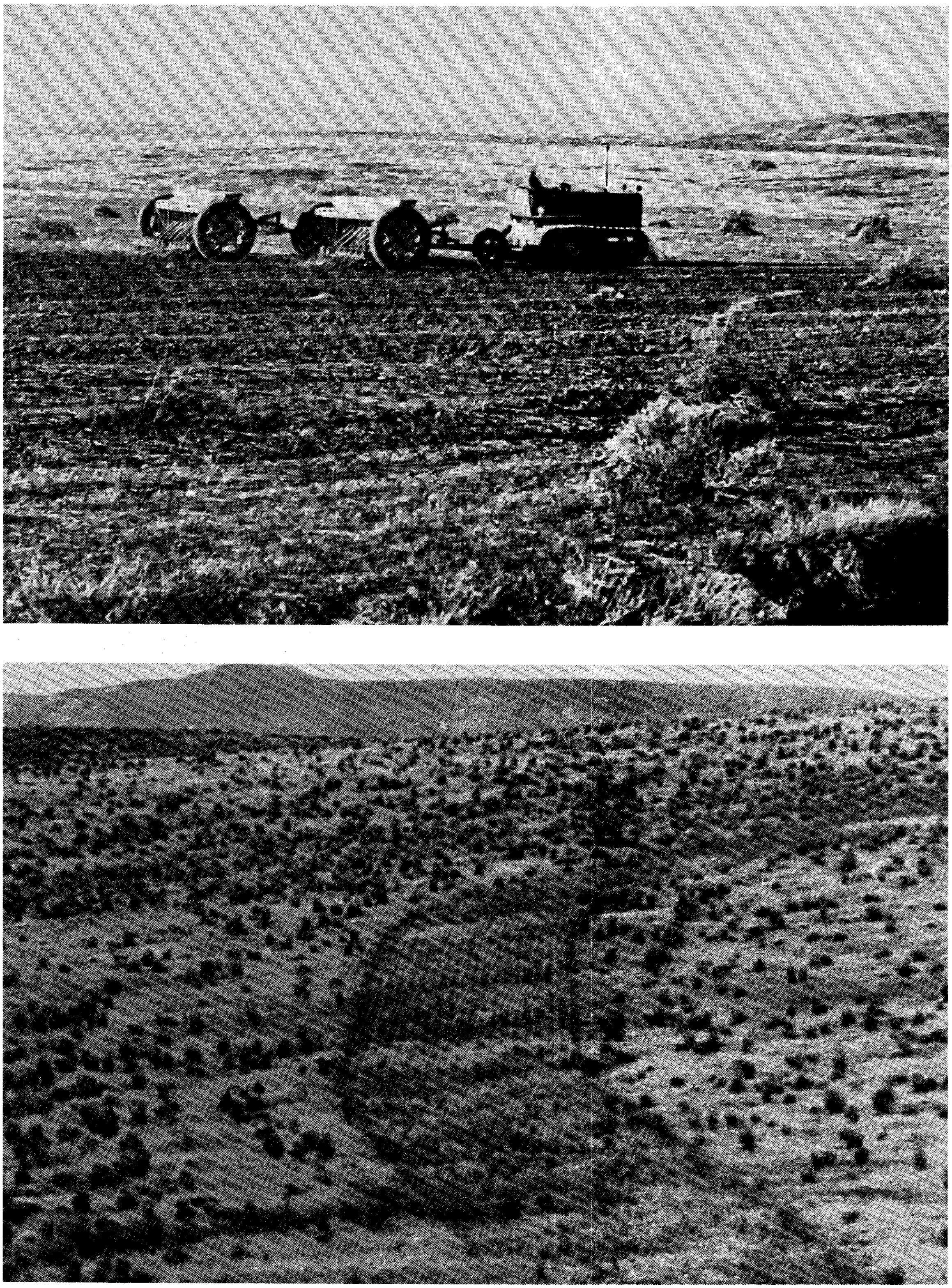

Figure 21.--Top, drilling crested wheatgrass (Bureau of Land Management photo). Bottom, a poor stand of crested wheatgrass in cheatgrass after a burn and broadcast seeding. The good stand from the single pass of the drill demonstrates the need for drilling. Inquiries about the rangeland drill should be addressed to the USDA, Forest Service Equipment Development Center, San Dimas, California 91773.

Figure 22.--A stand of nomad alfalfa and crested wheatgrass (photo, courtesy of R. Kindschy, Bureau of Land Management, Vale, Oregon).

Contract procedures for seeding became standardized in 1962. An example is the Sheep Springs project which was plowed twice with Wheatland plows in the fall of 1962 and seeded to crested wheatgrass at 8.5 lb/acre (9.6 kg/ha) in November of 1962 on partially frozen soils. Costs averaged $14.94/acre ($36.89/ha) for 605 acres (245 ha). A second example is the Gluch project which was sprayed with 2,4-D in diesel oil at 2 lb/acre (2.2 kg/ha) from a helicopter in April 1961. Areas in the project lacking in grass cover were drilled with crested wheatgrass at 5.5 lb/acre (6.2 kg/ha) in November 1961. Fencing enclosed 9,107 acres (3 688 ha) of which 5,450 (2 207 ha) had been sprayed and 3,567 acres (1 445 ha) seeded. Average cost was $5.77/acre ($14.25/ha).

FIRE

Fire, as an ecological and historical factor, has been mentioned repeatedly in this report without discussion of its role in the district operations. The original program budget included $314,000 for fire protection. The Vale District fire control program became large, effective, and the headquarters for widely used hotshot crews--the Snake River Valley firefighters--which service other areas. Planning and preparation for control take place in the winter and additional personnel are hired in the summer for detection and suppression of fire. When fires pose threats to valuable resources, structures, livestock, habitations, etc., they must be suppressed. After a wildfire, rehabilitation becomes an emergency project to be accomplished with haste.

The goals of the Vale Program stipulated that fire control, specifically the replacement of highly flammable cheatgrass with less hazardous perennial grasses, would be increased in effectiveness. Other benefits to fire suppression would include access roads, reduction of big sagebrush cover, and additional water sources. The Vale Program would incur costs for fire control because of needs to protect investments in land treatments, specifically seedings. Fire control was not considered a management tool nor the burned areas opportunities for rehabilitation.

Rangeland fires have persistently caused controversy over costs, damages, and benefits of burning. The ready availability of funds for wildlife suppression and rehabilitation, and conflicting goals in land management contribute to continuing disagreements. To illustrate, hundreds of thousands of dollars are spent annually in the Vale District for fire suppression (table 8); yet burned

Table 8--*Costs for fire protection and fighting fire on the Vale District, Bureau of Land Management, 1972-76*

Fiscal year	Protection	Firefighting
	Dollars	
1972	66,500	523,700
1973	67,467	924,555
1974	88,540	786,963
1975	105,178	707,558
1976	89,840	470,478

and rehabilitated lands produce as much forage as the acceptable but more expensive plowed-and-seeded areas. Perennial grasses are encouraged because they reduce the high fire hazard of cheatgrass, yet an abundance of perennial herbage with rest from grazing creates high fuel volumes on some pastures. These and other conflicting situations do not yield to simple solutions in planning for proper rangeland rehabilitation and use.

In hindsight, the dismissal of fire from the Vale District Program as a land treatment was a mistake. The district's present emphasis on fuel management in brush types of vegetation and the recognition of the natural role of fire in the big sagebrush-grass ecosystems have established the development of prescribed fire as a legitimate land management practice. At the beginning of the Vale Program, however, fire was considered both harmful and dangerous, which it is if uncontrolled.

Historically, fires in the Vale area were a result of lightning strikes or were set by Indians. Peter Skene Ogden mentioned fires along Bully Creek which Indians set in 1827 (Williams et al. 1971). Such fires did not eliminate big sagebrush nor the perennial bunchgrasses (Uresk et al. 1976), but they created a mosaic of big sagebrush and grass of varying proportions, densities, and ages. The big sagebrush at any given time probably did not exceed 25-percent cover. Due to overgrazing, the unrehabilitated range now has the introduced cheatgrass, much more big sagebrush, and less perennial grass than the vegetation before livestock grazing. The addition of cheatgrass caused the flammability and fire hazard to increase (fig. 23).

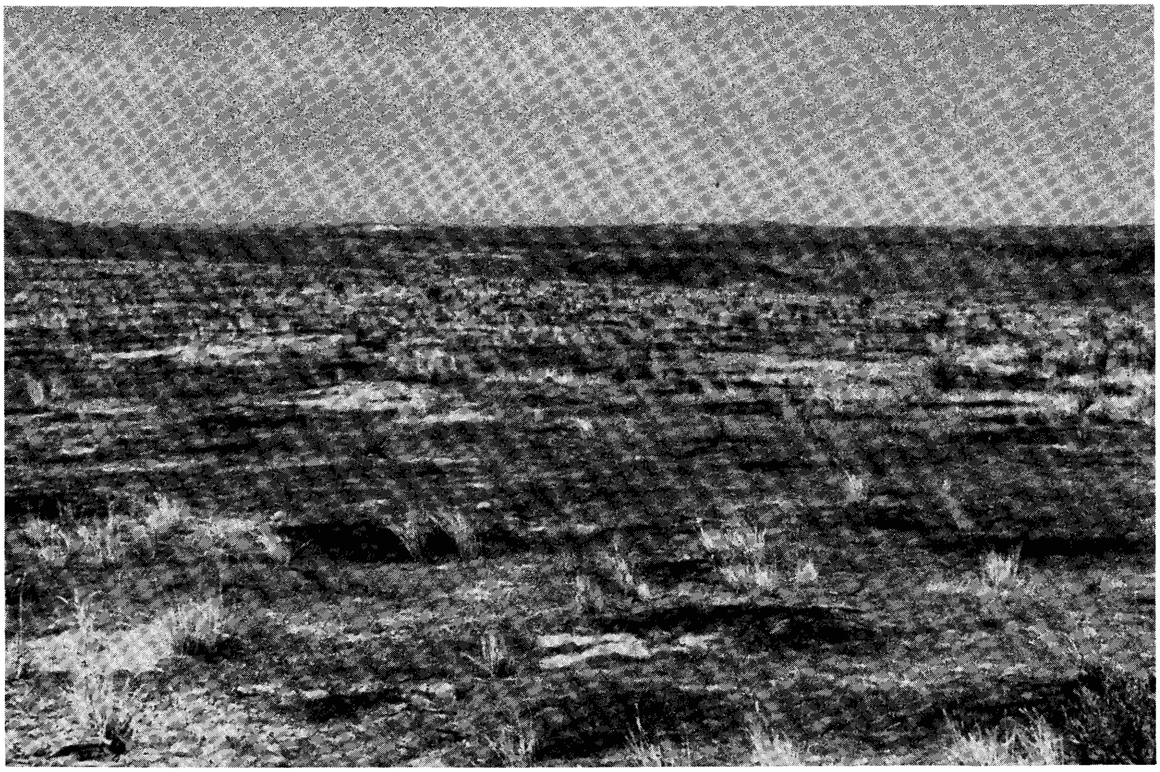

Figure 23.--Top, a fire burned this area in 1975; bottom, the same area in 1976. Crested wheatgrass did not burn as readily as the annual cheatgrass. Apparently cheatgrass and crested wheatgrass survived the fire with little damage.

Where the bunchgrasses are abundant, especially where their density exceeds an average of three plants/yd^2 (3.6 plants/m^2), cheatgrass is reduced or nearly eliminated, thus reducing a major source of fuel for range fires. Big sagebrush alone will burn and so will the bunchgrasses; but fires in vegetation without cheatgrass spread less rapidly and are easier to control. Therefore, fuel management should aim for reduction of cheatgrass and an increase in the perennial grasses with less big sagebrush. This reduction is in harmony with proper range management for other purposes.

Where native perennial bunchgrasses remain, even as scattered as 10 yards (9 m) between plants, proper livestock use will encourage establishment of thick stands which will reduce fire hazards. Where extreme overuse has eliminated perennial grasses, reseeding will be needed.

A well-designed management plan for large areas will have a few strategically placed perennial grass seedings which will allow other areas to rehabilitate through natural succession to perennial grass codominance with big sagebrush. When wildfires occur, any necessary seeding can be done. A wildfire should be viewed as a land treatment or site preparation and as an opportunity for range rehabilitation.

Fuel management aims to make fire suppression more effective than at present and to facilitate other uses. In big sagebrush-grass, fuel management must be coordinated with changes in botanical composition caused by defoliation, grazing, and wildfire. Cheatgrass, a high fire-hazard fuel, is not sufficiently defoliated by grazing animals to reduce the hazard. Cheatgrass can be reduced in most areas through proper grazing management which favors perennials. Fires which reduce big sagebrush also can favor the succession to perennial grass. Big sagebrush and perennial grasses should be managed as fuels and as forage in the integrated system. The pasture, then, is the logical management unit for both as it is already under controlled grazing use. Roads as fuel breaks should be used only where pastures do not make adequate fuel management units.

Ideal management of big sagebrush-perennial grass takes advantage of all alternative types of manipulations and uses. Fuel management affects the vegetation and the uses made of that vegetation. Grazing management, mechanical brush control, spraying, and seeding also affect vegetation *and* fuel management. The original Vale District Program considered fires as catastrophes. A fuel management program would risk perpetuating that attitude if people from all disciplines were not included from the beginning of planning. Fuel management, including the use of prescribed fire, has much to offer as an effective tool for rangeland rehabilitation, especially as a replacement for spraying with herbicides. Ecosystem considerations are essential.

WATER DEVELOPMENTS, FENCES, AND ROADS

Most range rehabilitation operations should include provisions for improvements in livestock management by increasing water, fences, and roads (fig. 24). Roads were difficult to evaluate because much of their utility was neither measured nor described. If an unimproved road existed and was graded, the access improved for only certain types of vehicles, perhaps cattle trucks; yet large areas in the district need no roads for accessibility for some types of vehicles. The permanence of a road constructed in conjunction with a range improvement project varied from quick abandonment after a project to one improved and maintained for general use.

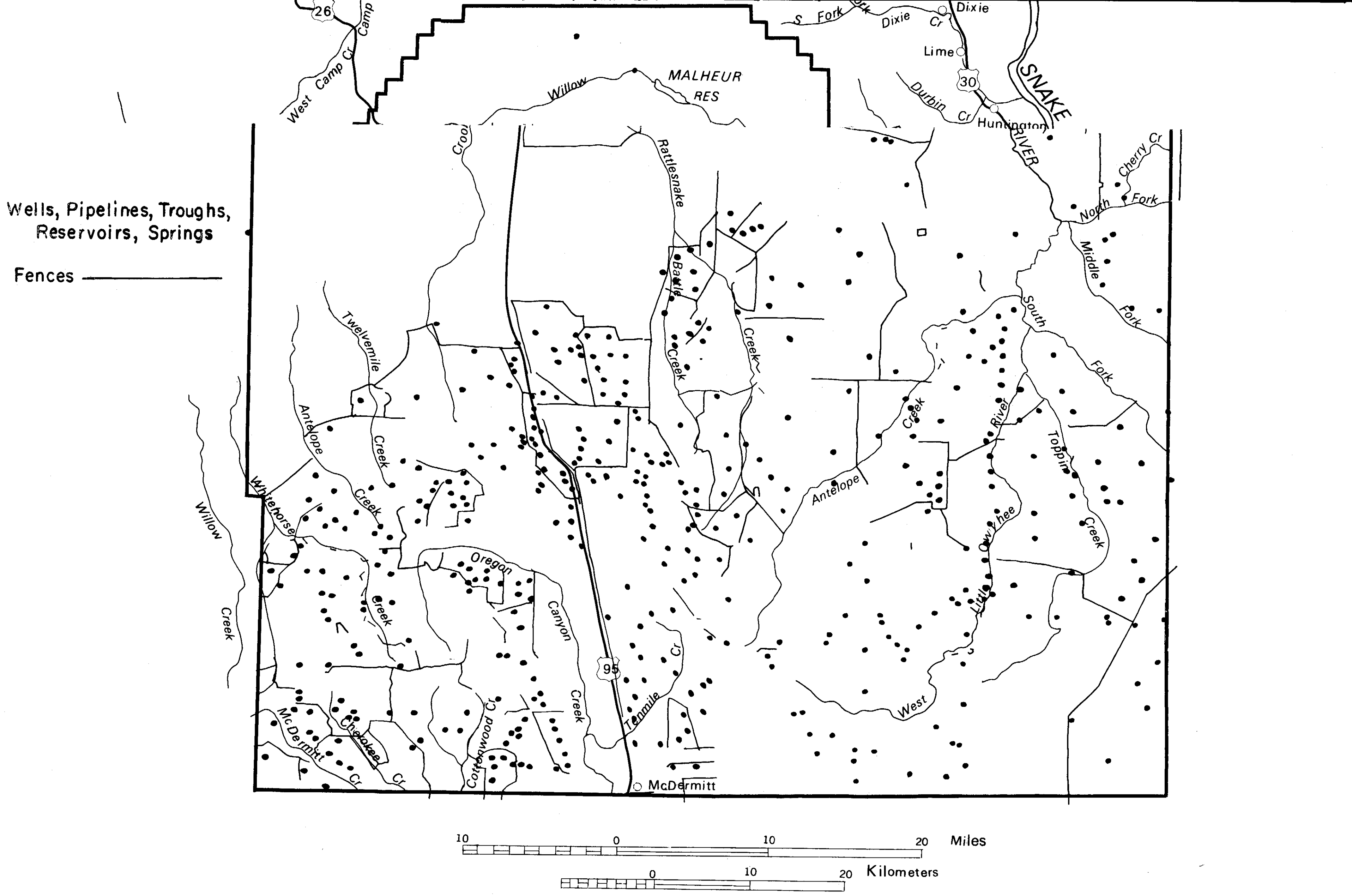

Figure 24.--Fences and water developments as of 1975.

Newly constructed fences and watering points, even though they benefited uses other than livestock grazing, facilitated use of all the rangeland. Seedings required fencing to insure their protection and use as special pastures, and seasonal grazing systems needed pastures. That usually necessitated new watering points. Location of fences depended on the characteristics of the pasture and the needs for animal management. A typical pattern utilized natural barriers and existing fences as outer allotment boundaries and the new fences as cross-fences. Usually, a large crested wheatgrass seeding would be divided in anticipation of an alternating spring turnout grazing system. In this system, a pasture would be grazed first in one year and second the following year. Seldom did the occurrence of free water fit the needs of livestock in these pastures. A total of 2,081 miles (3 348 km) of fences on the Vale District were built by the BLM to standards which allowed antelope passage under the lowest wire. Since 1971, users have maintained the fences. Six hundred miles (960 km) of fence were constructed, largely by ranchers, before the program began.

Two basic types of water development were used. One created reservoirs in suitable locations within pastures (fig. 25). During the course of the Vale Program, 624 such reservoirs were constructed. They had a high probability of failure to hold water for the full grazing seasons. Many were planned as sources of water for spring use of crested wheatgrass turnout pastures. This limited summer and fall use; consequently much effort went into the second type of development--reliable sources of year-round water, specifically wells, pipelines, and troughs. During the Vale Program (table 9), 28 such systems were built. A typical system used a well drilled at a location to produce sufficient water and in a place where gravity feed could be used to supply water to troughs. Propane-powered pumps, maintained by the BLM, kept water in an 18,000-gallon (65 000-liter) tank in each well system. From each centrally located tank, water flowed through buried plastic pipe by gravity to fill individual stockwater troughs. Many such troughs were made from discarded jet engine shipping containers (fig. 26). Spring developments numbered 448 during the Vale Program (table 9). The 2,000 miles (3 200 km) of fence and 1,600 watering points, plus those installed before the program started, fulfilled the original project goal.

ERRORS AND LACK OF COMPLIANCE WITH CONTRACTS

An undertaking with the scope in acreage and treatments of the Vale District Program cannot be without errors. Errors resulted from lack of knowledge, lack of experience, and lack of compliance to job specifications. A discussion of these problems may be useful for other rehabilitation programs.

One benefit was that plowing left patches of brush, irregular borders, and a mosaic of vegetation, because the machinery could not operate on steep slopes and rocky areas. Spraying by air, however, covered the landscape completely. Spraying tended to convert larger and more continuous blocks than plowing. Aerial brush control requires more careful attention to siting and ground flagging than does plowing. Such control was not always accomplished in the Vale Program.

Although contracts were carefully written, they were not always carefully followed. Some examples serve to illustrate the need to have continuous field supervision. Sprayings in a few instances killed big sagebrush in strips because of improper flagging or cheating on the contract. Some sprayings extended over areas that should not have been sprayed. In one instance the seed of intermediate wheatgrass was used when the contract called for crested wheatgrass.

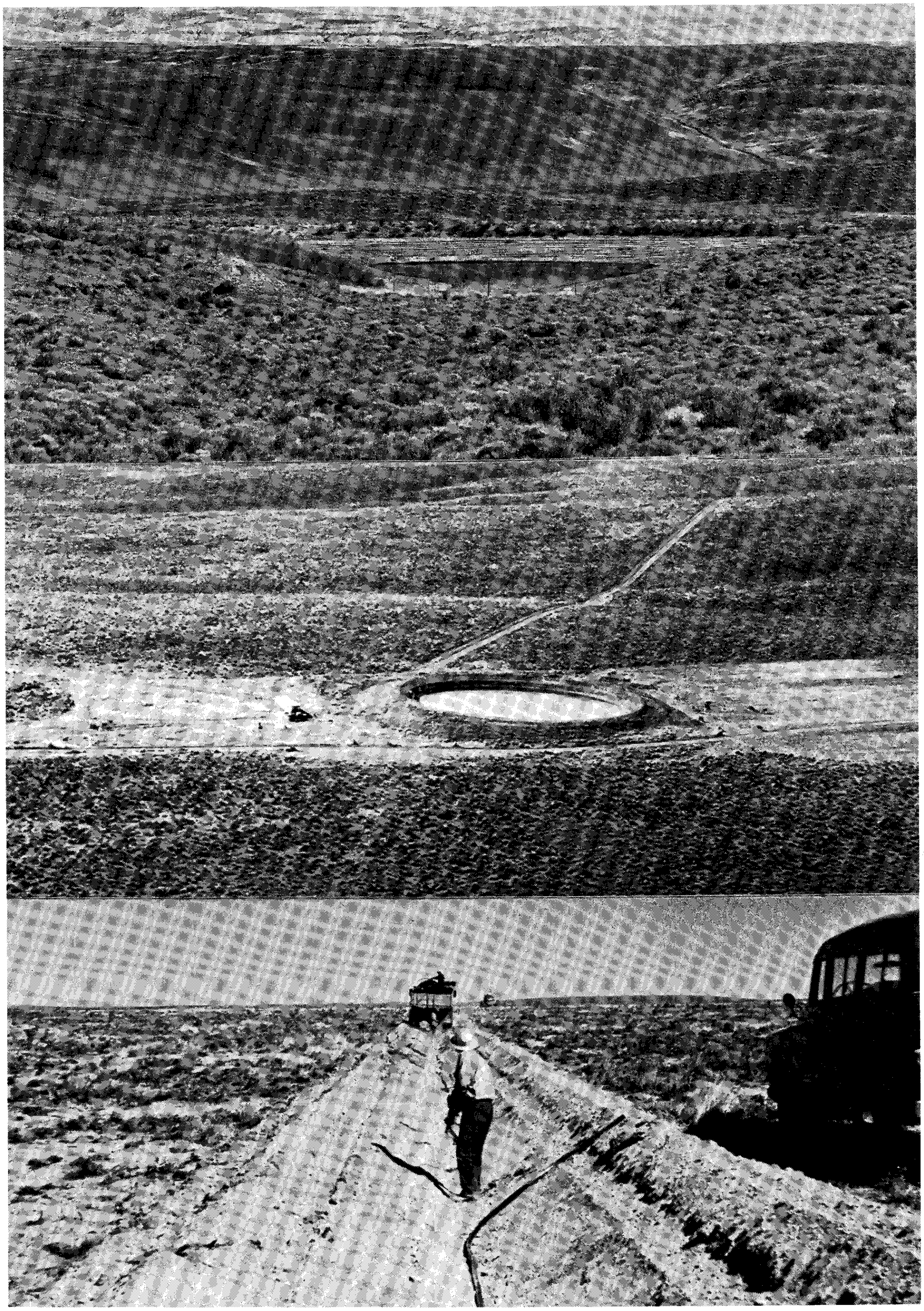

Figure 25.--Commonly, one type of water system starts with a reservoir (top), water piped to a storage tank called a noodle-bowl (middle photo by Bureau of Land Management), and buried pipeline to troughs (bottom photo by Bureau of Land Management).

Table 9--*Wells, pipelines, other water developments, and fences in the Vale District, Bureau of Land Management, 1940-75*[1]

Years	Wells	Pipeline	Reservoirs	Springs	Troughs	Total	Fences
		Miles			Number		Miles
1940-60	12	0.2	413	119	1	533	596.7
1961	0	0	41	8	0	49	87.7
1962	0	21.4	9	11	28	48	108.2
1963	2	12.8	24	17	20	61	80.5
1964	2	--	13	62	--	75	181.0
1965	1	9.0	54	49	13	116	175.9
1966	1	28.7	44	43	35	122	56.2
1967	1	38.4	52	30	39	121	277.3
1968	0	142.0	169	59	152	380	461.3
1969	7	28.6	69	52	44	165	269.8
1970	5	82.5	36	44	85	165	141.1
1971	3	28.6	31	11	39	81	87.3
1972	5	30.6	16	32	41	89	64.0
1973	1	10.9	15	2	11	28	35.6
1974	0	7.7	33	19	11	63	42.8
1975	0	21.7	18	9	20	47	12.6
Total, 1961-75	28	462.9	624	448	538	1,610	2,081.3
District total	40	463.1	1,037	567	539	2,143	2,678.0

1/ 1 mile equals 1.6 kilometers.

Siting and developing of watering points did very well for livestock, but these same developments variously affected wildlife habitats. Before development, many small springs had wet areas, small meadows, and associated fauna that were destroyed when all the water was collected into tanks and troughs. The smaller animals find watering at a trough difficult or impossible. Even though chukar partridge, sagegrouse, and quail can water at properly built troughs, their foods provided by the meadows are gone. Overflow water should be piped to fenced sites to create new meadows. A few of these new meadows in the Vale District have produced larger wildlife sites than the original meadows.

Provision for watering and safety of small animals at livestock watering troughs need imaginative engineering. Few troughs have satisfactory designs for smaller animals. The design of troughs for livestock and the large game animals also needs consideration.

Fence design and construction show few errors. The standards used, a four-strand wire fence with the bottom wire 18 inches (46 cm) and the top strand 42 inches (107 cm) above the ground, allow the free movement of antelope and mule deer. A new fence should be flagged with a white cloth between every post to make it obvious to antelope. Fence surrounding study exclosures should have two additional wires with stiles substituted for gates.

CONTINUED UPKEEP AFTER THE VALE PROGRAM ENDED

The users pay fuel costs to operate the water systems; maintenance of pumps, tanks, troughs, and pipelines is BLM's responsibility. BLM also maintains

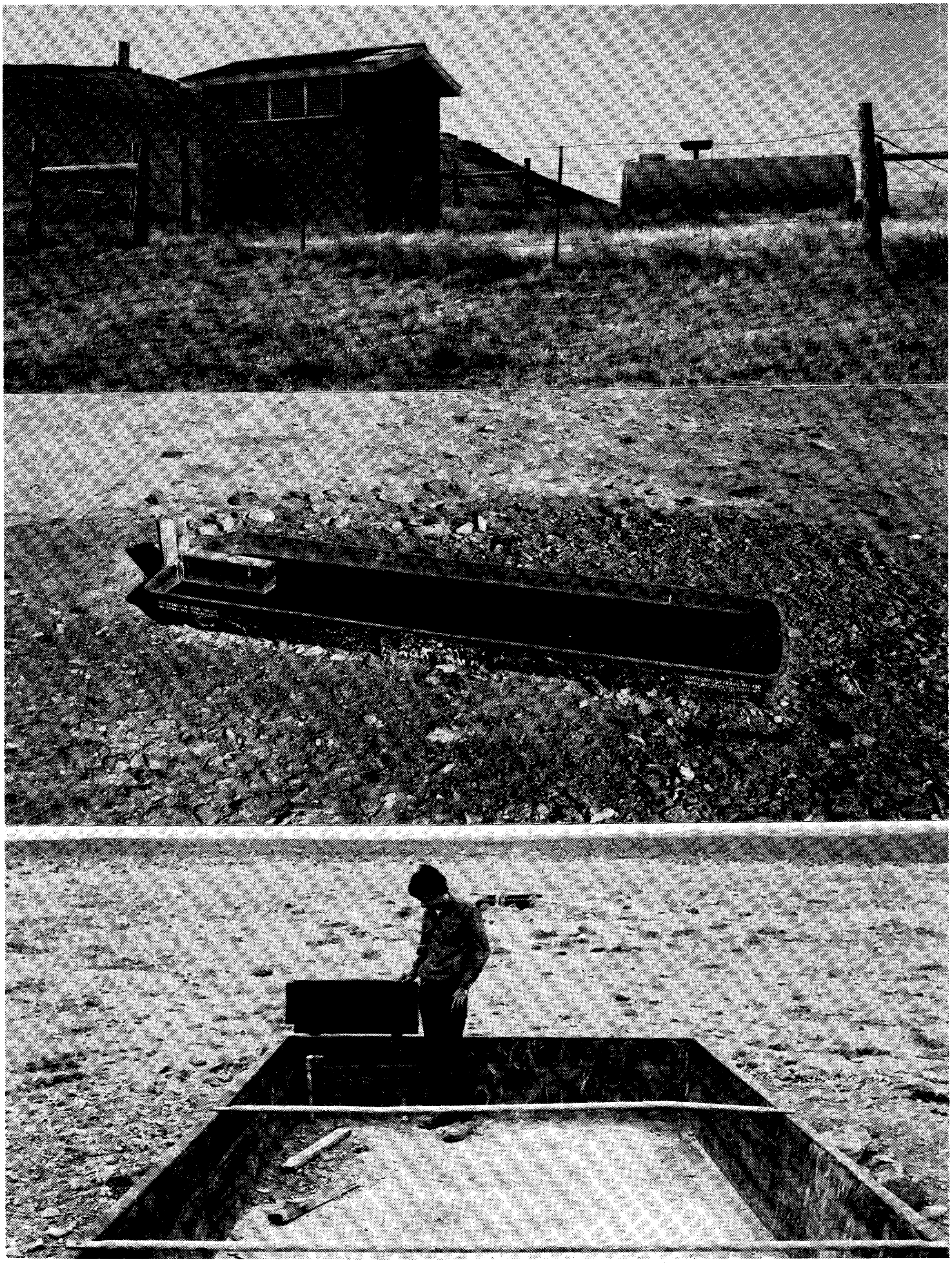

Figure 26.--A second type of water system uses a well and butane-operated pump, a metal storage tank on the hill (top), and pipeline to troughs (middle). The large shallow trough (bottom) stores water and permits cattle to escape if they fall into the trough.

reservoirs and springs on public lands. Maintenance personnel and the permittees continually monitor water supplies; many of the water systems are examined from low-flying aircraft every 2d or 3d day during the grazing season. Much of the maintenance budget is used to keep the water systems operating. Since livestock are critically dependent on water, the systems must be continually monitored. A failure in 1972 resulted in cattle dying of thirst, controversy over responsibilities, and unfavorable publicity.

The permittees maintain fences but BLM replaces them. Fences last many years before they need replacement. BLM repairs the roads. Since 1973, the Vale District has concentrated on maintenance of the facilities developed during the program and continued vegetational improvement, essentially through management of livestock grazing. For the most part, the action has been aimed at the holding of gains, protection from fire, and some rehabilitation after wildfires, rather than new and expanded projects.

The costs of the Vale Program go beyond initial establishment. Maintenance of improvements continues to be expensive. Thus, any cost-benefit evaluation of the program on a long-term basis must include continuing costs. Imperfect data are available for those costs, even for investments in the program itself, because accounting has not separated costs of rehabilitation projects, maintenance, and other operating expenses. Rough estimates of these costs are possible when funding of the Vale District is compared with that of the adjacent Burns BLM District. The largest single annual allocation for range improvement to the Vale District was $1,406,000 in 1965, but funding was over $1 million annually from 1964 to 1968. During that period, the Burns District received approximately $200,000 per year (table 10). The Vale Program formally ended with fiscal year 1973, by which time funding for the district had dropped to $538,875. The budgets for 1974 and 1975 were $503,081 and $530,025, respectively. In contrast the Burns District received only $120,000 for range improvements in fiscal year 1973 and

Table 10--*Estimated costs of the Vale Program, fiscal years 1962-73*

Fiscal year	Range management, soil, and watershed		Base budget for Vale	Program funds for Vale
	Vale District	Burns District		
			$1,000	
1962[1]	107.5	103.2	107.5	0
1963	918.7	149.0	155.0	763.7
1964	1,116.0	195.0	205.0	911.0
1965	1,159.3	241.0	245.0	914.3
1966	1,332.3	283.0	295.0	1,037.3
1967	1,406.9	273.6	285.0	1,121.9
1968	1,369.3	284.0	292.0	1,077.3
1969	1,079.2	209.2	215.0	864.2
1970	1,072.4	224.3	234.0	786.4
1971	794.9	251.1	260.0	534.9
1972	792.5	211.5	208.0	584.5
1973	666.9	200.3	205.0	461.9
Total	11,656.4	2,521.7	2,599.0	9,057.4

Source: Bureau of Land Management State and District Office records.

[1]1962 gives pre-Vale Program funding level and is not included in the total.

$270,000 in 1975. Thus, the difference of $260,000 between Vale and Burns Districts, adjusted downward by 25 percent because of the size difference in the districts, yields an estimate of $195,000 per year in added maintenance costs which must be attributed to the Vale Program. BLM resource lands in the Burns District total 3,500,000 acres (1 400 000 ha) which support 265,000 AUM's; in the Vale District they total 4,600,000 acres (1 860 000 ha) which support 420,000 AUM's.

Grazing Management

PERMITTED GRAZING LOAD

Animal unit months of forage provided on the Vale District are largely the outcome of customary practice. There is little accurate analysis of either the ultimate capacity of the land to produce forage or of the forage-producing capacity of dependent property. Before 1934, unfenced public domain was free to anyone who ran livestock. After the passage of the Taylor Grazing Act, a user of the public domain had to establish a right to obtain a permit and to pay for the grazing use. Two categories of permits were established by the act. Class I permits for a certain number of AUM's depended on use of the public lands during the 5 previous years, and the number of animals which could be supported by local private property for 5 winter months. Class II permits were to be granted after all Class I permits had been filled. Class II permits required the independent private property commensurability but did not require the establishment of prior use on public land. In 1934 there was no way of knowing how much actual forage could be provided by the public domain; thus, all Class I and most of the Class II applications were granted. In the beginning, the Vale District provided the amount of forage to permittees with commensurate property that they had historically used. It took 2 years for all permits to be issued; therefore, permitted numbers increased from 146,193 AU's in 1935 to 122,322 AU's in 1936 (table 11).

Forage provided in AUM's increased from 255,900 in 1935 to 412,618 in 1936 and continued to increase, reaching a maximum of 504,024 in 1955. The peak in 1955 was approximately a 20-percent increase from the late 1930's. As described earlier in this report, the advisory board on the Vale District in effect regulated permitted animal numbers until the late 1950's. At that time, the BLM won a series of battles with livestock users and began to assert control over livestock use on the Vale District and elsewhere. Range surveys conducted during the 1950's showed that the range was overobligated to the point that proper use of some areas on the Vale District would require 50-percent cuts in permitted use. To avoid this reduction by restoring forage production was the principal motive for the Vale Program.

The first districtwide estimated grazing capacity, 285,000 AUM's, was made in 1961. In that year, 427,476 AUM's were licensed (table 12). Cattle and horses consumed 96 percent of the forage, sheep only 4 percent.

As the Vale Program developed, grazing capacity increased. Within the separate projects, the permittees took temporary nonuse in lieu of a permanent reduction of permitted grazing and the promise that temporary nonuse would be restored. Estimated grazing capacity for the district as a whole first exceeded actual use in 1972 (table 12).

Although these data are the best available, they can be misleading. First, as mentioned above, demanded forage or permitted numbers stem from the historical

Table 11--*Licensed numbers of animal unit months of grazing and animal units, Vale District, Bureau of Land Management, 1935-75*

Year	Animal unit months	Animal units
1935	255,900	146,193
1936	412,618	122,322
1937	346,980	114,113
1938	457,360	111,972
1939	424,231	106,662
1940	418,594	90,638
1941	424,070	90,446
1942	406,649	110,091
1943	414,718	108,595
1944	399,903	109,110
1945	442,454	113,070
1946	468,121	117,678
1947	459,751	105,891
1948	489,718	122,717
1949	458,294	121,032
1950	448,895	118,854
1951	484,800	107,439
1952	458,124	102,969
1953	468,728	110,416
1954	467,111	108,474
1955	504,024	111,695
1956	491,311	114,249
1957	483,539	181,673
1958	489,971	107,708
1959	415,737	1/ 88,811
1960	439,013	100,920
1961	427,476	98,559
1962	400,663	92,743
1963	399,386	86,435
1964	409,726	85,676
1965	411,285	87,024
1966	419,567	88,166
1967	392,481	75,698
1968	422,414	80,910
1969	426,024	83,829
1970	407,152	1/ 72,805
1971	418,010	72,676
1972	416,248	77,640
1973	417,207	75,504
1974	432,394	77,493
1975	415,383	75,868

1/ The drops in licensed use resulted from Vale District boundary changes.

granting of permits which was largely determined through negotiations and not by measurement of the capacity of the land. Thus, increased grazing capacity from 1961 to 1974 signifies that the rangeland now has the capacity to produce what has been used throughout that period. Area range conservationists provided the grazing capacity data in table 12, and they based the estimates on impressions of overuse and underuse. No planned grazing capacity surveys were made.

Second, district data mask variations. Forage beyond that being used exists in the southern part of the district while parts of the northern resource area received heavy use each year. Therefore, former cuts in Class I permitted numbers are being restored in the south but not in the north. Some range users are still

Table 12--*Licensed grazing use by livestock and estimated grazing capacity in the Vale District, Bureau of Land Management*

Year and class of livestock[1/]	Licensed numbers	Licensed AUM's of use	Estimated grazing capacity, available AUM's
1961:			
Cattle and horses	89,624	409,691	
Sheep	44,679	17,785	
Total	134,303	427,476	285,000
1962:			
Cattle and horses	81,461	2/	
Sheep	56,409	2/	
Total	137,870	400,663	343,000
1963:			
Cattle and horses	79,963	389,306	
Sheep	32,518	10,080	
Total	112,481	399,386	285,000
1964:			
Cattle and horses	79,016	399,211	
Sheep	33,301	10,515	
Total	112,317	409,726	300,000
1965:			
Cattle and horses	78,456	401,201	
Sheep	42,841	10,084	
Total	121,297	411,285	350,000
1966:			
Cattle and horses	82,061	410,316	
Sheep	30,525	9,251	
Total	113,586	419,567	300,000
1967:			
Cattle and horses	68,332	384,895	
Sheep	36,828	7,586	
Total	105,160	392,481	331,000
1968:			
Cattle and horses	75,160	417,180	
Sheep	28,748	5,234	
Total	103,908	422,414	340,000
1969:			
Cattle and horses	79,584	419,237	
Sheep	21,225	6,787	
Total	100,809	426,024	373,000
1970:			
Cattle and horses	67,904	400,858	
Sheep	24,505	6,294	
Total	92,409	407,152	383,000
1971:			
Cattle and horses	67,646	411,729	
Sheep	25,050	6,281	
Total	92,696	418,010	414,000
1972:			
Cattle and horses	74,160	411,374	
Sheep	17,400	4,874	
Total	91,560	416,248	419,000
1973:			
Cattle and horses	73,264	413,361	
Sheep	11,200	3,846	
Total	84,464	417,207	423,000
1974:			
Cattle and horses	75,893	429,623	
Sheep	8,000	2,771	
Total	83,893	432,394	435,000
1975:			
Cattle and horses	74,388	411,873	
Sheep	7,400	3,510	
Total	81,788	415,383	438,000

1/ Excludes wild horses.

2/ Data not available.

operating under reductions in Class I permits while others are not able to use all the forage produced.

Many reasons exist for the differences, including less rainfall in the north, a longer history of rangeland abuse, allotment herds composed of mixed dairy and beef animals, common use allotments with animals from several owners, failures in cooperative management by numerous permittees with few animal units, frequent changes in permittees, and a more complicated mixture of landownerships in the north than in the south. Individuals find herd improvements difficult to attain, and the group allotments remain difficult to manage. Allotments with large pastures, however, require less fencing, fewer water developments, and are easier to administer than small areas. Some reallocation of grazing has been done, but redistributing grazing use to fit available forage remains one of the critical problems facing Vale BLM administration.

SEASON OF GRAZING USE

Most of the Vale District is generally considered spring range. Water and green forage are then abundantly available and animals put on the best gains. Wildlife, however, use rangeland at all seasons, and livestock can use it whenever weather permits (fig. 27 shows actual use). Few areas are used yearlong. Areas well supplied with palatable browse, especially the desert shrub type, are used in the winter by livestock. The area of sagebrush-grass, which encompasses most of the public lands, is used in spring, summer, and fall. The typical permitted grazing season on Federal lands is 7 months long, April through October. Within that grazing season, the grazing period in any pasture follows a particular management system. For example, many areas are not grazed in the fall to preserve browse for wintering wildlife. Lack of water restricts use to spring and early summer. In other places elevation restricts fall use, and convenience to the home ranch results in repeated seasonal use of a few pastures.

GRAZING SYSTEMS

Within the season of grazing use--that time during which grazing is feasible--animals often graze different pastures. The grazing period is defined as the time when livestock actually graze a pasture. It may be as long as the grazing season, or it may be considerably shorter. The pattern of grazing one to several pastures within the grazing season constitutes a seasonal grazing system. The term "grazing system" implies many possible combinations of grazing periods during which grazing is systematically regulated and controlled. Grazing systems require an organized framework for understanding. Table 13 shows the wide variety of seasonal grazing treatments practiced with 144 pastures in 29 systems. The Vale District has many more pastures and systems not formalized in allotment management plans.

The simplest grazing system keeps the animals in one pasture throughout the grazing season. This season-long use has been the historic pattern of livestock use on public lands in the West and continues on many areas today. Much overuse and range deterioration have been blamed on season-long grazing with little thought being given to other faulty range management practices. Thus, efforts toward improvement of range livestock management have usually started with elimination of season-long grazing. The initiation of an allotment management

Table 13--*Number of pastures for 29 grazing systems by type of management and season of use, Vale District, Bureau of Land Management*

Type of seasonal use	Native	Seeded	Total
Summary of 29 grazing systems:			
Number of pastures[1/]	105	39	144
Turnout to 6 weeks into season (about Apr. 1 to May 15)	63	39	102
Spring until seed ripening (about May 15 to July 15)	89	31	110
After seed ripening, deferred (about July 15 to Sept. 1)	75	24	99
Fall (about Sept. 1 to Oct. 31)	59	21	80
Winter (Nov. to March)	4	0	4
Rest (no grazing in a year)	40	5	45
2 consecutive years of rest	6	3	9
Pastures with repeated seasonal use, no rotation at any season:			
Number of pastures[1/]	9	6	15
Turnout to 6 weeks into season (about Apr. 1 to May 15)	4	6	10
Spring until seed ripening (about May 15 to July 15)	1	0	1
After seed ripening, deferred (about July 15 to Sept. 1)	1	4	5
Fall (about Sept. 1 to Oct. 31)	2	4	6
Winter	1	0	1
Pastures with repeated seasonal use in at least one season, rotation in some other season:			
Number of pastures[1/]	27	20	47
Turnout to 6 weeks into season (about Apr. 1 to May 15)	0	0	0
Spring until seed ripening (about May 15 to July 15)	0	0	0
After seed ripening, deferred (about July 15 to Sept. 1)	27	20	47
Fall (about Sept. 1 to Oct. 31)	20	4	24
Winter	0	0	0
Pastures with rotation of seasonal use	96	33	129
Pastures with "switchback"[2/] system of turnout on crested wheatgrass and deferment of native range (two grazing systems with 11 pastures)	7	4	11
Pastures with crested wheatgrass treated the same as adjacent native range (seven grazing systems with 45 pastures)	24	21	45

[1/] Not a total of seasonal treatments because some pastures are used more than once.

[2/] Alternating forest grazing among two pastures in succeeding years.

by BLM in recent years has been almost synonymous with the establishment of some kind of grazing system other than season-long grazing. Yearlong grazing is not practiced on Vale District lands.

Repeated seasonal grazing describes use that occurs at the same season each year. On the Vale District, repeated seasonal grazing may be spring, late spring, after seed ripening, fall, winter, or some combination of these times. About 15 percent of the pastures studied received only repeated seasonal grazing.

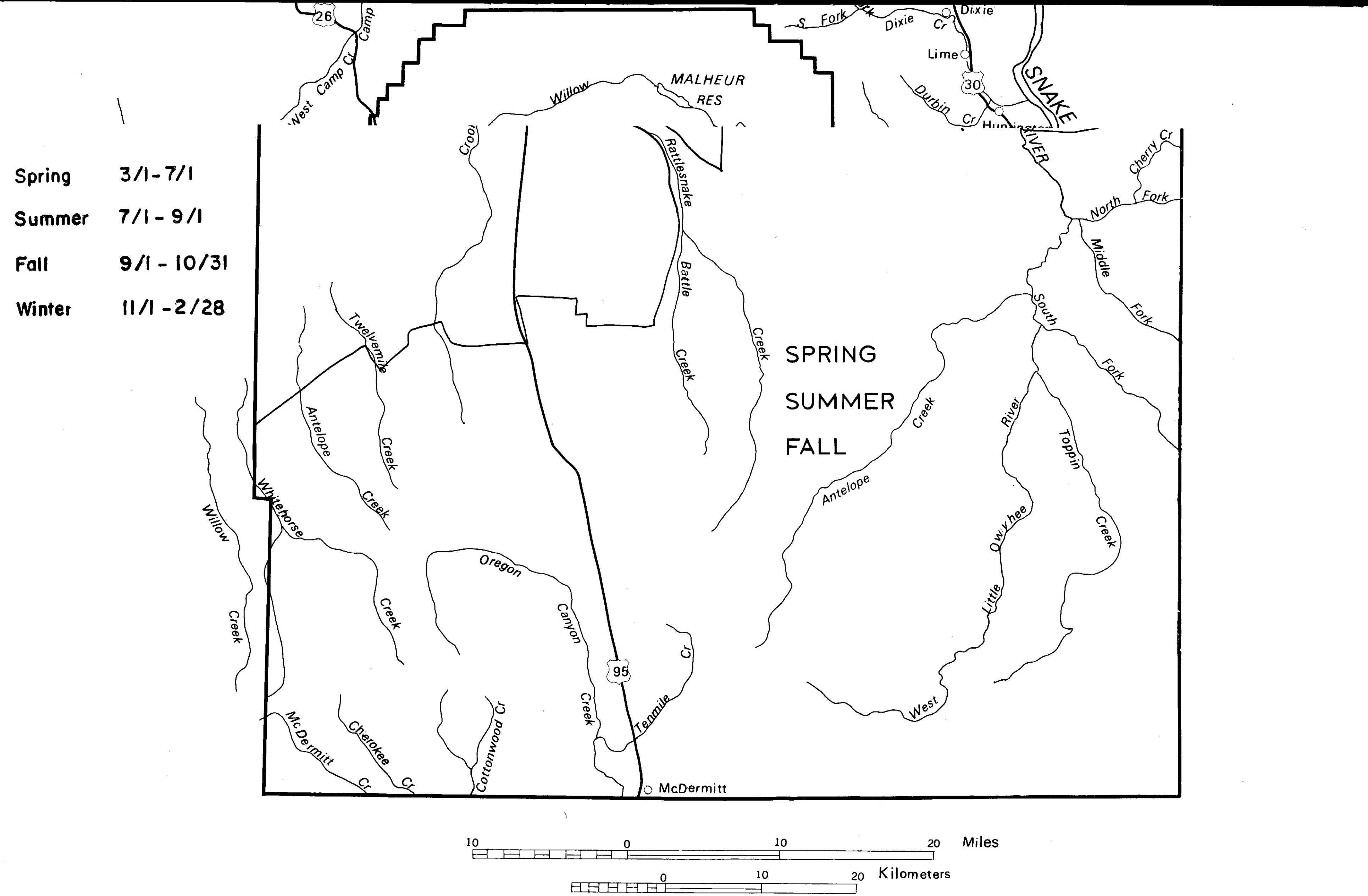

Figure 27.--Seasons of use.

Nine were native range and six were crested wheatgrass. Of the 15 pastures so grazed, 8 received repeated grazing at more than one time each year (table 13). Reasons for repeated seasonal grazing included adequate stock water only in the spring season, crested wheatgrass grazed early to defer native range, need to facilitate animal husbandry practices, and proximity to the home ranch. Repeated fall grazing reduced trailing and permitted gathering of animals before winter storms. In a few instances early fall removal preserved bitterbrush for wildlife. An additional 47 pastures received repeated grazing after seed ripening as well as some form of rotational grazing before seed ripening. None of these pastures failed to improve in range condition during the program.

The third main category of grazing systems involved rotation of seasonal grazing--the modification of the pattern of grazing in succeeding years (fig. 28). Patterns took a wide variety of designs with all seven seasonal periods of grazing rotated in innumerable combinations (table 13). Rotational grazing is said to avoid damage to vegetation caused by repeated grazing at the same time each year. We found the pastures grazed in the same season every year to be in as good range condition as those grazed on a rotational basis. The systems aim to improve range conditions by fostering seedling establishment of desirable species. Rotational systems will not be described in all combinations but a typical example would be a native range allotment which is divided into several pastures. A different pasture would not be grazed until after seed ripening each year. Another system would begin with grazing on a pair of crested wheatgrass pastures, which would be followed by a rotation on native ranges. The crested wheatgrass pastures would be alternated in consecutive years. This system delays turnout onto native ranges and rotates early use of the seeded pastures. Rotational grazing was practiced on 129 pastures.

Allotment management plans early in the program established deferred-rotational systems on native range. Many of these systems have changed. At the inception of the Vale Program it was envisioned that crested wheatgrass seedings would primarily serve for deferment of native ranges. Turnout onto crested wheatgrass every spring, with a switchback between two pastures in alternate years, would permit late spring use of native range. In 1975 that arrangement persisted in only 2 of 29 sampled allotments. Although all crested wheatgrass seedings are still used for turnout, at least in some years, most are treated like native bunchgrass range. Twenty-one of 39 seeded pastures were managed identically to adjacent native range. Another recent modification involves the use of identical treatments for 2 years rather than 1 in the rotational cycle. Resting, or no grazing at all, for 2 consecutive years occurred on nine pastures, six native and three seeded, about 6 percent of the pastures in our sample. The most notable change in seasonal grazing practice has been the tendency to use the seedings and the native ranges in the same manner.

All grazing systems provide for flexibility in dates of grazing and numbers of animals to deal with variability in water supply, forage quantity, and inclement weather. Large variations from the written plans indicate day-to-day decisionmaking in the grazing of the national resource lands, as should be the case. A few plans which include large proportions of private land in mixture with public land give the users responsibility for management of animals, and the BLM range conservationist serves only in an advisory capacity. This arrangement encourages user responsibility for the range and it should be encouraged as the range improves.

The grazing systems originally established aimed to protect and use the crested wheatgrass seedings, to rehabilitate the native ranges, and to preserve browse for wildlife. For those objectives yearlong rest and little early grazing on the native

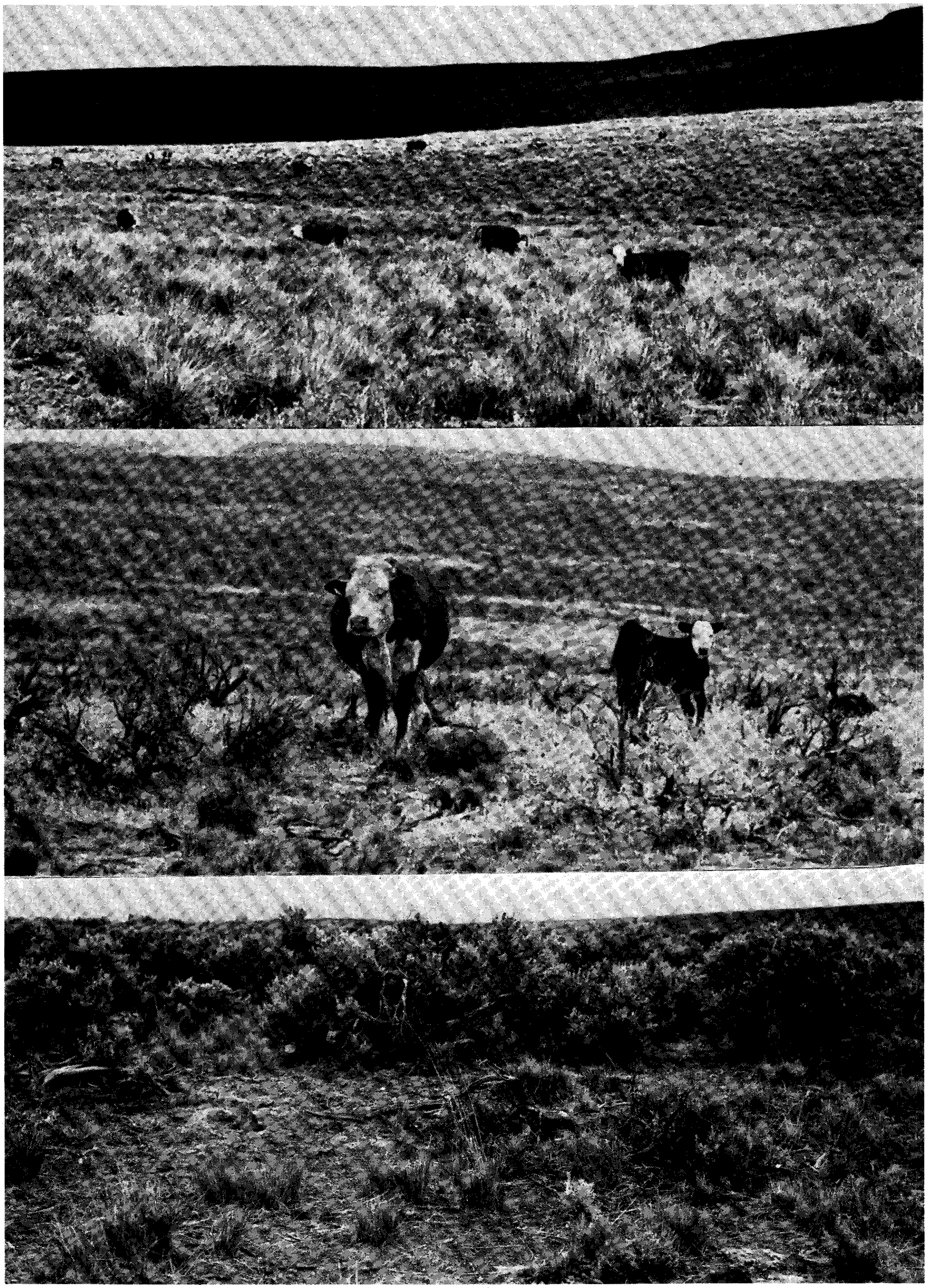

Figure 28.--Top, cattle entering a stand of bluebunch wheatgrass (big sagebrush reduced by spraying) about June 20. The middle photo shows proper use of bluebunch wheatgrass in June without big sagebrush, and bottom, with big sagebrush.

bunchgrass were effective practices. Many ranges are now in good to excellent condition and the permittees have learned to manage the vegetation as well as the livestock. Some of the seasonal plans could be improved. We see little need and some disadvantage in yearlong resting of pastures with good to excellent stands of bluebunch wheatgrass. The bunches accumulate dead material in their centers, causing increased fire hazard and less vigor in the plant.

Some grazing each year in the mature bunches promotes greater vigor than no grazing at all. Deferred and rotational treatments must be maintained. Season-long use should be included in some systems. This is the most flexible method of livestock use, involves a minimum disruption of livestock, takes less labor, reduces animal diseases related to crowding, and allows animals to exercise natural selectivity of forage. With proper regulation of animal distribution and numbers, season-long use of ranges in good to excellent condition can be a highly satisfactory grazing treatment. The time has arrived to take a new look at seasonal grazing systems on the basis that the ones needed for rehabilitation are not necessarily the best, especially not for using excellent condition range.

CONTROL OF ANIMAL DISTRIBUTION AND MANAGEMENT

Any effective modification of forage production must include provisions for control of animal numbers and distribution. Improvements such as fences, gates, roads, and water furnish the attractions and boundaries needed to control animal distribution.

Water controls animal distribution more than fencing but both could have been used more effectively in the Vale Program. A few pipelines terminate in troughs located near the bottoms of drainages, where livestock naturally congregate. Perhaps these locations were selected by compromise between engineering and managerial requirements. Not only must the systems function for entire grazing systems; they must be continually maintained, at a substantial cost. In 1975, maintenance of the district's water systems required 15 full-time employees. Maintenance of water has been critical for livestock survival. Minimized installation costs and engineering considerations led to high maintenance costs in a few instances.

Water, to the ranchers, was the first priority for development. Lack of water on large land tracts in the districts had prevented grazing abuse, and abundant forage was going unused. The ranchers argued that more drinking water would make use of that feed possible.

The BLM rightly resisted development of water without an overall plan which included the needs for protection and encouragement of wildlife as well as the use of all feasible range management practices. Livestock water also improves wildlife habitat, particularly around fenced reservoirs, and even provides new wildlife habitat. Where livestock are uncontrolled, water developments can be ineffective for wildlife. Overall, the water systems on the district operate with high efficiency as managerial devices.

Supplementary feeds other than minerals are not allowed on Vale District lands, and none are needed. Uneven use of salt and mineral supplements results in poorer than expected distributional control of livestock. Often salt blocks are dropped near water, along roads, and in other undesirable locations. Allotment management plans need to specify appropriate locations for placement of salt.

Ranchers, for the most part, practice herding of animals for animal husbandry requirements. Unfenced seedings that did not have protective boundaries and fire rehabilitation areas within large pastures required herding to prevent concentration of livestock. Riders have been cooperatively employed between the Advisory Board and BLM to keep animals out of such areas. Herding is an expensive and necessary measure for proper range management. Herding does not substitute for the lack of properly placed fences and watering points. Several allotment management plans specify that a rider be used to influence animal movement where natural drift does not achieve desired grazing use. Any system for the control of animal distribution must also allow for flexibility in order to accommodate animal husbandry requirements.

MONITORING OF GRAZING

A management plan, no matter how sophisticated, cannot function properly for long periods without continual checks for compliance. BLM grazing policies and allotment management plans require monitoring even with stated acceptance by the user. Plans or policies may not be followed automatically, especially where memories of historic conflicts still exist.

Monitoring of livestock numbers and movement of animals from one pasture to another are a time-consuming but necessary part of the BLM managerial role. Thinly available manpower requires that most of the control rest with the users. Several management plans require that the user (1) limit livestock numbers and season of use to those specified in the written plan, and (2) submit certification of actual use at the close of the season. Ideally, this should be the method on all allotments as it fosters user responsibility.

Table 14 lists the number of formal trespass actions by year between 1961 and 1976. No trespass at all existed prior to 1934; the public range was free to all. Lack of data from 1934 to 1961 prevents evaluation of trespassing during that period. The increase in number of court cases to a maximum in 1966 resulted from increased surveillance. Afterwards, compliance with stocking rate restrictions improved and the cases declined.

Table 14--*Number of livestock trespass cases in the Vale District, Bureau of Land Management, by fiscal year*

Year	Trespassing cases	Year	Trespassing cases
1961	35	1969	32
1962	41	1970	24
1963	47	1971	18
1964	47	1972	8
1965	66	1973	16
1966	81	1974	5
1967	38	1975	18
1968	42	1976	32

Proof in animal trespass requires two witnessed observations and counts of the same animals at different times. Even so, trespass is extremely difficult to prove in common use allotments where ownership of animals can change. In a sample of 22 cases, each involved an average of 75 cattle or 13 horses and only one action implicated more than 135 head.

To ease administration of the monitoring program, the BLM started an ear-tagging procedure in 1975. Tags were issued for only the permitted number of animals. Licensees objected because of the added cost of labor to the tags.

Monitoring of grazing systems enforces regulations on animal movements between pastures and the length of time animals spend in the various pastures. Typically, BLM personnel observe compliance with animal movement dates by checking opening and closing of gates. A small number of trespass cases were due to grazing on areas which should have been either deferred or rested. Our observations during the course of field studies and the data in table 14 suggest that compliance was good over the district as a whole. Noncompliance was more likely to be caused by difficulty in gathering every animal from rugged terrain rather than from deliberate noncompliance with grazing schedules.

Small but important enclosed areas on the Vale District were built for scientific studies, plot tests, protection of riparian vegetation, protection of reservoirs, and for wildlife habitat. Evidence of trespass animals was occasionally observed in these enclosures. Although the probable impact on the vegetation was not great. The high and specific values of these enclosures make any grazing in them intolerable.

Vegetational Condition in 1975

METHODS

The methods of vegetational sampling used in this study provide information on the results of the Vale Program, and they also suggest a need for more efficient and accurate sampling of range vegetation than has been accomplished in the past by the district. The parameters measured were density of selected species and percentage of botanical composition by foliage cover. Time restraints limited the sampling methods to those which yielded data rapidly. Large representative sections within each project area and in adjacent untreated brushland were selected as the general locations of the samples. Of the 164 projects listed in table 6, 153 were sampled. Many rehabilitation projects resulted in relatively uniform vegetation with adjacent untreated brush stands relatively homogeneous in density and cover. Therefore, a single or a few large samples were taken in each project, placing the emphasis on variable results among projects rather than within them.

Major species in paced belt transects, each 18 inches wide and 200 yards long (46 cm by 183 cm), were tallied to obtain densities. A hand carried T-shaped sampling fork established the transect width. Plants with more than 50 percent of their base within the belt were tallied on hand counters. Infrequent species were tallied directly. Only major categories of brush and desirable grasses were included in this type of sample. The recorded grasses included as desirable were crested wheatgrass, bluebunch wheatgrass, basin wildrye, Idaho fescue, Thurber's needlegrass, and Indian ricegrass but not Sandberg bluegrass, squirreltail, and cheatgrass. Coefficient of variation among transects was about 50 percent.

After completion of the transects, the surveyor estimated botanical composition on a basis of foliage cover. His notations at each site included the presence of seedlings, dead plants, erosion, grazing use, and other characteristics. Many sites were photographed. Thus, counts and reconnaissance evaluations provided the data for vegetational analysis.

In June of 1976, 50 sagebrush plants were collected in each of six project areas to determine age through ring counts, density on the ground, and size of plants.

UNTREATED AREAS

Sampling of adjacent treated and untreated areas provided data for comparisons and evaluations of projects. Results from the untreated areas do not apply to the Vale District as a whole but only to those sites which have undergone brush control, seeding, and fire. Projects were concentrated in the big sagebrush-grass vegetational type so all untreated samples came from that one type.

Overall vegetational composition of untreated rangeland is related to elevation and rainfall. Since these two factors correlate on the Vale District, rainfall will serve as the basis for comparison. Samples from 65 untreated sites were divided into 4 rainfall categories, 6-8, 8-10, 10-12, and 12-14 inches (152-203, 203-254, 254-305, 305-357 mm) of annual precipitation with 5, 27, 28, and 5 samples per category, respectively.

Brush density averaged 1.05 plants/yd^2 (1.25 plants/m^2) (fig. 29). Big sagebrush remained consistent and rabbitbrush increased in density with increased rainfall. Lack of significant correlation between brush density and desirable grass density fails to show a consistent relationship. This suggests that the density of brush does not determine density of grass, but instead, that the grass is related to rainfall (fig. 30).

Density of desirable grasses was greater at higher rainfall (and elevation) than at lower rainfalls (fig. 29). In areas with annual rainfall of less than 8 inches (203 mm), the desirable grasses were almost entirely bluebunch wheatgrass. At 8-10 inches (203-254 mm), bluebunch wheatgrass still dominated but the stand included basin wildrye on low lying areas. Idaho fescue and needlegrass were present in significant numbers above 12 inches (305 mm) of rainfall. Bluebunch wheatgrass was the most common desirable grass at all rainfall categories.

When related to precipitation, brush species showed the same trends in relative percent species composition as they did in density; big sagebrush remained constant at 50 percent of the stand, and rabbitbrush became more important as rainfall increased (fig. 31). Rabbit brush formed less than 1 percent of the vegetation in areas with rainfall of less than 10 inches (254 mm), and about 5 percent with more than 10 inches (254 mm). Bitterbrush, present in areas with more than 12 inches (305 mm) of precipitation, never exceeded 1 percent of the cover. Relative percent of brush cover declined with increased precipitation.

Desirable grasses, when analyzed, revealed the same trends for relative cover as they did for density (fig. 32). Cheatgrass decreased in importance as rainfall increased, squirreltail followed the same trend as bluebunch wheatgrass, and Sandberg bluegrass reached its greatest percentage of the stand at middle amounts of rainfall. Annual forbs in the season sampled averaged 1 percent or less of the cover for all rainfall groups.

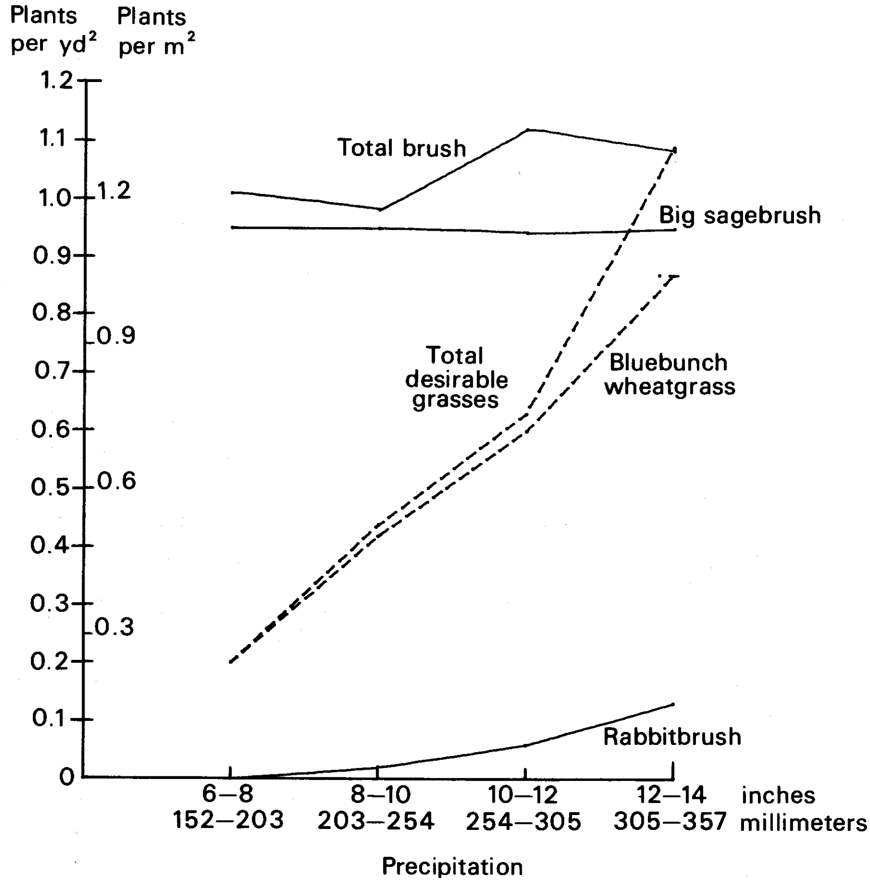

Figure 29.--Density of brush and grasses on 65 untreated areas in 1975 in relation to mean annual precipitation.

Estimates of percentage species composition provided a basis for comparison with step-point data taken prior to treatment in the 1963-68 period. Interpretation of the differences directly pertains to plant succession and range trend. Plant groups compared include big sagebrush, rabbitbrush, bitterbrush, total brush, bluebunch wheatgrass, desirable grasses, squirreltail, Sandberg bluegrass, cheatgrass, and annual forbs. Interpretations must be evaluated in the context that different sampling methods were used. Seasonal and yearly variability also undoubtedly contributed to the differences, especially where cheatgrass and annual forbs formed a significant part of the vegetative cover (fig. 33).

Samples in the years 1963 to 1968 contained more cheatgrass and annual forbs than those in 1975. This may be either improvement in the range condition or yearly variability. On the other hand, the increased percentage of brush and desirable grass in 1975 may indicate a real decrease in percentage of annual grasses and forbs. Changes in composition within the group of perennial grasses,

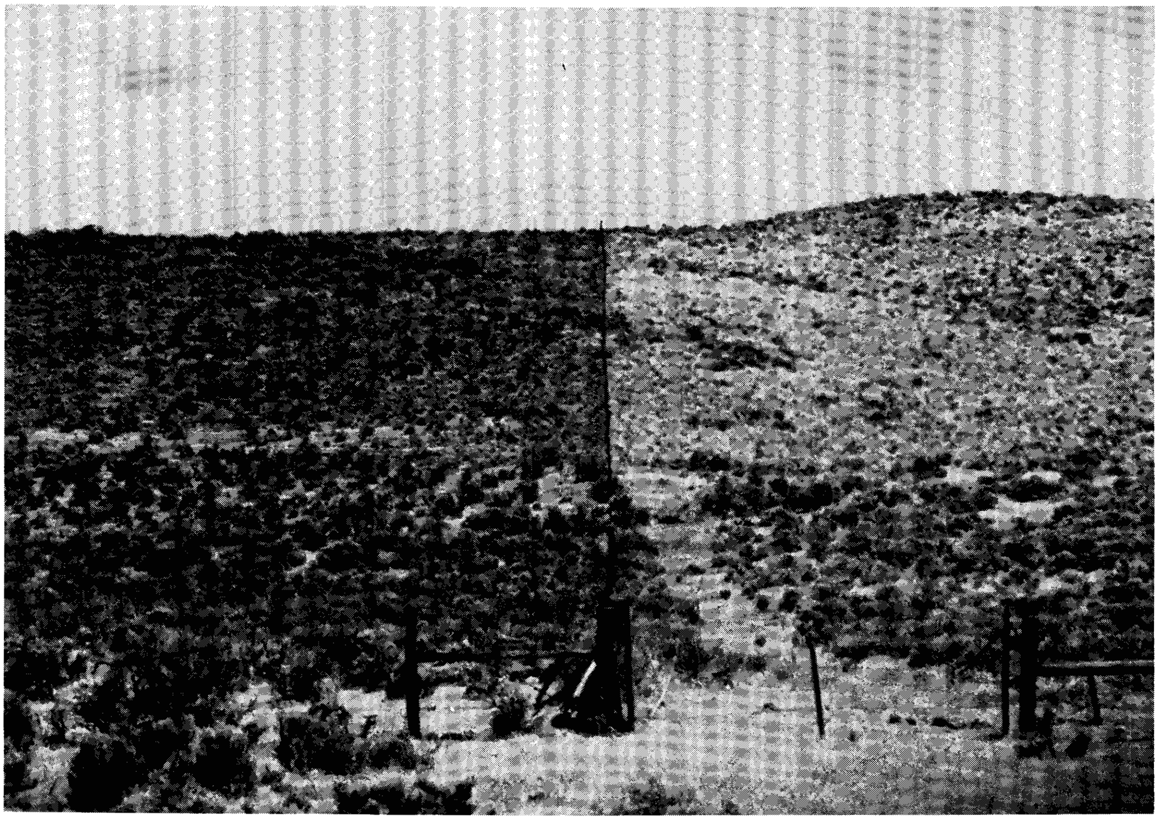

Figure 30.--Neither the monoculture of the big sagebrush on the left nor the sagebrush-bluebunch wheatgrass mixture on the right received a brush control treatment. The differences in botanical composition are due to livestock management.

28 percent of the vegetation, suggest that range improvement has occurred. The small increase from 8.5 percent desirable grasses in 1963-68 to 11.1 percent in 1975 masks important changes (fig. 34). Bluebunch wheatgrass increased from 8.1 to 10.2 percent and squirreltail from 3.5 to 6.9 percent, whereas Sandberg bluegrass decreased from 16.1 to 9.7 percent.

These modest changes in percentages portray significant ecological effects. The taller grasses now occupy more space between the sagebrush plants than they did in 1963-68, hence there is less room for Sandberg bluegrass and cheatgrass. These results substantiate the description given earlier for the climax vegetation and, in fact, contribute to that description.

An additional point needs emphasis. Little ongoing increase in the density of bluebunch wheatgrass was actually observed. Sampling disclosed few seedlings of this species. Perhaps none were needed to maintain many of the stands because the bluebunch wheatgrass plants on grazed untreated areas were growing vigorously with no dead plants and few dead centers of plants. The only plants of bluebunch wheatgrass in poor condition individually in relation to livestock grazing were some of those in an exclosure west of Jordan Valley which had *not* been grazed by livestock for several years. Resting an area for a year or more without grazing

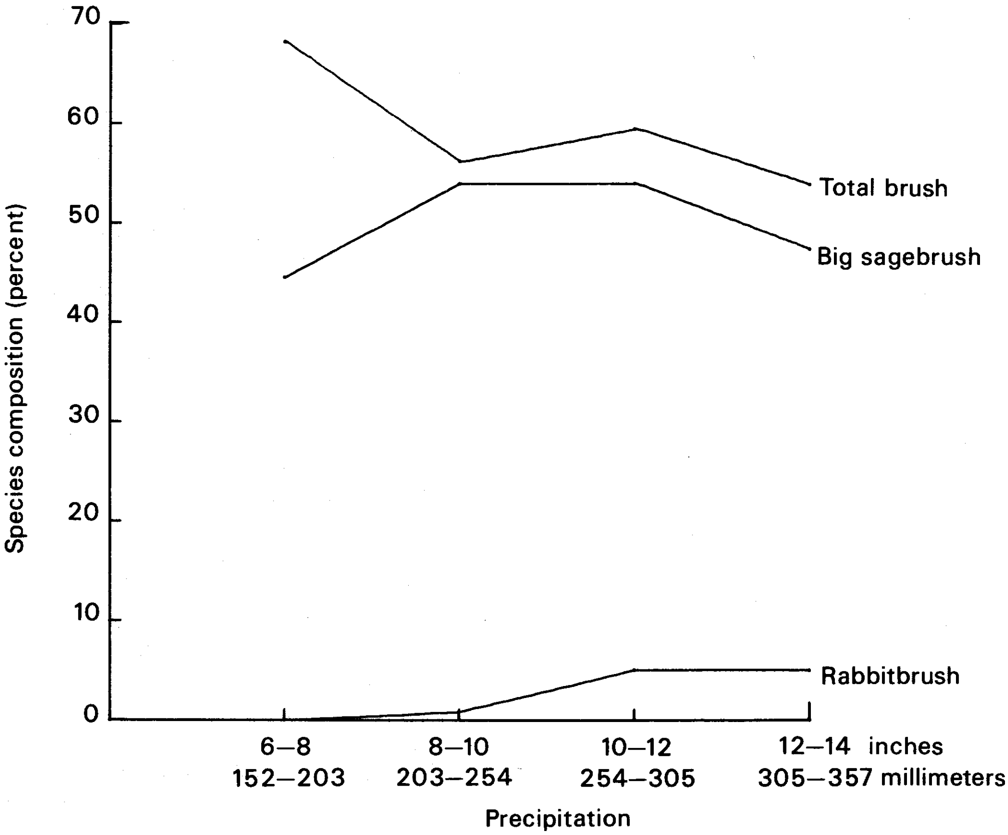

Figure 31.--Composition of brush on untreated areas in 1975 in relation to average annual precipitation.

promotes accumulation of litter and dying in the centers of bluebunch wheatgrass. Many areas without brush control are in much improved range condition in 1975 over what they were in the early 1960's. Several allotments in the northern part of the district, however, will take decades to improve significantly because of the virtual absence of desirable grasses.

Methods previously used by BLM personnel for evaluating range condition on the Vale District were inadequate for our purposes. A few key sites were selected for permanent plots, each consisting of a photo point and a staked yard-square (0.836 m^2) plot on which vegetation was mapped. Proper evaluation of an entire management unit could not be made from examination of one to a half dozen of these small plots. Photos yielded valuable information and should be continued. Mapping of the small plots, however, is time consuming and of questionable accuracy because of infrequent sampling by a wide spectrum of individuals, some with little interest in the assignment, and none with adequate instruction. A more reliable method for collecting adequate condition and trend data should be found. A second fault with the present plots is that most were located close to water and other places of livestock concentration, hence they do not represent entire management units. A third problem with these plots stems from the practice of including cheatgrass

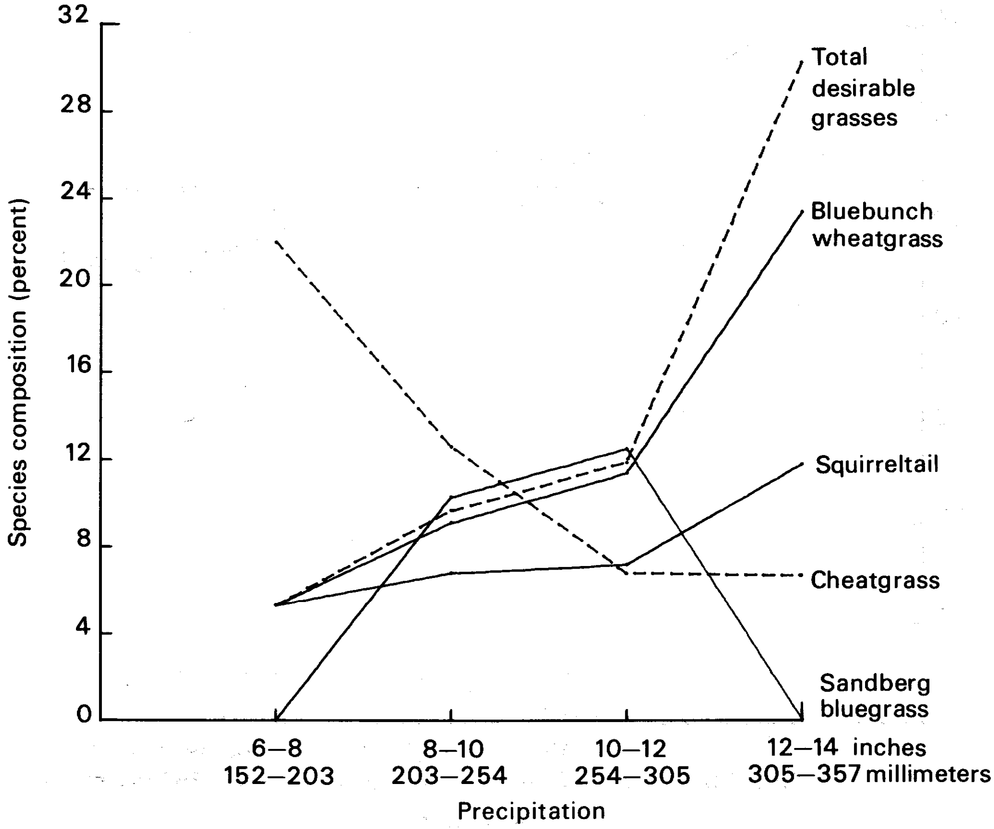

Figure 32.--Relative percentage species composition of grasses on untreated areas in 1975 in relation to average annual precipitation.

in the trend sample, thus confusing high yearly variability in cheatgrass stands with long-term trends in range condition. Annuals should be included in the analysis as important parts of the vegetation, but their small and ephemeral nature makes them difficult to map and the maps of doubtful meaning. A fourth problem is inadequate plot size. A yard-square plot included less than one big sagebrush plant and about three of the desirable perennial bunchgrasses on the average. A large number of these plots would be needed on each site in order to obtain an accurate estimate of range condition and trend.

New procedures need to be established for monitoring changes in vegetation on the lands administered by BLM. The technique should apply to large managerial units, give reasonably pertinent and accurate data on vegetational changes, and be useful to nonresearch-oriented personnel, who have many other assignments.

BRUSH CONTROL AND SEEDING TREATMENTS

Seedings followed four pretreatment practices: plowing, spraying, wildfire, and no preparation prior to planting. A few reseedings followed unsuccessful

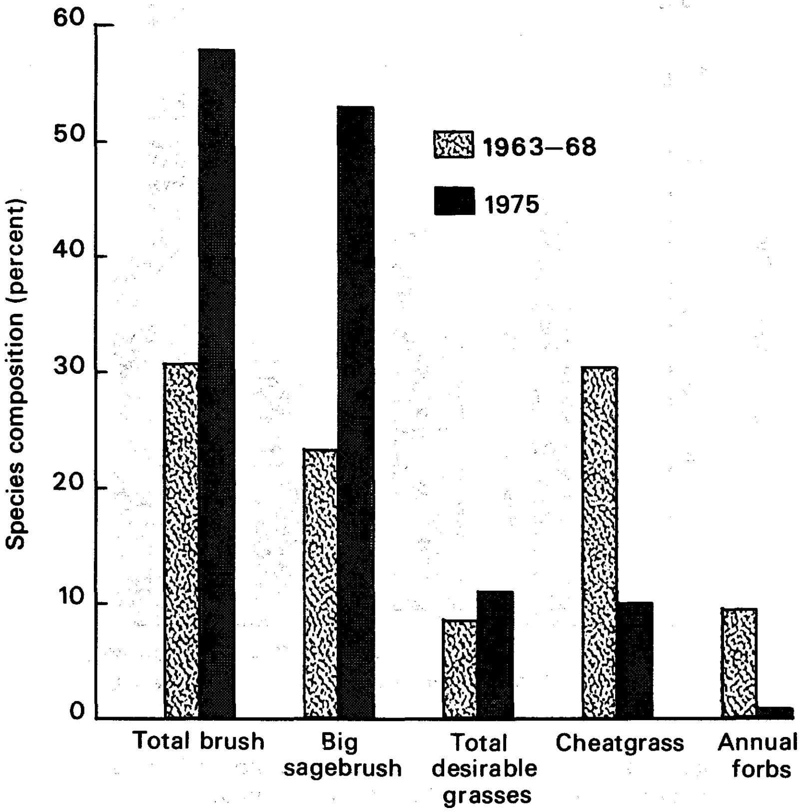

Figure 33.--Species composition, 1963-68 and 1975.

prior attempts--as many as three or four tries. This section of the report examines the vegetation that returned following brush control and seeding. All seedings were to crested wheatgrass, unless stated otherwise.

In general, similar big sagebrush kills were obtained with either spraying-and-seeding or plowing-and-seeding. Many well-executed and planned operations resulted in kills exceeding 95 percent (figs. 35 and 36). The relationship between sagebrush kill and longevity of projects, however, is not at all clear. Brush density on untreated areas averaged 1.05 plants/yd^2 (1.25/m^2), 0.95 (1.14) big sagebrush, 0.04 (0.05) rabbitbrush, and 0.06 plant/yd^2 (0.07/m^2) of other species (fig. 37). Big sagebrush was dramatically killed by all treatments, with wildfire the most effective in reducing its density. Burned areas averaged only 0.09 big sagebrush plant/yd^2 (1.08/m^2). Areas sprayed and seeded showed the lowest sagebrush density of any nonburned section with 0.17 plant/yd^2 (0.20/m^2). Plowing reduced big sagebrush density to 0.24/yd^2 (0.29/m^2); spraying alone was least effective with 0.26 plant/yd^2 (0.31/m^2) (fig. 38). Lowest sagebrush densities were observed where seeding followed spraying, rather than with no seeding.

Rabbitbrush was more common on treated areas than untreated, averaging 0.04/yd^2 (0.05/m^2). Plowing effectively reduced rabbitbrush to 0.02/yd^2 (0.024/m^2). Spraying resulted in higher density, 0.05 and 0.08/yd^2 (0.06 and 0.09/m^2) for

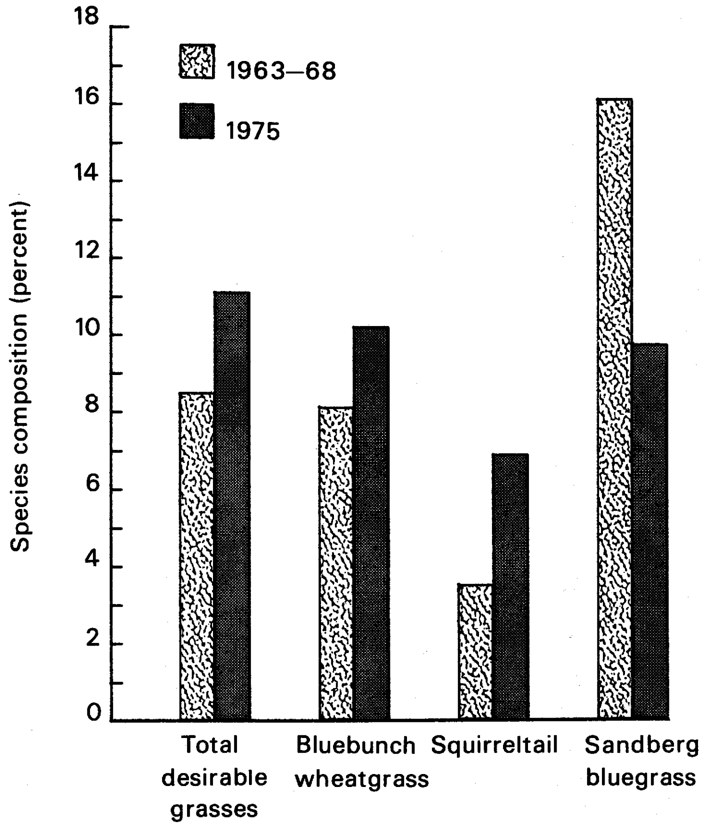

Figure 34.--Percentage species composition of perennial grasses, 1963-68 and 1975.

for seeded and nonseeded sprayed areas. Rabbitbrush was strongly correlated with particular soil and elevational types, complicating interpretation of the results.

Brush control projects which were without seedings used aerial application of 2,4-D to kill big sagebrush. This practice was used most often.

Spraying had variable results. Sprays before 1965 used diesel oil as a carrier for the active agent, and they more effectively killed brush than the water-based sprays used beginning in 1965. Applications were timed more accurately by 1967, making the water-based sprays as effective as the earlier results with diesel oil (fig. 38). In paired treated and untreated samples, the untreated areas adjacent to sprays averaged 0.98 big sagebrush plant/yd^2 (1.17/m^2), and spray-treated samples averaged 0.26 plant/yd^2 (0.31/m^2) (fig. 39), half of which became established after treatment (see next section). Estimated initial overall percentage kill by spraying was 80-90 percent.

Desirable grass density increased in unseeded sprayed areas. Paired treated and untreated adjacent transects had 1.02 desirable grasses/yd^2 (1.22/m^2) on treated areas versus 0.81/yd^2 (0.97/m^2) on untreated areas, a 25-percent increase in grass density due to spray treatment.

When crested wheatgrass is grouped into four categories of areas with 6-8, 8-10, 10-12, and 12-14 inches (152-203, 203-254, 254-305, 305-357 mm) of average precipitation, little difference is noted between success at the various rainfall

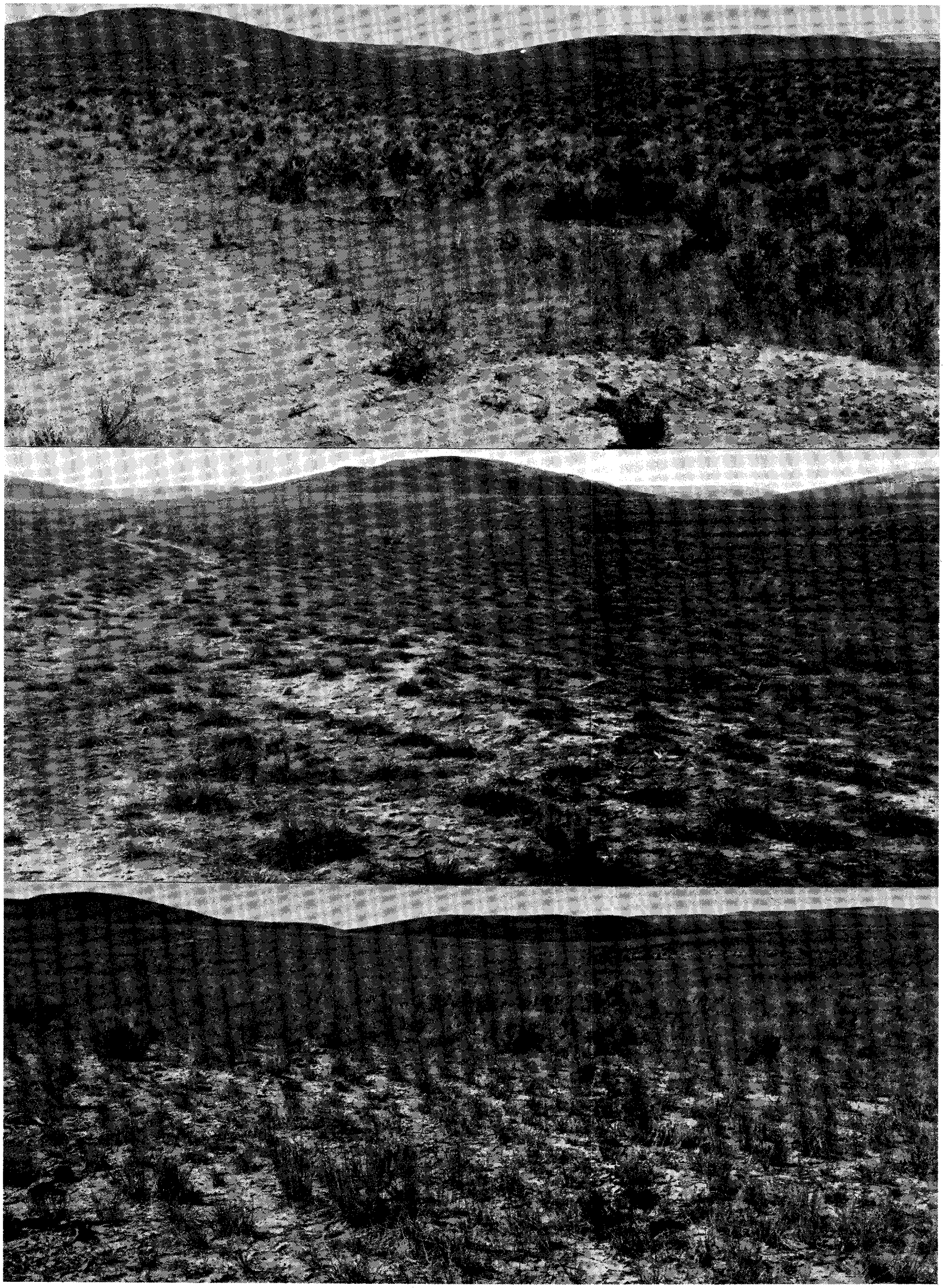

Figure 35.--Top, N. G. Creek seeding site dominated by big sagebrush and cheatgrass before treatment in 1963 (Bureau of Land Management photo). Middle, grazed crested wheatgrass with little apparent big sagebrush in 1969 (Bureau of Land Management photo). Bottom, big sagebrush appears as a scattered stand in 1975.

Figure 36.--The spray-only treatment (top) released bluebunch wheatgrass which developed into a thick stand. Most spray and seed treatments also developed grasslands (bottom). Big sagebrush invaded areas receiving either treatment.

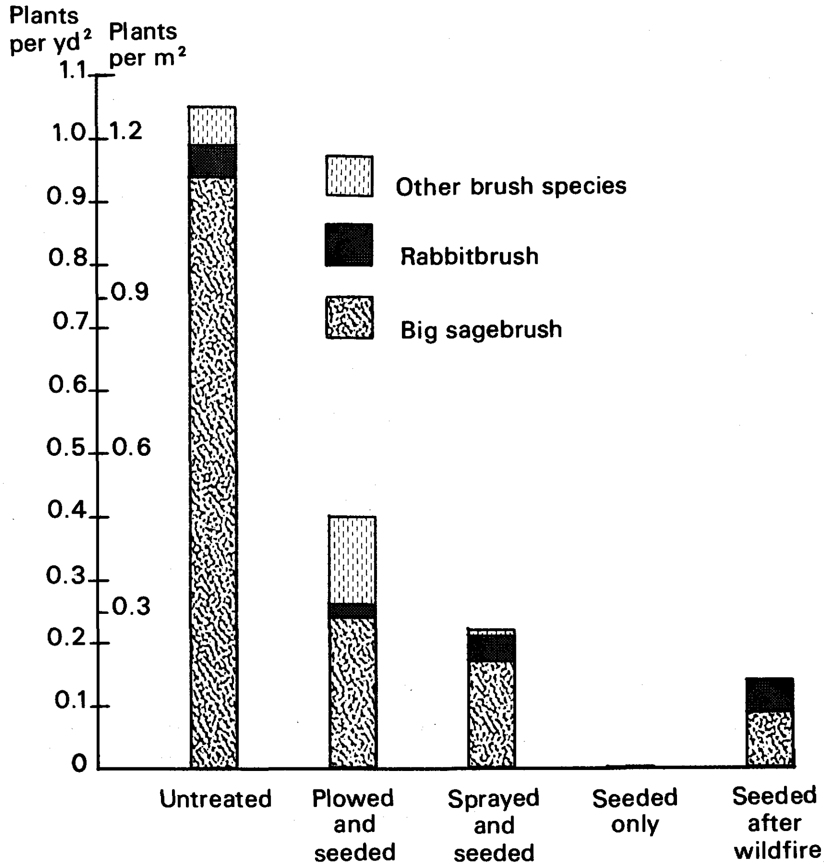

Figure 37.--Density of brush in 1975 in seeded areas, by treatment.

levels. Plow-and-seed operations resulted in crested wheatgrass densities of 3.19, 3.11, and 3.38 plants/yd^2 (3.82, 3.72, and 4.04/m^2) for the three lowest levels of rainfall. However, the dry years reduced seedling success. The 2 years with the least rainfall during the Vale Project, 1966 and 1968, resulted in poor seeding success with average densities of 2.82 and 2.11 plants/yd^2 (3.37 and 2.52/m^2) for plow-and-seed and spray-and-seed operations compared with the overall average success of 3.15 plants/yd^2 (3.77/m^2). Generally, plowing was the most successful preseeding treatment, giving an average crested wheatgrass density of 3.22 plants/yd^2 (3.85/m^2) (fig. 40). Spraying, fire rehabilitation, and no pretreatment, in that order, resulted in 2.99, 2.77, and 2.17 plants/yd^2 (3.58, 3.31, and 2.60/m^2). The two sampled attempts at reseeding without site preparation following initial failure were judged unsuccessful with only an average of 1.61 perennial grass plants/yd^2 (1.93/m^2).

Percentage compositions of species on seeded areas generally parallel these for density. Plow-and-spray reduced brush composition of 59 percent for untreated areas to 12 percent, and burning lowered the composition to 9 percent. Notable, however, was that the highest average percentage composition of desirable grasses

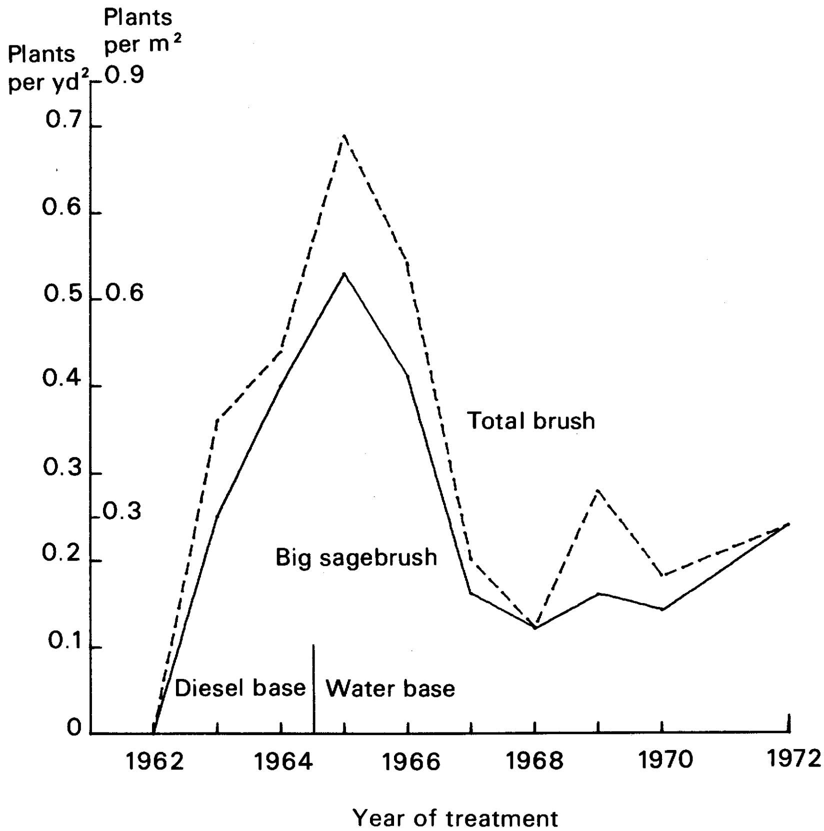

Figure 38.--Density of brush in 1975, averaged for the year of spray treatment with 2,4-D at 2 lb acid equivalent per acre (2.2 kg/ha).

occurred on spray-and-seed areas. The slightly lower percentage composition of crested wheatgrass in sprayed areas compared with plowed areas (49 vs. 55 percent) was balanced by the presence of desirable native grasses in the sprayed areas. Although sprayed-and-seeded areas were among the poorest ranges on the Vale District at the beginning, the presence of remnant native grasses resulted in an average of 60-percent desirable grasses (11-percent native and 49-percent crested wheatgrass). Spraying, by not killing native grasses, resulted in significantly better mixtures of perennial grasses than plow-and-seed.

Trend in grass composition on treated areas was closely related to the rate of change in the brush population, not to changes in their own density. Since the grasses displayed little evidence of decrease or change in density, downward trend would be the result of brush reinvasion. A widely accepted proposition in many evaluations of range improvement by means of brush control stipulates that the improvement has a finite lifespan due to return of brush. We disagree with this proposition in the Vale District. Few areas on the district which were successfully treated will require retreatment to maintain a substantial portion of their forage productivity. Brush will invade but not to the degree that grasses will be greatly impaired--as long as overgrazing does not destroy the grasses.

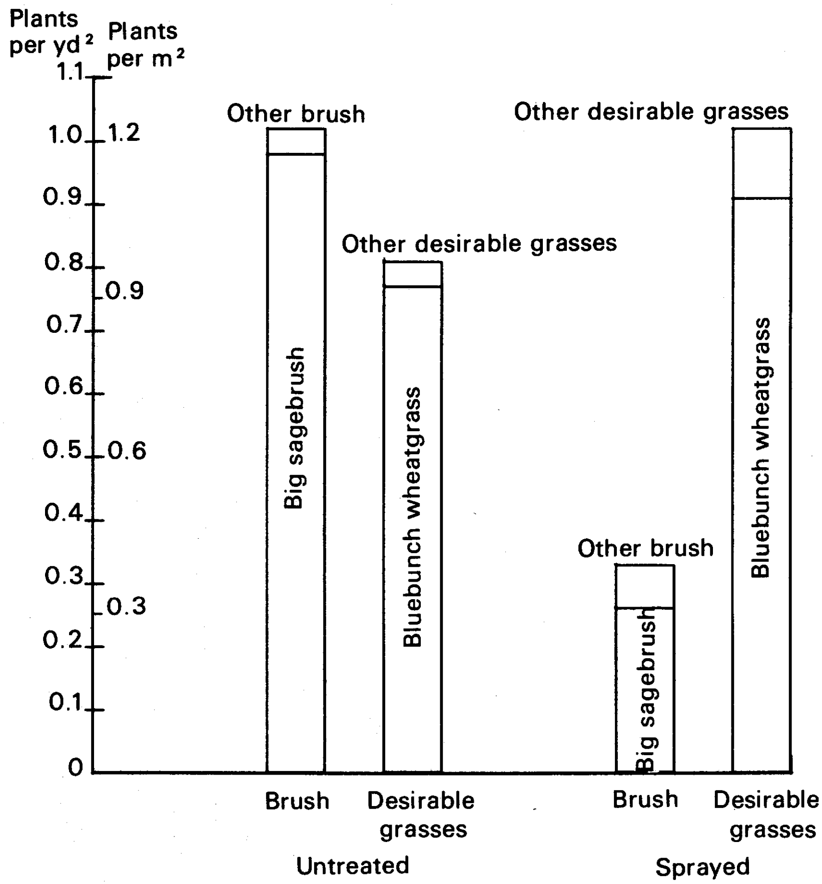

Figure 39.--Comparison of sprayed areas and adjacent untreated areas, 1975.

BIG SAGEBRUSH REINVASION

To further investigate the structure of controlled sagebrush and seeded stands, we obtained 300 plants of big sagebrush in lots of 50 from six project sites (table 15). All big sagebrush plants within a 1-meter-wide belt were measured for crown diameter and height and were cut at ground level for ring counts to estimate age. The sample ended when 50 plants had been measured. Although rotten centers and incomplete rings reduced the accuracy of age determination, the number of annual rings in any stem younger than approximately 20 years gave a good estimate of the age of the plant. Estimates of actual age were not possible in 29 plants, or about 10 percent of the samples, because of missing centers.

Areas sampled were chosen primarily for convenience and thus do not constitute a representative sample of the Vale District as a whole. However, the data point to important facts concerning treatments, their effectiveness, and sagebrush reinvasion in general.

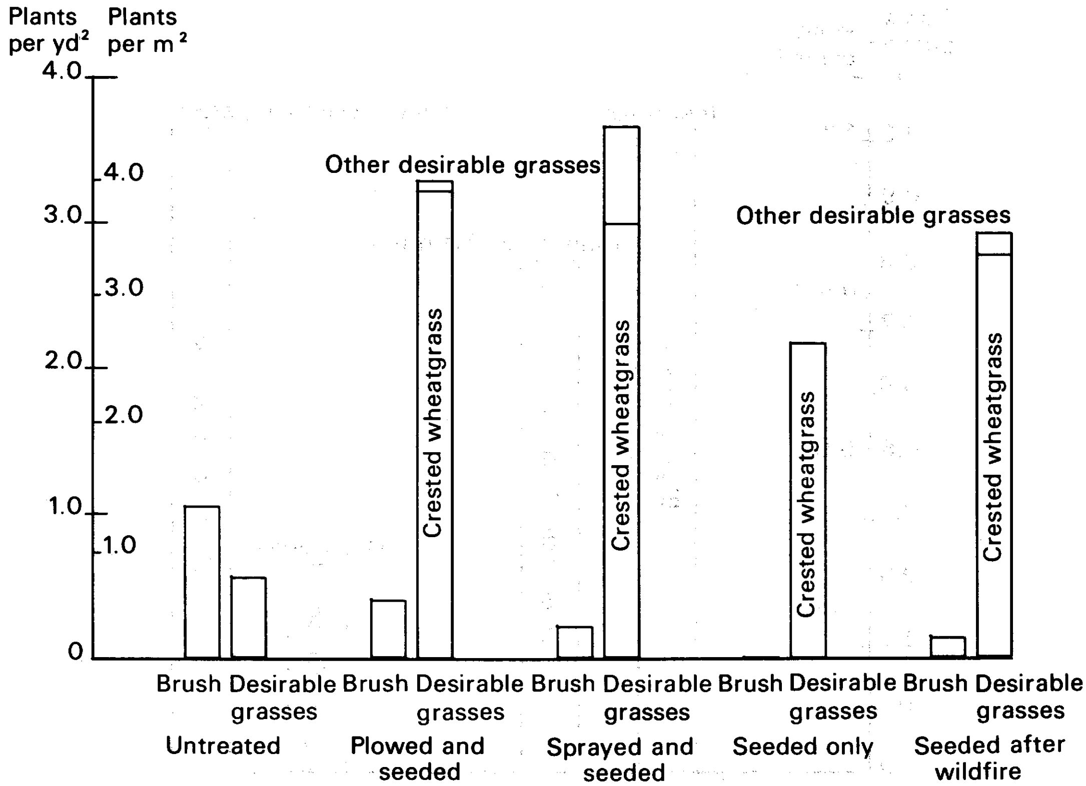

Figure 40.--Density of brush, crested wheatgrass, and other desirable grasses in 1975 according to treatment before seeding.

Table 15--*Age in years and density of big sagebrush on six treated areas, Vale District, Bureau of Land Management, 1976*

Project name	Number of project	Age at time of treatment	Age				Plants per square yard[1/]
			Mean	Median	Min.	Max.	
		- - - - - - - - - Years - - - - - - - - -					
Ten Mile seeding	1	24	17.7	19	5	24	0.35 (.42)
Brickey Springs seeding	8	15	12.6	13	6	21	.24 (.29)
Rock Creek seeding	15	14	12.2	12	5	26+	.63 (.75)
Big Ridge seeding	106	9	9.3	9	1	18	.24 (.39)
Antelope seeding	109	9	11.2	10	7	23	.33 (.39)
Basque seeding	111	9	15.4	11	3	38+	.54 (.65)

1/ Figures in parentheses are plants per square meter.

Size of plant and age were poorly correlated (fig. 41). The best regression coefficient for age on size of plant was obtained in the Basque brush control but it was only r = 0.482. The Big Ridge, Antelope, and Rock Creek seedings all had correlations of less than 0.13 or no relation at all between size and age. The practice of making inferences about age-class distribution of sagebrush stands based on size classes is highly inaccurate and in fact may lead to erroneous conclusions. Often, apparent seedlings less than 5 inches (1 dm) tall may be more than 10 years old. As an example, the Big Ridge seeding yielded sagebrush plants within a few meters of each other, both with nine growth rings, one with a crown 2.5 by 1.5 inches (6 by 4 cm) and the larger 32 by 36 inches (80 by 90 cm). Brickey Springs had two adjacent plants, one with 14 rings and 8 by 4 inches (2 by 1 dm) in size; the other 15 rings and 36 by 50 inches (9 by 12.5 dm) in size.

A common assertion is that big sagebrush invades rapidly following land treatment and that most seedlings become established at that time. In general, the results of the age-class survey substantiate that claim. On three of the treated areas the most numerous age class occurred the year after the treatment. This effect was particularly pronounced in the Big Ridge seeding where 32 of the 50 plants in the sample apparently established in the 2 years following treatment in 1966 (fig. 42). All treated areas showed evidence of continued establishment in the years following treatment except that the Antelope and Brickey Springs seedings had no plants younger than 6 years (figs. 43 and 44).

Figure 41.--Both these plants of big sagebrush, growing side by side, were 9 years old.

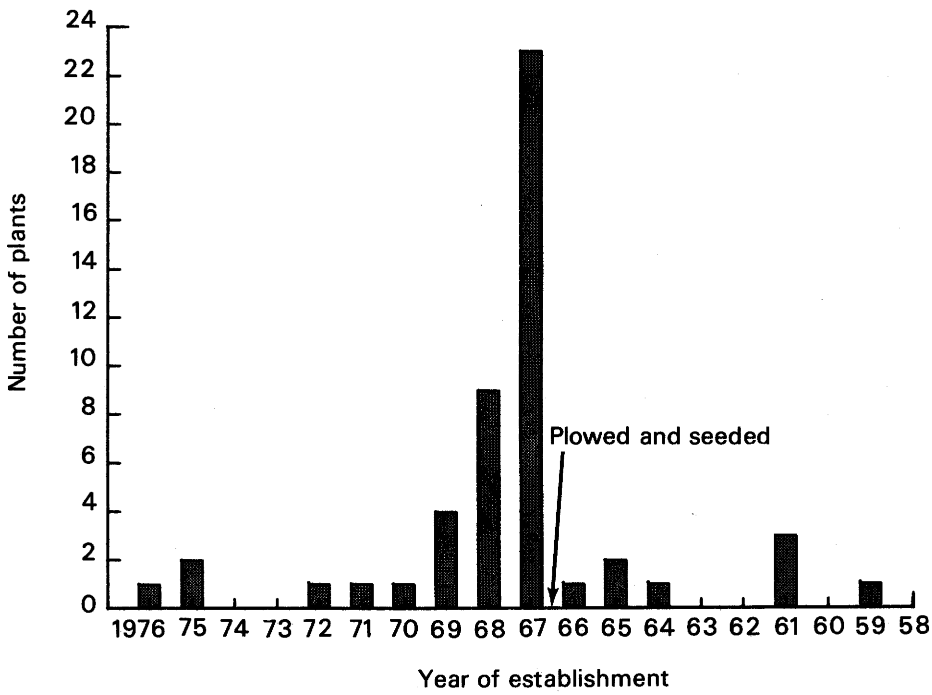

Figure 42.--Age-class distribution of big sagebrush, Big Ridge seeding project.

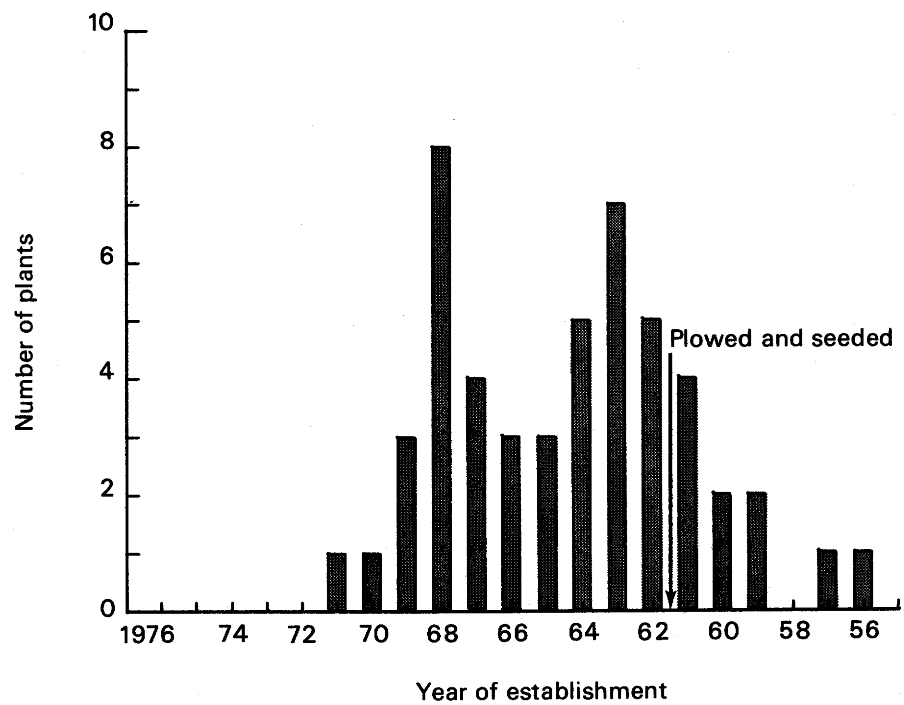

Figure 43.--Age-class distribution of big sagebrush, Brickey Springs seeding project.

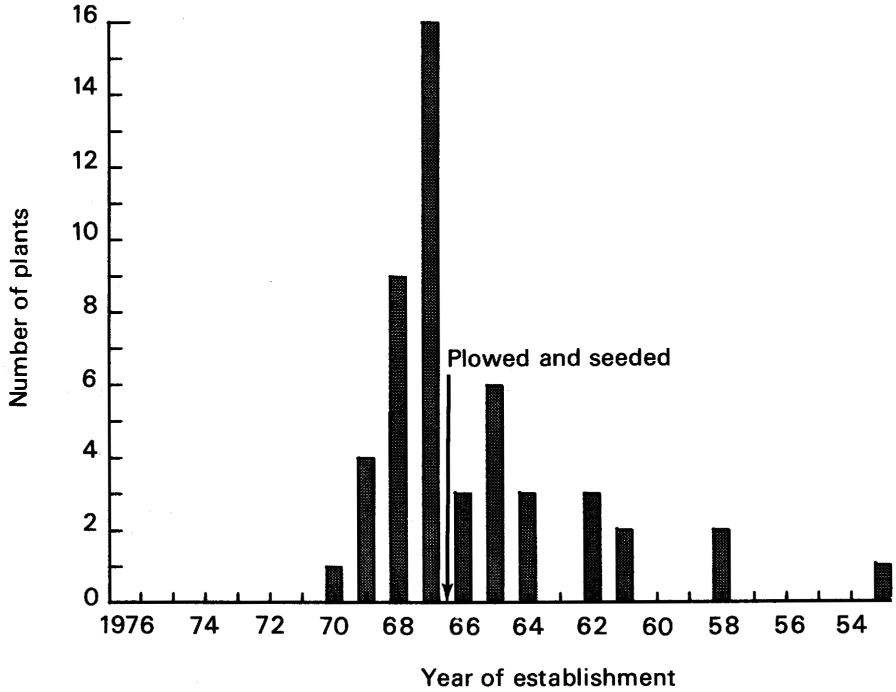

Figure 44.--Age-class distribution of big sagebrush, Antelope seeding project.

The Brickey Springs seeding had large and obvious big sagebrush, whereas the Antelope seeding appeared relatively free of big sagebrush plants because they were small (fig. 45). Densities of big sagebrush plants in the two areas were similar. Big sagebrush crown cover in Brickey Springs was 5.7 percent, but only 1.6 percent in Antelope; yet median ages were similar--13 years in Brickey Springs and 10 years in Antelope. The only real difference was that the big sagebrush plants in Brickey Springs were larger and hence covered more area.

Only the Ten Mile seedings displayed complete kill of big sagebrush by initial treatment (fig. 46)--no plants older than the treatment were found. In all other projects sampled, ample big sagebrush plants remained after treatment to allow reinvasion from seed produced. Invasion is by establishment of seedings immediately after treatment from seed on the site and from seed produced later. Little evidence was found that particular years were more favorable for sagebrush establishment than others. Individual areas showed groups or cohorts of seedlings, but they were of different ages. From 1970 on seems to have been unfavorable for sagebrush establishment.

This sample, encompassing many years of treatment, resulted in some conclusions concerning the life expectancy of crested wheatgrass seedings and the rate of big sagebrush reinvasion. First, older brush controls did not show more sagebrush invasion than younger projects. Degree of big sagebrush invasion related to the type and effectiveness of the particular treatment rather than

Figure 45.--Antelope seeding on the left and Brickey Springs seeding on the right. Small plants of big sagebrush in the Antelope seeding are about the same number per unit area as the larger plants in Brickey Springs.

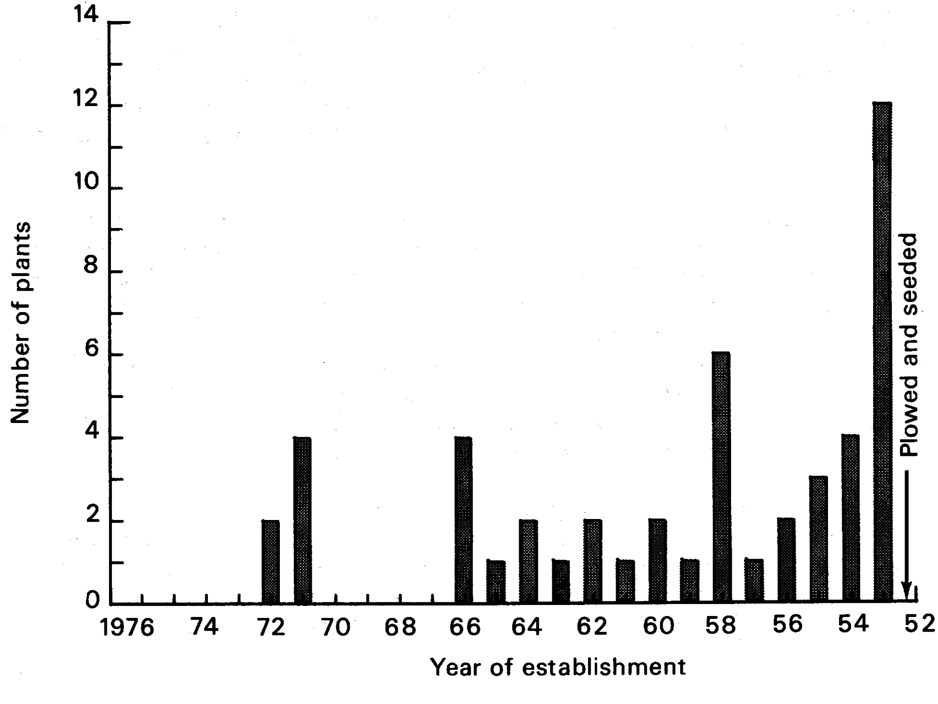

Figure 46.--Age-class distribution of big sagebrush, Ten Mile seeding project.

year of treatment. Plowing, spraying, and burning are all effective methods of big sagebrush control when used properly.

A reasonably effective brush kill can be expected to last indefinitely if properly managed and if a certain degree of big sagebrush cover is tolerable. Stands of grass usually appear to be deteriorating rapidly in the first few years following treatment. Most of the apparent reinvasion of big sagebrush, however, is actually the recovery of unkilled plants and the growth of seedlings established in the first few years following treatment. Seedlings established shortly after treatment generally remain small as adult plants. Growth of big sagebrush seedlings in stands with either well-established crested wheatgrass or excellent native bunchgrass is very slow, and many brush seedlings do not reach maturity. We believe that big sagebrush stands composed of less than 25-percent brush do not significantly lower the grazing capacity of associated crested wheatgrass or native grasses. If properly used, seedings containing big sagebrush should not significantly deteriorate unless brush cover increases beyond 25 percent.

Areas with nearly complete big sagebrush kills, especially those doubly treated--as spraying followed by wildfire--will return to brush slowly or not at all during a reasonable management timespan. Although a complete big sagebrush kill will result in an essentially permanent absence of big sagebrush, kills of between 90 and 95 percent allow seedlings to become established and significant mature plants to survive. We contend that the mixture of brush and grass will also be expected to have a long lifespan. Once the brush reaches equilibrium, generally within a few years, proper use will result in ample grass on a long-term basis.

Areas sprayed and then seeded to crested wheatgrass had much less brush than areas sprayed and not seeded, 0.22 and 0.33 plant/yd^2 (0.26 and 0.39/m^2), respectively. Before spraying, the spray-and-seed sites supported the heaviest brush stands and the fewest perennial grasses. The drilling operation certainly killed some brush plants, but higher density of perennial grasses following seeding resulted in less re-establishment of big sagebrush.

SUMMARY COMMENTS ON VEGETATION IN 1975

Condition and trend of the treated and untreated areas varied as did the rangeland itself. An argument can be made that thickening of stands and reinvasion by big sagebrush are causing a decline in range condition for domestic livestock. Although this is happening, we believe that management through control of stocking rates, animal distribution, and seasonal grazing systems will prevent the return of the big sagebrush to its pretreatment density. Stands of the large perennial grasses between the bushes will cause the invasion to stabilize at a probable brush cover of less than 25 percent, whereas it frequently was 50- to 60-percent cover before treatment. Few areas sampled showed concrete evidence of a downward trend. Plant vigor was excellent, and only one project area had significant numbers of dead desirable grasses. Sheet erosion was minor, and both erosion and pedestalling of plants were less in grazed areas than in the ungrazed exclosure west of Jordan Valley. Pedestalling of as much as 1 inch (2.5 cm) is normal for the perennial bunchgrasses in this area. Although we do not have survey data, we believe that at least 50 percent of the district is in good or excellent condition and that the trend of nearly all the district is either stable or improving.

Crested wheatgrass is stable or increasing in density in seeded areas. Only in China Gulch "B" seeding were any dead crested wheatgrass plants noted. Reproduction of crested wheatgrass over much of the Vale District was related to the present stand density. Seedings with more than four plants per square yard ($4.8/m^2$) rarely contained crested wheatgrass seedlings. Less successful initial seedings often contained seedlings, indicating stand thickening. Apparently, the maximum density of crested wheatgrass beyond which the stand does not thicken is about one plant for 2 square feet. Management practices intended to foster plant reproduction in these well-established stands wastes forage and are not needed. Crested wheatgrass shows little evidence of dying out, even under heavy use. We found none of the many seasonal patterns of grazing harmful to crested wheatgrass. It should be used in whatever pattern overall management requires.

Bluebunch wheatgrass also appears stable on treated areas. Not one seedling was found during sampling in the summer of 1975. Small plants occurred commonly, but none was unequivocally a seedling and not part of a broken larger bunch. Bluebunch wheatgrass has been reported to establish only in summers of higher than average rainfall (Harris 1967). Paired treated and untreated samples showed density to be 0.75 plant/yd^2 ($0.90/m^2$) in the brush and 0.96 plant/yd^2 ($1.15/m^2$) with little brush. Following spraying, large bunches which had grown under big sagebrush plants often broke into several smaller plants. The evidence, as observed in the field, suggests that bluebunch wheatgrass, although a bunchgrass, primarily increases by this vegetative means rather than by seed. We believe that moderate grazing helps this process. Bluebunch wheatgrass appears to be stable under the intensities of grazing practiced on the Vale District. The potential for further increase is not clear. Many areas, both with and without brush control, support excellent stands of bluebunch wheatgrass. Less well-stocked stands will slowly increase in grass density. Sprayed areas with densities of bluebunch wheatgrass of less than one plant per square yard ($1.20/m^2$) appear to have more big sagebrush seedlings with the shrubs more actively invading than do treated areas with denser stands of native grasses. The eventual density of big sagebrush in the climax stands was discussed above. A dense stand of big sagebrush with numerous plants of bluebunch wheatgrass responds dramatically to a treatment of spraying and no grazing for 2 years. Two years of resting unsprayed areas also brings dramatic response. Perhaps spraying alone has been overrated as a treatment of sagebrush-grass. This point will be explored later in conjunction with costs and benefits of spraying.

The relationship between crested wheatgrass and the annual cheatgrass must be discussed. Some areas have little cheatgrass and others have dense stands. This pattern, obvious on a large scale, also occurs within small areas (fig. 47). Seedings with crested wheatgrass densities of less than three plants per square yard ($3.6/m^2$) were patchily infested with cheatgrass. Seedings with more than four plants per square yard ($4.80/m^2$) rarely had significant amounts of cheatgrass. This annual formed dense stands where crested wheatgrass density was less than 1.5 plants/yd^2 ($1.79/m^2$). The mechanism of establishment of this pattern is not at all clear since cheatgrass seed occurs everywhere, and the periods of growth of both species differ significantly. A research study is needed on this point. Cheatgrass does fill a useful role in the poorer seedings, providing forage in some years, which rivals total production in successful seedings, and protecting the soil from erosion.

From a vegetational standpoint the Vale Program has been highly effective. Formerly dense and nearly pure stands of big sagebrush have been converted to grasslands on about 8 percent of the district. The additional forage provided

Figure 47.--Patches of cheatgrass occur and remain ungrazed where crested wheatgrass is in thin stands.

by improvement of range conditions gave the opportunity for flexibility in grazing use and further improvement in the untreated ranges. The district now produces more range forage than livestock harvest. The excess, however, provides stability against drought and needed cover and feed for wildlife. Some of the relationships with other uses of the land are examined next.

Multiple Uses and Relationships in the Vale District

LIVESTOCK

The Vale Program began with major emphasis on rehabilitation of soil and vegetation, conservation of water, and increased forage for livestock and wildlife. Clearly, the rangeland resource needed repair, regardless of the use to which it might be put. In 1962, that use was grazing by livestock and, in fact, major emphasis in the program aimed to improve livestock forage resources and livestock management. The accomplishments for 1962-75 are listed briefly as follows:

Big sagebrush plowed and seeded to crested wheatgrass	164,000 acres (66 400 ha)
Big sagebrush sprayed with 2,4-D	280,000 acres (113 400 ha)
Big sagebrush sprayed and seeded to crested wheatgrass	53,000 acres (21 500 ha)
Seedings for wildlife (legumes and browse)	58,000 acres (23 500 ha)
Seeded only and reseeded	8,000 acres (3 250 ha)
Fencing	2,000 miles (3 200 km)
Deep wells and water storage tanks	28
Pipelines	443 miles (709 km)
Reservoirs	574
Spring developments	428
Cattle guards	360
Roads	500 miles (800 km)

In addition to rehabilitation and construction of physical improvements, 28 grazing management plans have been formally accepted by livestock permittees and the BLM. All the remaining national resource grazing lands are in less formally controlled seasonal grazing plans.

The estimated grazing capacity of the whole district increased from 17 acres (6.9 ha) per AUM to 10.4 acres (4.2 ha) between 1962 and 1975, largely through removal of big sagebrush and increases in crested wheatgrass and the native perennial bunchgrasses. The task is not finished because large portions, mainly in the northern part of the district, remain in big sagebrush and cheatgrass. If all the vegetation were changed to something near the climax types, the overall grazing capacity might be 5-6 acres (2-2.5 ha) per AUM. The final result of the Vale Program, we estimate, will be about 8 acres (3.2 ha) per AUM.

The purposes for which the Vale District Program was established have been met in large measure. Livestock grazing caused the range deterioration in the first place, and the rehabilitation has restored much of the land into its once fully vegetated condition. The economy of the community depends on livestock, about a third of which grazes the public lands. Livestock grazing exceeds all other uses, the situation for over a century and one likely to continue.

To recognize that livestock is the principal use does not suggest that others of the multiple uses should be eliminated or reduced. Many are compatible with grazing by domestic animals, especially where fences, water, and riding permit manipulation of when, where, and how much grazing takes place. Grazing by domestic animals may be used as a tool to enhance the habitats for other species. Actually, other users, particularly wildlife, received increasing attention as the program proceeded. In addition to the seedings mentioned above, deep reservoirs provided permanent fish habitats. Goose nesting sites, fenced water, fence designs, and other practices favored wildlife. Eleven of the originally planned projects were eliminated because of probable damage to browse. Areas within projects were eliminated from treatment, including streambanks, canyons, deer winter ranges, sagegrouse concentration areas, and most of the low sagebrush vegetational type.

Although multiple use decisions from 1962 to 1973 may not suffice for 1975 or 1980 situations, the Vale Program attempted to be accountable to all users. The following sections examine the multiple use situations, as we found them. Mainly because few data were collected before and during the program, these analyses are inconclusive, and they depend largely on value judgments.

WILD HORSES

Thirteen horse management areas on the Vale District supported 2,416 wild horses according to counts made from an airplane on April 19, 1975 (fig. 48, table 16). Average band, family, or harem size was 7.6 head which ranged from about 4 to 11 mares per dominant male. Younger males may be in the band and single males may be found. About 15 percent of the horses were young foals. It is estimated that 10 percent of the colts are born in the fall and 90 percent in March, April, and May.

Horses have been regularly counted on the district, but with varying accuracy, since 1968 (table 16). Two herds, Jackies Butte and Three Fingers, which had been reduced in numbers, increased from 94 to 150 and from 66 to 225, respectively, in the 3-year period 1972-74 (table 17). Although inaccurate counting and addition of adults to the herds cannot be ruled out in either area, the major increase reflects natural reproduction. The data for Jackies Butte are believed accurate and they suggest a reproductive rate of 60 percent in 3 years or 20 percent per year. Wild horse herds throughout the Western States are known to have high rates of reproduction until feed becomes extremely scarce. Few deaths result from predators and diseases, and confined herds soon increase to and beyond the grazing capacity of their habitats.

In 1975, Cold Springs, Sheepheads/Barren Valley, and Jackies Butte had too many horses. The early signs of damage by horses, enlarged dusting areas and numerous trails, indicated deterioration where horses congregate in the Cold Springs area. Sheepheads/Barren Valley had deteriorating conditions within both winter and summer ranges, and Jackies Butte had denuded winter range area due to wild horses.

Table 16--*Counted numbers of wild horses in the Vale District, Bureau of Land Management, April 1975*

Number[1/] and name of horse management area		Acres[2/]	Number of horses: Adults	Foals	Total	Percent foals	Average band size
1	Hog Creek	18,120	64	6	70	8.6	6.2
2	Lake Ridge	2,720	11	1	12	8.3	6.0
3	Pot Holes	3,840	19	3	22	13.6	7.3
4	Basque	7,570	28	5	33	15.2	6.6
5	Cottonwood Basin	2,300	[3/] 0	0	0	0	0
6	Cottonwood Creek	5,660	49	9	58	15.5	8.3
7	Cold Springs	21,540	181	27	208	12.6	8.8
8	Atturbury	4,080	15	3	18	16.6	18.0
9	Stockade	26,866	49	5	54	9.3	10.8
10	Morger Allotment	26,172	128	19	147	12.9	8.2
11	Sheepheads/Barren Valley	639,770	952	176	1,128	15.6	6.9
12	Jackies Butte	78,094	186	36	222	16.2	8.8
13	Three Fingers	70,868	379	65	444	14.6	8.7
	Total	907,600	2,061	355	2,416	14.7	7.6

1/ Numbers refer to locations in figure 48.

2/ 1 acre equals 0.405 hectare.

3/ 67 horses claimed but ungathered.

Table 17--*Counted numbers of wild horses, Vale District, Bureau of Land Management*

Horse management area	1968	Spring 1969	Fall 1970	Winter 1972	Winter 1973	Spring 1974	Fall 1974
Hog Creek	--	--	--	1/18	1/35	1/17	56
Lake Ridge	--	--	--	11	1/4	1/5	1/5
Pot Holes	--	--	--	17	21	1/4	19
Basque	--	--	--	6	6	6	28
Cottonwood Basin	--	--	--	2	0	--	1
Cottonwood Creek	--	--	--	19	34	1/31	50
Cold Springs	--	--	--	1/52	105	136	164
Atturbury	--	--	--	6	6	0	0
Stockade	--	--	--	10	13	42	47
Morger Allotment	--	--	--	80	85	132	154
Sheepheads/Barren Valley	--	--	--	539	660	1,217	--
Jackies Butte	--	225	263	2/94	113	140	150
Three Fingers	364	3/64	--	66	120	234	225

1/ Inaccurate.

2/ 181 head of horses removed in November 1970.

3/ 300 head of horses removed in fall of 1968.

We believe that too many free-roaming horses existed in the Vale District in 1975. They grazed to the extent of 28,000 AUM's on 900,000 acres (360 000 ha) designated for horses. Even distribution of grazing remains impossible to attain with wild horses; therefore, some areas become overgrazed and others not grazed at all. This situation is happening on the three areas mentioned above where numbers of horses should be reduced and maintained at lower levels. A reasonable balance between maintenance of the range and the horses should be attained with 2,000 horses, provided the three management areas receive most of the decrease.

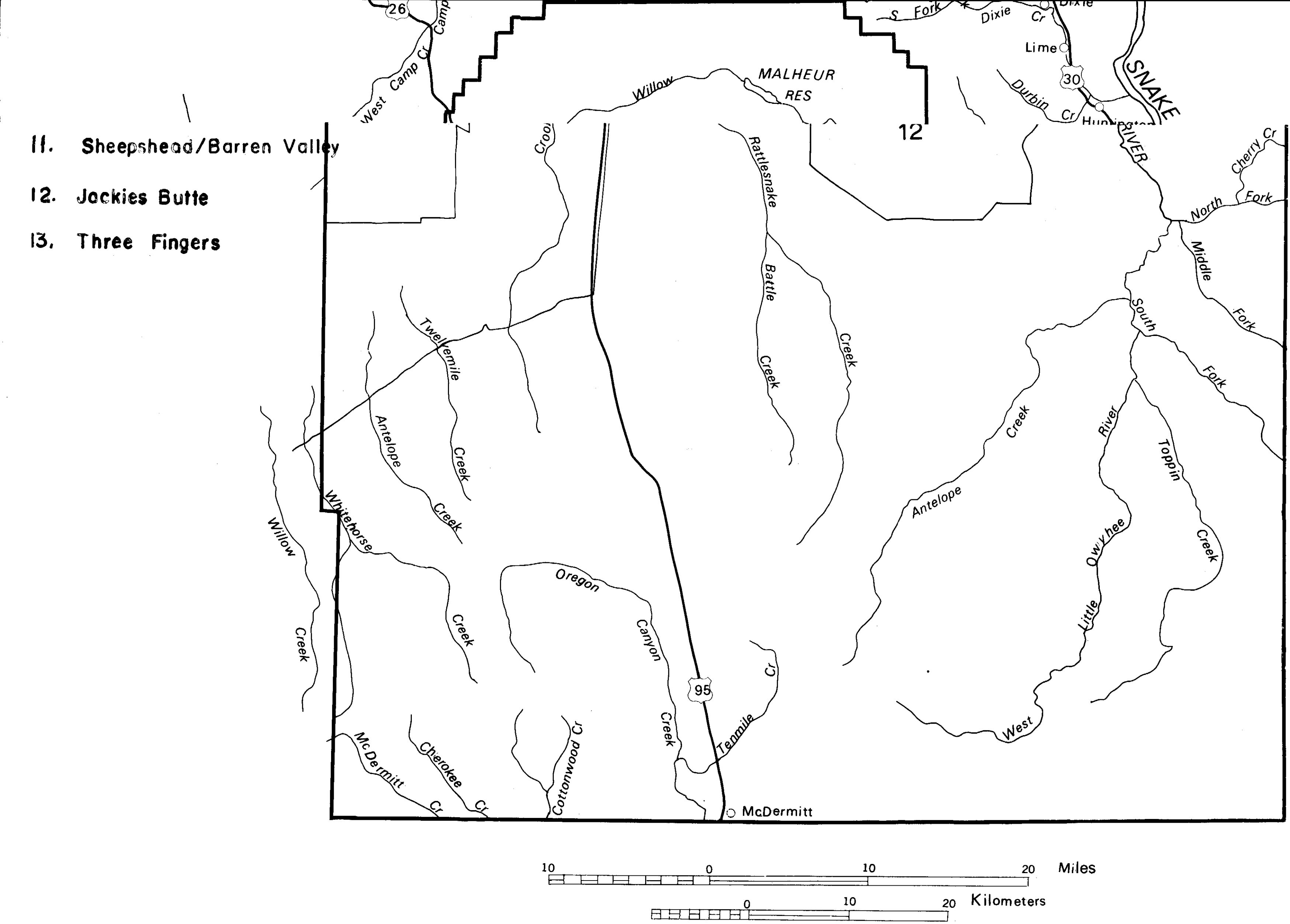

Figure 48.--Wild horse management areas.

Management of the horses has not been attained. They are creatures of habit and reuse the same trails and dusting areas many times; they paw, especially at springs and other water sources (fig. 49). Most will not go through a fence unless they are driven to it; however, many learn to crawl under or get through fences. The survey in 1975 found 181 head outside the management area boundaries.

Conflicts between needs of wild horses and those of other users potentially exist. Perhaps 8 percent of the grazing capacity is reserved for wild horses, and we doubt that any local person wants to eliminate them. However, they damage or cross over fences on snow during the winter. The BLM has scheduled gate-openings, removal of existing fences, and changed patterns of livestock grazing to favor the wild horses--not without concern and extra effort by the permittees. Wild horses, in isolated instances, have kept cattle away from water for short periods, but antelope have been observed at water with them. They pay little attention to coyotes.

An unknown and possible conflict may exist because of overlapping diets with the ruminants. Wild horses consume mostly grass but they do feed on forbs and browse, especially in severe winters and when the grass is gone. They tend to "chase" after the early growth of annual grasses from low to high elevations as the growing season develops, thereby grazing too early and trampling wet soil. Cattle, not permitted on high ranges till summer, perhaps do not overlap with the wild horses on more than 20 to 25 percent of the range. Behavior conflicts between cattle and wild horses appear minor. Competition between the horses and bighorn sheep, antelope, and other wildlife is unmeasured and a matter for speculation only. A major effect is most likely to occur through grazing by horses which changes the available feed and cover for other species.

Recreationists make little onsite use of the wild horses. In one year, two persons separately and one party made pack trips to see the wild horses. Of course, many persons have some satisfaction in knowing that wild horses still exist on the Vale District. In actual fact, they are so well adapted to the terrain that their removal would be most difficult. The major problems are to keep them within the designated wild horse management areas and to prevent them from overgrazing their own habitats. Both problems are current and in danger of intensifying.

WILDLIFE AND FISHERIES

This section borrows heavily from an analysis of the wildlife situation in the Vale District by R. R. Kindschy (1971). Kindschy's paper summarizes available data to 1971. We have leaned heavily on Mr. Kindschy's personal observations in the Vale District since 1958, several years before the program started. He estimated in 1971 that 57,000 big game animals plus numerous upland game birds and nongame wildlife resided in the Vale Program area. The number of species is about 300. His analysis used data collected by the Oregon State Game Commission to determine the impact of the Vale Program on selected wildlife species.

Changes in vegetation because of overgrazing, which resulted in extensive and thick stands of brush with little grass, probably favored mule deer and blacktailed jackrabbit; but populations of both tend to be cyclic. Pronghorn antelope, sagegrouse, and bighorn sheep suffered from the increased brush. Bighorn sheep disappeared from the area about 1914 due to changes in vegetation, hunting, and scabies contracted from domestic sheep. Animal population numbers

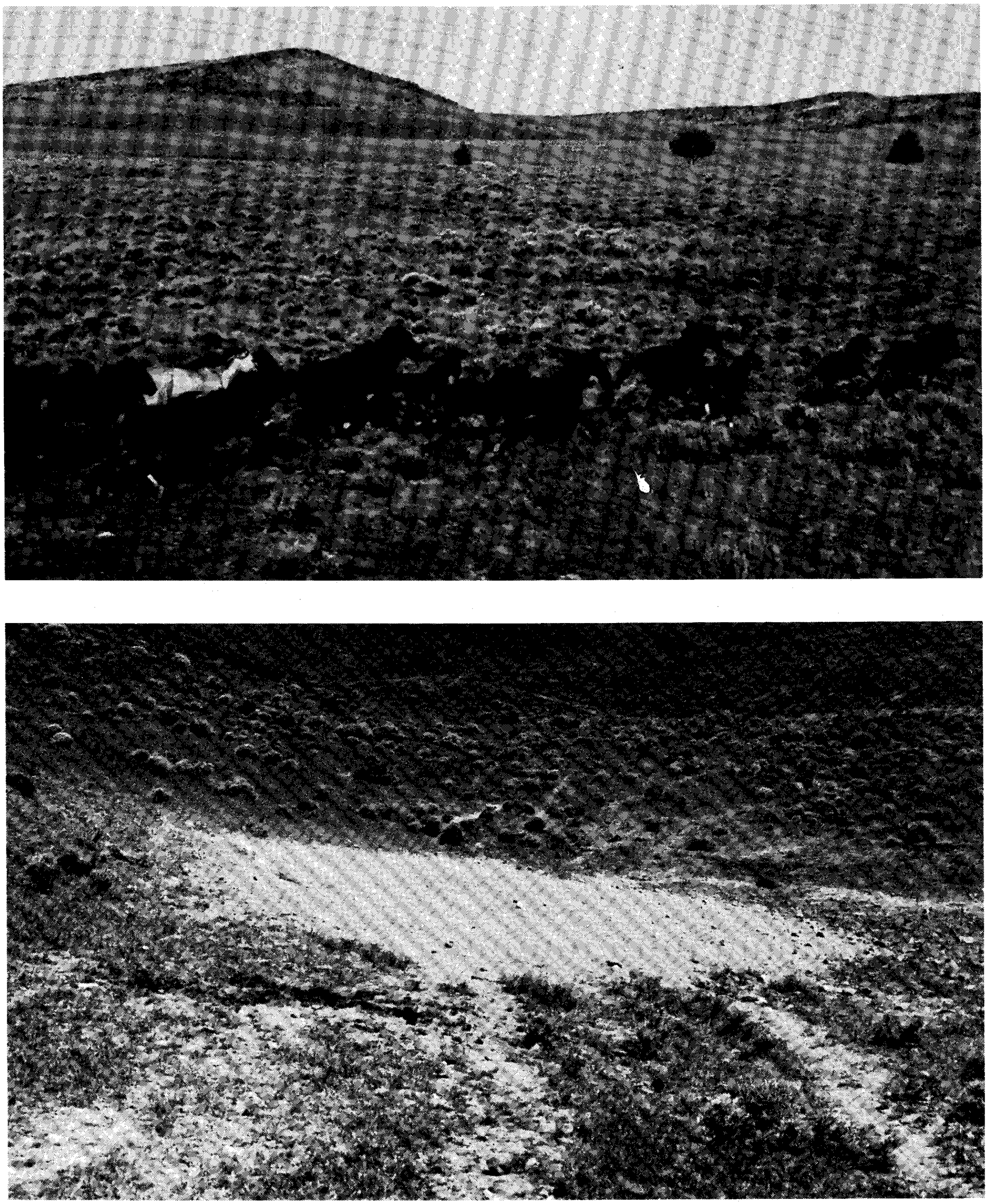

Figure 49.--Wild horses (top) damage the soil by trailing and pawing dust-bath areas (bottom) (Bureau of Land Management photos).

in 1962 reflected 100 years of many kinds of use and abuse. Animal responses to the Vale District Program give us an entirely new set of population numbers, which are analyzed in this section without implied desirability. Each may still be far different from those in the time before domestic livestock.

Mule Deer

Unusually high populations of mule deer occurred in the Vale District in the 1950's, as they did in other western rangeland. Fluctuations in numbers on the district have paralleled those of other districts, except for indications that reduction in numbers since 1973 has not been as severe as elsewhere (fig. 50).

The ratios of bucks to does appear to be decreasing more rapidly, from 36 to 19 bucks per 100 does on the Vale District, than on other areas in Oregon. That, however, is a drop of about 50 percent, just the same in the district as elsewhere in Oregon (table 18). The ratio continues to be higher in the district than in the remainder of Oregon. The number of fawns per 100 does remained relatively stable with a slightly higher ratio in the district than in other parts of Oregon until 1971, when the Vale District herd was highly successful. Fawns per 100 does were lowest in 1962. Low numbers of hunter days and relatively poor hunter success suggest two periods of low deer populations, 1966-68 and 1973-75 (table 19). The first followed a severe winter kill in 1964-65, great reductions in permits for antlerless deer, and reductions in hunting pressure. The reasons for the latest decline are unknown in the Vale District as they are elsewhere.

Figure 50.--Mule deer fawn (photo, courtesy R. Kindschy, Bureau of Land Management, Vale, Oregon).

Table 18--*Mule deer bucks and fawns on the Vale District and on other Oregon areas*

Year	Bucks per 100 does		Fawns per 100 does	
	Vale District 1/	Other Oregon 2/	Vale District 1/	Other Oregon 2/
1960	36	24	75	73
1961	38	20	94	73
1969	20	13	76	69
1970	19	12	74	68
1971	--	--	79	40

1/ Bureau of Land Management.

2/ Oregon State Game Commission annual reports.

Table 19--*Hunting pressure and hunter success for mule deer on Oregon State Game Management units which include the Vale District, Bureau of Land Management, 1961-75*1/

Year	100 hunter days	Hunter days per deer	Hunter success
			Percent
1961 2/	57.3	--	70.8
1962	57.4	8.2	60.0
1963	31.5	5.3	59.0
1964	35.9	4.5	62.0
1965	27.3	6.1	48.3
1966	21.8	4.8	61.3
1967	19.5	4.9	47.3
1968	24.3	4.4	61.8
1969	33.2	5.9	47.8
1970	35.7	6.3	53.0
1971	54.1	10.8	43.8
1972	37.9	15.5	40.8
1973	37.3	14.0	28.3
1974	29.1	16.5	27.0
1975	17.7	16.0	26.0

1/ Oregon State Game Commission annual reports.

2/ Variable length of hunting season and variable limitations in legal bag among years reduces precision of data.

Many management decisions in the Vale District have successfully increased palatable browse. These include seedings of browse, no brush control at all on 11 projects, boundary lines changed to exclude browse from other brush controls, and minimized late summer and autumn livestock grazing on deer winter range. Kindschy (1971) found a 25-percent increase in available browse on 22 transects between 1963 and 1971. Mule deer often find grasses attractive during the winters and springs after fall growth. Crested wheatgrass, cheatgrass, and Sandberg bluegrass often produce sufficient green leaves in mild autumns to furnish feed for deer and other species later. In one example, deer have changed their migrations from the Three-Forks area (4,600 feet or 1 400 meters in elevation) to the Rome seedings (3,500 feet or 1 060 meters in elevation) to take advantage of the new feed. Uncontrolled brush and much browse still grow in the canyons, along the streambanks, and on steep slopes which surround and intermingle with the brush controls and seedings. The combinations of seedings, rejuvenating shrubs on them, and the uncontrolled brushlands appear to be attractive habitats for mule deer winter range (fig. 51). In a comparison of deer use before and after spraying of their summer range, Reeher (1969) found in the one example studied that spraying reduced deer use on a summer range. Seedings apparently received light use by deer except when heavy winter snows forced them to lower elevations.

In the period 1963-71, mule deer were estimated to have decreased from 57,000 to 44,000. These numbers are the broadest kind of estimates as no systematic efforts were made to count mule deer populations. Total herd numbers were determined by a formula which used hunting pressure, harvest data, and percentage of herd removal. After 1971, the general deer decline appears to be slightly less in the district than in other western mule deer herds. In general, mule deer exhibited the decline in population typical of the Intermountain west during the establishment of the Vale District rehabilitation program. They declined no more than in most other places. A conservative view is that the Vale Program had no great impact on mule deer populations.

Figure 51.--A mixture of bitterbrush, big sagebrush, and bluebunch wheatgrass on winter deer range.

Pronghorn Antelope

The dramatic increase in pronghorns during the course of the Vale Program and under increasing hunting pressure has been a most impressive wildlife phenomenon (fig. 52). The population increased 2.6-fold and the hunters by three times without diminishing the hunter success from 1961 to 1975 (table 20). The largest population was reached in 1968. Pronghorn antelope were seldom seen in the early 1900's.

In 1970, the Vale District had 143 percent more antelope than in 1962, but other eastern Oregon antelope populations had increased only 50 percent. A census showed that numbers had increased from 0.9 to 2.0 antelope per mile (1.6 km) of transect on the Vale District but the level of their occurrence was constant in

Figure 52.--Antelope buck (Bureau of Land Management photo).

Table 20--*Numbers of antelope and hunter success in the Vale District, Bureau of Land Management, 1961-1976*

Year	Number of antelope	Number of permits	Hunter days	Hunter success
				Percent
1961	947	--	532	56
1962	1,445	175	386	63
1963	1,800	175	374	60
1964	2,039	200	389	64
1965	2,321	200	448	65
1966	2,615	250	502	73
1967	2,823	250	494	56
1968	3,315	250	500	66
1969	2,840	300	623	70
1970	2,957	500	924	60
1971	2,840	525	1,017	62
1972	2,831	525	991	61
1973	2,956	625	1,166	59
1974	2,504	625	1,164	58
1975	1/ 1,523	625	1,104	52
1976	2,979	625	--	--

Source: Oregon State Game Commission.

1/ Inaccurate census due to weather conditions in 1975.

the remainder of Oregon. The actual hunter harvest increased from 123 to 249 (1961-71) on the district but only from 295 to 387 in the other parts of eastern Oregon during the same period. Each hunter averaged 2.4 days of hunting.

Observations indicate that antelope prefer places where brush has been removed and crested wheatgrass seeded. Young, tender growth of grasses and forbs attracts them. They are frequently seen in areas closely used by cattle.

Nomad alfalfa has been seeded with crested wheatgrass on 56,340 acres (22 818 ha) on 36 separate areas in the Vale District, and it is highly preferred by antelope and other animals (Vale District Manager 1974). The common seeding procedure was to plow sagebrush in the spring, plant crested wheatgrass in the autumn, and aerially spread inoculated alfalfa seed at 1 lb/acre (1.1 kg/ha) the following spring. A survey of 20 of the seedings in 1973 and 1974 revealed that nomad alfalfa composed 10.7 percent of the vegetation present on 12 of the seedings where it was encountered, but it had completely failed or was minor in 8 of the projects. Apparently once established, the alfalfa can persist unless blacktailed jackrabbits dig out the crowns, but its actual persistence is unknown. Our observations suggest less alfalfa present in 1975 than was reported in 1973-74 but the differences may have been due to season or method of sampling. A particularly important characteristic of alfalfa is that it stays green and highly nutritious all summer.

Plowing of sagebrush and seeding to crested wheatgrass attracts antelope for a few years after the operation, probably because of high forb content in the vegetation. Antelope abound on the rehabilitated Cow Creek and Soldier Creek units and on the Antelope Flat and Deer Flat units which are native sagebrush-grass range in excellent condition (Reeher 1969). These animals avoid tall stands of big sagebrush, preferring low stands and the short species of sagebrush. Some ranges do not attract antelope in either the native brush or seeded stands. For example, the Starvation spray-and-seed project, which lies between winter and summer range, received little use by antelope before and after treatment. Antelope moved from the Chicken Creek plow-and-seed project to adjacent areas in the year of treatment, but returned the following year and remained in large numbers (Reeher 1969). It appears that plowing and seeding makes better antelope range than either spraying or spraying and seeding.

Antelope frequently drink at livestock watering points. Undoubtedly, provision of dry-season water has permitted antelope to use areas in the summer which were not formerly available to them. Additional water provided in the Vale Program may have benefited the antelope as much as any other practice. Fences appear not to restrict antelope movements.

Bighorn Sheep

Seventeen California bighorn sheep were reintroduced in November 1965 into the Mahagony unit at Leslie Gulch along the east side of Owyhee Reservoir. The actual count was 53 (11 rams, 25 ewes, 17 lambs) in 1971, increasing from 6 rams, 8 ewes, and 3 lambs in the original group which came from the Hart Mountain Refuge. Over 100 sheep were estimated in the herd in 1974, but cursory search revealed only 20 in 1975 (fig. 53). They are elusive animals, and many could have been missed in the rugged topography. Some were believed to have migrated to new ranges.

Bighorn sheep have not extended their range into the brush controls and seedings but are on native ranges which have improved during the program. Range management practices, including controls of livestock numbers and seasons of grazing, apparently have fostered return of near-climax sagebrush-grass and permitted bighorn sheep to do well. Hunters were allowed to draw for two permits (rams with three-quarters curl or better) in 1973-74 and four permits in 1975.

Rocky Mountain Elk

Migratory herds, estimated at 100 head, enter the district during the winter but numbers vary with severity of winter. Little potential elk habitat, especially summer range, exists on the Vale District and there need be little concern for elk in this area.

Blacktailed Jackrabbits

The last peak in jackrabbit populations in the Vale District occurred in 1957-58 when large numbers invaded farmlands, causing thousands of dollars in losses to the farmers and overuse to rangelands. Neighboring areas in both Oregon and Idaho have experienced subsequent but less severe increases in populations of jackrabbits.

Reasons for the failure of cycling on the Vale District and lack of synchronism with cycles in other districts are unclear. Present jackrabbit populations appear to be low and stable. They are known to prefer brush-covered lands with little grass (fig. 54). The change in range condition from poor to good or excellent for livestock may have greatly reduced favorable jackrabbit habitat in the Vale District. Reeher (1969), after comparing four rehabilitation projects with nearby untouched brushland for 6 years, concluded that the projects did not affect cottontail and jackrabbit populations or their use of an area. Sagebrush cover provided greater winter protection for them than the grasslands.

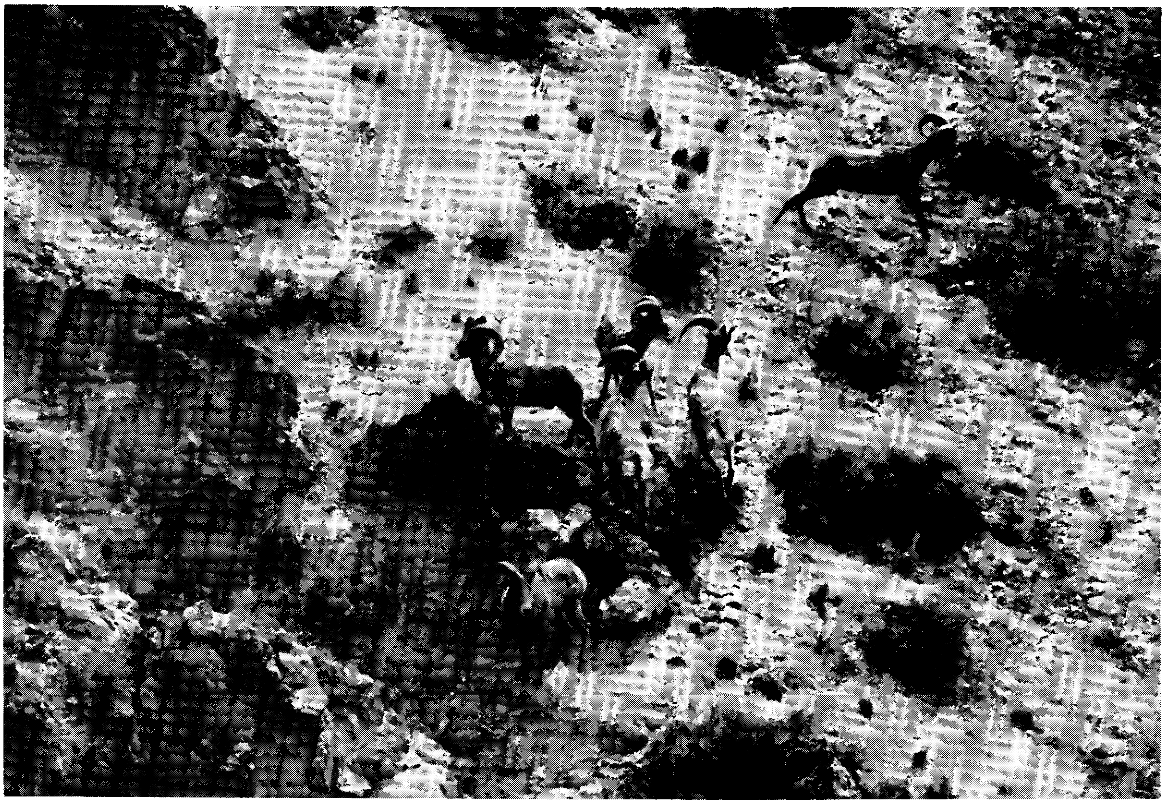

Figure 53.--Bighorn sheep (Bureau of Land Management photo).

Figure 54.--Jackrabbit (Bureau of Land Management photo).

Chukar Partridge

Chukars were introduced into the Vale District in the 1950's and have since found their way to many if not all suitable habitats. Data from the annual reports of the Oregon State Game Commission (1962 and 1970), as compiled by Kindschy (1972), show that the numbers of chukars in the Vale District were higher than in other eastern Oregon areas and that they increased twofold during the Vale District Program but only by one-fifth outside the district (table 21). In 1969, an estimated 48,000 birds were taken by hunters in the Vale District.

Chukars feed on insects and seeds. Cheatgrass and crested wheatgrass seeds commonly occur in their diets, but grass and weed seeds abound everywhere. It is doubtful if the rehabilitation project markedly affected their population numbers (fig. 55). Chukars prefer rocky slopes, talus, and steep escarpments--during winter those facing south. These topographic types were omitted from the rehabilitation projects. The mobility of the birds permits them to feed in the seedings and return to their favorite habitats.

Kindschy (1971) believes that development of water for livestock was the practice giving greatest benefits to chukars. Reeher (1969) found that spraying of sagebrush did not reduce chukar use of an area and may have increased it. Variable use from year to year prevented more definite conclusions from Reeher's study.

Sagegrouse

The population dynamics, ideal habitat conditions, and impacts of rangeland rehabilitation on sagegrouse are little understood in the Vale District. Many thousands of birds inhabited the area in the 1920's and 1930's. They nearly disappeared in the 1940's and 1950's but have been increasing since. The increase was estimated to be over 100 percent from 1961 to 1970, but similar kinds of census data suggested a 60-percent decrease in the remainder of eastern Oregon (table 21). In 1971 the Vale District was the only area in eastern Oregon that had an open hunting season for sagegrouse. The Oregon State Game Commission reported 1,090 sagegrouse taken in the Vale District during the 1969 season.

Table 21--*Average numbers of chukar partridge, sagegrouse, and valley quail counted per 10-mile (16-km) transect of the Vale District Program, 1961-62 and 1968-70*[1/]

Item	1961	1962	1968	1969	1970
Chukar partridge:					
Vale District	42	51	170	126	127
Other eastern Oregon	24	15	28	22	21
Sagegrouse:					
Vale District	69	33	132	92	95
Other eastern Oregon	23	37	15	7	14
Valley quail:					
Vale District	14	8	40	22	29
Other eastern Oregon	40	18	28	8	20

1/ From Kindschy 1972.

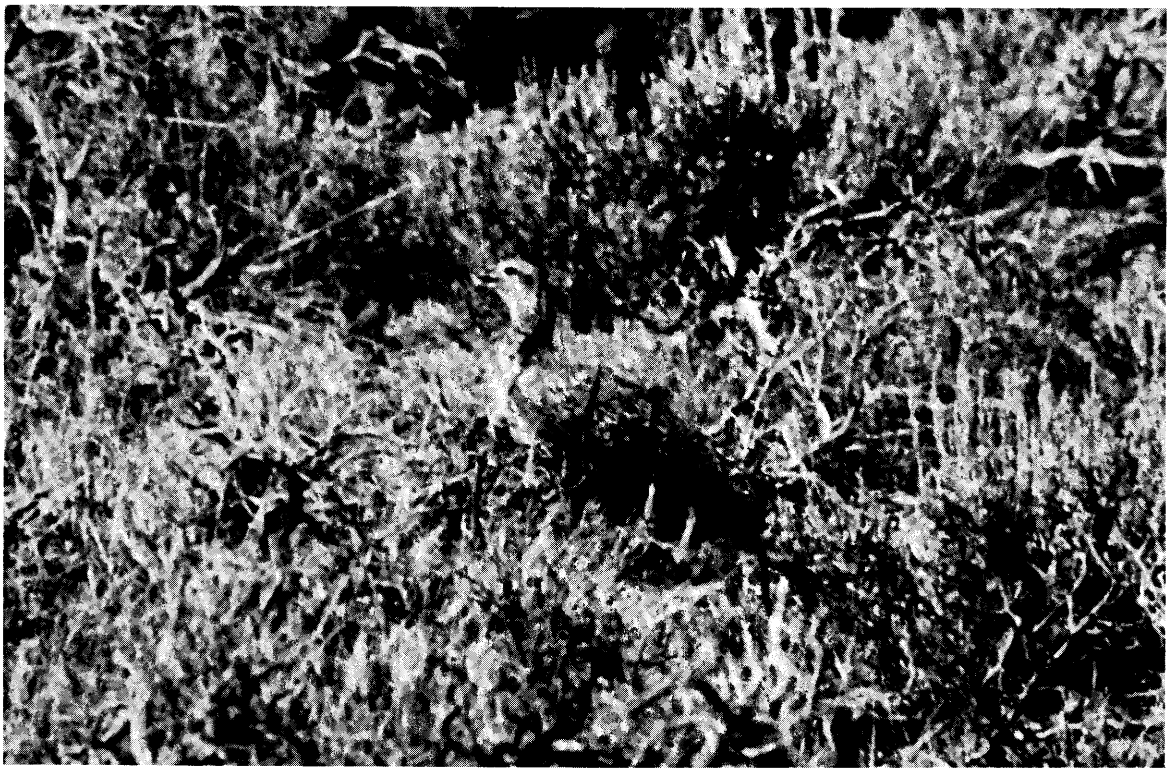

Figure 55.--Top, chukar partridge; bottom, sagegrouse (Bureau of Land Management photo).

Sagegrouse use big sagebrush for food and cover, especially for nesting and in the winter, but apparently large areas of continuous big sagebrush are marginal sagegrouse habitat and reduction of wide expanses of brush causes little loss of their habitats (fig. 55). They need meadows, seeps, and open areas along the valley bottoms as well as the big sagebrush. Many are found along the edges and in hay and grain fields. Concentrations of livestock, which damaged the meadows, may have caused more loss of sagegrouse habitat than overgrazing in wide expanses of brushlands. Reeher (1969) found that spraying and spray-seed operations reduced use by sagegrouse, but it increased following the plow-seed operations. Overall sagegrouse populations are greater than they were before the program began in 1962, a situation not matched in other parts of eastern Oregon.

Quail

Both the valley or California quail and the mountain quail occur in the Vale District. Both species fluctuate widely in population numbers. The valley quail increased during the course of the rehabilitation program (table 21). Lack of data and even of opinions prevents comment on the uncommon mountain quail.

All the rehabilitation projects stated that streambank and other shrub vegetation along the valley bottoms must be retained. Therefore, the principal native cover of the valley quail was preserved. Rotational grazing has fostered more vegetation in sites where cattle normally concentrated along the streams. Improved habitat for valley quail has resulted, but we doubt that the rehabilitation projects reached into the mountain quail habitats.

Waterfowl

Mallard and teal have benefited from at least 624 of the reservoirs on the district, many of which are 1 to 4 surface acres in size. A few have been fenced to exclude livestock use from the pond edges where increased vegetational cover provides nesting sites for waterfowl. Rotational grazing and no spring to early summer grazing often gives the same protection as fencing to the nesting birds but on an irregular basis. Most of the reservoirs should have been equipped with a pipeline and trough for livestock watering and fenced at the time of construction.

The Rock Creek Reservoir, a large, shallow pond near Jordan Valley, and over 200 acres (81 ha) of fenced land around it provide protection for a small population of Canada geese. Construction included 18 islands for nesting sites which are regularly used (fig. 56). In 1971 over 50 goslings were observed at the sites.

Ground Squirrels

Several species, but principally *Spermophilus townsendii*, occur ubiquitously and in large numbers within the Vale District. They prefer the sandy loam soils and lacustrine sediments. Although these rodents usually cycle, high numbers have been sustained since 1968 on several crested wheatgrass seedings near Vale. Forage for livestock may have been reduced but permanent effects on the grass stands appear to be minor. These rodent populations furnish recreational shooting for local residents and their continued abundance has permitted an increase in predators, especially raptorial birds.

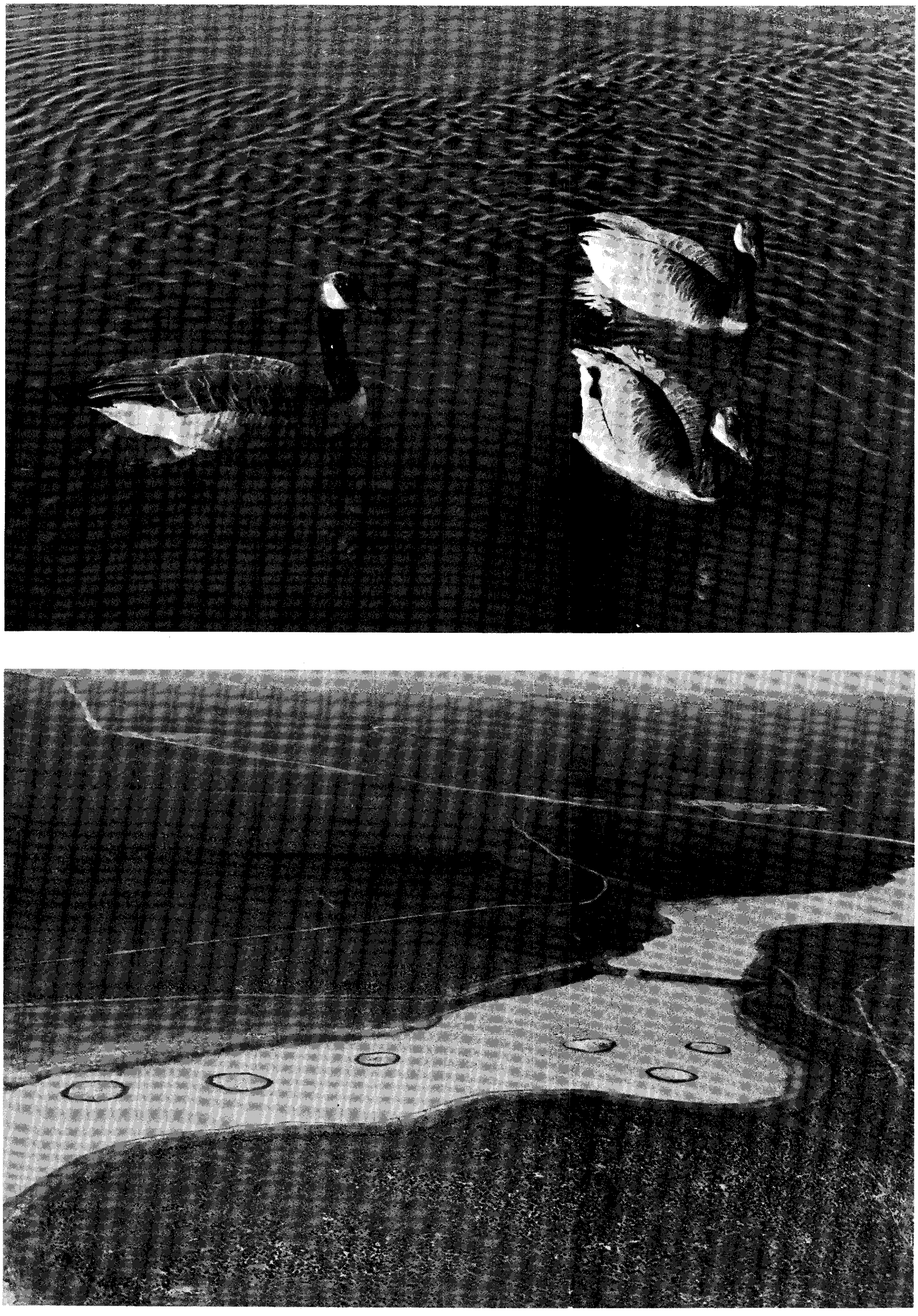

Figure 56.--Canada geese (top) and nesting sites constructed for them (bottom) (photos, courtesy R. Kindschy, Bureau of Land Management, Vale, Oregon).

Raptorial Birds

No census data are available on raptor populations, and none are being collected. Local wildlife people generally agree that populations are higher than at any time they can remember. Numerous golden eagles; rough-legged, redtailed, and marsh hawks; prairie falcon; and several species of owls can be found with little effort. Sustained ground squirrel populations supply their food, and national publicity for preservation has increased their chances for survival.

Other Predators

A recent high in the observed, but not counted, coyote population may be diminishing, as few young animals appeared in 1975. Abundance of ground squirrels and reduced predator controls contributed to the high population; but reasons for a decline, if one exists, are unclear. Bobcat populations peaked about 1960, dipped to a low in 1968-69, and now are believed to be recovering (fig. 57).

Figure 57.--Bobcats (photo, courtesy R. Kindschy, Bureau of Land Management, Vale, Oregon).

A timber wolf (identified at the Smithsonian Institution) was shot in 1973. Mountain lions occur rarely. Badgers and long-tailed weasels associate with rodents, their principal food supplies. Skunks and raccoons depend more on cultivated areas than on native rangelands.

We estimate that effects of the rehabilitation program upon predator populations have been minor. Increases in some species at a few locations might be due to increased rodent populations which in turn resulted from less brush and more grass than in the early 1960's or before. The chain of events cannot be proved because other factors have contributed to the changes. A negative conclusion seems more reasonable--apparently the rehabilitation program has not reduced the populations of predators.

Fisheries

The Oregon State Game Commission takes responsibility for fisheries work within the district, and the BLM actively cooperates with technical assistance and limited project construction. Treatment of both the Malheur and Owyhee Rivers removed nongame or rough fish; and restocking included rainbow trout, smallmouth bass, and channel catfish, with little involvement in the rangeland rehabilitation program.

The Alvord cutthroat trout, a threatened subspecies, occurs naturally in three streams in the Oregon Canyon Range near the southwestern corner of the district. Fencing of critical portions of the riparian habitat has been accomplished through special funding and the fish has been successfully released in other suitable habitats. Trash catchers in some of the streams result in resting pools for improved pool/riffle ratios.

The Vale District contains approximately 6,500 surface acres (2 630 ha) of natural lakes and reservoirs, many 2 to 5 acres (0.8-2.0 ha) in size. Some have been fenced and planted with rainbow trout. The BLM constructed Squaw Creek Reservoir specifically for a fishery, and it has been a successful recreational project.

Since livestock naturally congregate along the streams and damaged these locations in the past, only intensive rangeland practices can successfully repair many riparian sites. On the Vale District, rotational systems of grazing and abundant forage on thousands of acres have reduced grazing pressure and permitted vegetation to return on streamside sites, the water to carry fewer sediments, and streambed scouring to decrease. More places have flowing water throughout the summer. Fencing of some areas is still needed to allow full growth of riparian vegetation. Sport fishing as provided, protected, and improved by the Vale District Program has become a popular activity in the region (fig. 58). Many drive miles over poor roads to fish in a relatively small pond.

An Overall View

Wildlife data available to support the analyses and conclusions in this section leave much to be desired. Few numbers were available for the periods before 1962 and after 1971. Many projects started after 1971, and the effects of all extended beyond that time. Our statements use those data, views expressed by wildlife biologists, and our own assessments. We believe that antelope and sagegrouse have benefited by the project treatments, although their numbers and

Figure 58.--A constructed reservoir which has been protected to provide wildlife and fish habitats (photo, courtesy R. Kindschy, Bureau of Land Management, Vale, Oregon).

and their movements may have been temporarily interrupted or even changed. Mule deer numbers may not have changed greatly, although we suspect favorable responses before 1971 and less decline in the herd on the Vale District than in other places after 1971. Many mule deer in the district depend in part on hay meadows, grain fields, and other irrigated crops, which were only indirectly influenced by the rehabilitation projects. Widespread native range improvement but not rehabilitation projects *per se* contributed to the successful release of bighorn sheep. Sagegrouse have increased, although their numbers are still small. Valley quail expanded in both range and numbers during the program. Water and streamside site management practices have improved the fisheries and quail habitat. We find every animal species on which data or opinions existed to have increased or to be unchanged because of the Vale District Program.. The collared lizard may be an exception as it prefers bare ground, much less of which exists since the program ended. Perhaps the large areas of grass discourage jackrabbits. Our concern is the continued lack of pertinent data on the wildlife responses to particular factors which cause change.

The importance of the management of public lands for wildlife has gradually increased in the Vale District Program during the last 20 years, largely because of three factors: (1) A professional wildlife manager has been a part of the team throughout the program. (2) Increased knowledge of wildlife requirements has accumulated. (3) The public has demanded that attention be given to wildlife. The continuing inability of professional people to predict effects of rehabilitation practices on wildlife populations in the district contributes more than any other factor to controversy between wildlife enthusiasts and other land users.

Another problem is the lack of a conceptual framework which allows consideration of all vertebrates in the planning process and the retention of an emphasis on management of a single or a few species. Still another problem is the lack of a definition of "ideal habitat" for each species. If ideal habitat were known, it could be attained through land management (Thomas et al. 1976). These problems define specific needs and work is beginning on this subject by a team in the district. Continued generalized criticism by one user group of another will not help attain these needs whether they are wildlife vs. livestock or some other multiple use controversy.

The full integration of wildlife planning into the management of rangeland on the Vale District should recognize several realities: (1) Livestock grazing is, and likely will remain, the principal land use of the district; (2) wildlife management is the management of habitats, mainly vegetation, because public land administrators and private landowners cannot by law control wildlife numbers; (3) livestock grazing management constitutes a powerful tool in the favorable management of habitats for wildlife; (4) viable populations of wildlife and reasonable livestock production will result from coordinated effort. The managers of rangeland need to be able to predict impacts and outcomes of each of their actions before doing or not doing a job.

THREATENED AND ENDANGERED SPECIES

Species of vertebrate mammals in southeastern Oregon which have been listed as threatened and endangered are Merriam shrew, white-tailed jackrabbit, Richardson ground squirrel, little pocket mouse, northern grasshopper mouse, and the sagebrush vole (Dyrness et al. 1975). All but the white-tailed jackrabbit appear to be in low numbers due to natural causes. That publication also includes a list of references that describe the species and where they might be found. A study is underway to determine if the long-billed curlew should be added to the threatened list. The bird nests in grass stands on alkaline soils along the Malheur River west of Vale. Data on either good or bad influences on these species resulting from the Vale District Program, or any management program, do not exist.

A list of vascular plants of special interest includes 17 species (table 22), 10 of which occur on the national list of threatened and endangered species prepared in 1974 (Smithsonian Institution 1974). A majority of those plants were originally collected on bluffs and in the canyon of the Owyhee River, which provides maximum protection from grazing, fire, and other land management practices. The canyon wall effectively prevents livestock use, and man himself can reach much of the area only with great difficulty. It is and will remain an effective wilderness or research natural area, even without official designation. The Jordan Craters were set aside in 1975 as a Research Natural Area.

Gathering of field data on threatened and endangered species of all kinds in the Vale District constitutes a continuing study which should be funded separately and justified on its own values. Very likely, more species would be found in such a study than are presently on the lists.

Table 22--*Vascular plants that may be threatened and endangered in the Vale District*

Species	Distribution
Astragalus iodanthus var. *vipereus*	Bluffs, eastern Malheur County
Astragalus mulfordae[1/]	Dry sandy ground, lower Owyhee River, eastern Malheur County
Astragalus nudisiliquus	Gravelly bluffs, northeastern Malheur County
Astragalus purshii var. *ophiogenes*[1/]	Sagebrush desert, Owyhee River, Malheur County
Astragalus solitarius[1/]	Usually in sagebrush, Owyhee River, Malheur County
Astragalus sterilis[1/]	Clay hills, Succor Creek, Malheur County
Cryptantha propria	Dry hillsides, northern Malheur County
Cymopterus corrugatus[1/]	Dry hills, southern Malheur County
Eriogonum novonudum[1/]	Stony clay hills, eastern Malheur County
Eriogonum ochrocephalus ssp. *calcareum*	In loose, white volcanic ash, Malheur County
Hackelia cronquistii[1/]	Unknown
Hackelia ophiobia[1/]	Cliffs, Three forks of Owyhee River, Malheur County
Hackelia patens	Between Vale and Harper, Malheur County
Mentzelia mollis[1/]	Clay slopes, eastern Malheur County
Mirabilis bigelovii	Canyon of Owhyee River, Malheur County
Silene scaposa var. *lobata*[1/]	Unknown
Trifolium owyheense	Dry slopes, Succor Creek, Malheur County

Source: Dyrness et al. (1975).

[1/] Species list of threatened and endangered plants (Smithsonian Institution 1974).

Table 23--*Major recreational areas in Malheur County dependent on lakes*

Name of facility	Nearest town	Surface acres[1/]	Improvements	Species	Access
Antelope Reservoir	Jordan Valley	3,000	Park, Bureau of Land Management	Trout	Dirt roads
Bully Creek Reservoir	Vale	1,000	Boat ramp and park	Trout	Oiled road
Beulah Reservoir	Juntura	1,900	Boat ramp	Trout	Gravel road
Batch Lake	Jordan Valley	50	None		
Coyote Hole Reservoir	McDermit				
Cow Lakes	Jordan Valley	975	Boat ramp Picnic facilities	Trout	Gravel road
Chapman Reservoir	Riverside	18		Bass	Dirt road
Dunaway Pond	Adrian	5		Bass-bluegill	Dirt road
Granite Creek Reservoir	Riverside	15		Bass	
Littlefield Reservoir	Harper	34		Trout	
Malheur Reservoir	Brogan	1,400	Roads, pit toilets	Trout	Gravel road
Murphy Reservoir	Beulah-Juntura	15		Trout	Dirt road
North Indian Creek Reservoir	Westfall	40		Trout	Dirt road
Odom Reservoir	Jordan Valley	40			
Owyhee Reservoir	Nyssa	12,700		Bass-crappie	
Leslie Gulch	Adrian			Bass-crappie	Gravel
Dry Creek Arm	Vale			Bass-crappie	Dirt
Resort and State park	Nyssa		Boat ramps Picnic and overnight	Bass-crappie	Paved
Deadman's Gulch	Vale		Airstrip	Bass-crappie	Road not passable
Pole Creek Reservoir	Brogan	60	Pit toilets	Trout	Dirt road
Rattlesnake	McDermit	10		Trout	Dirt road
South Cottonwood Reservoir	Harper			Trout	Dirt road
Squaw Creek Reservoir	Harper			Trout	
Vaughn, South Indian Creek	Westfall	50			Dirt road
Warm Springs	Juntura-Riverside	4,400	Boat ramp and overnight, etc., in Harney County	Trout-perch Bass	Dirt and gravel road

[1/] 1 acre equals 0.405 hectare.

RECREATIONAL USES

The proposal for the Vale District Program stated that 55 tracts would be developed for recreational purposes (fig. 59)--42 were essentially water- and canyon-based sites to be developed for family camping, picnicking, hunter camping, and scenic qualities. Plans called for facilities such as parking, tables, sanitation, and potable water. The other 13 sites included a historic monument, wilderness areas, and natural preserves. Certainly, most of the planned roads, cattle guards, and many of the small reservoirs could have been listed for their values to recreationists. Recreational use in 1961 amounted to 60,000 visitor days.

Recreationists generally congregate around large bodies of water, such as the Owyhee, Antelope, and Bully Creek Reservoirs, for three main purposes--camping, boating, and fishing (table 23, fig. 60). Hunting brings large numbers of persons to the public lands, many from outside the county. River rafting on the Owyhee has recently increased. Rock hounds from all over the United States are increasing their searches for geodes, petrified wood, agates, jasper picture rocks, and other minerals. Traffic counters now record roughly 250,000 visitor days per year in the Vale District, four times the number in 1961.

During the 15 years since the original recreational survey and planning, many changes have become necessary. Perhaps no more than half of the original sites were completed as recreational facilities. For those that were, construction of

Figure 59.--Chukar Park illustrates a well-developed and posted recreation site (Bureau of Land Management photo).

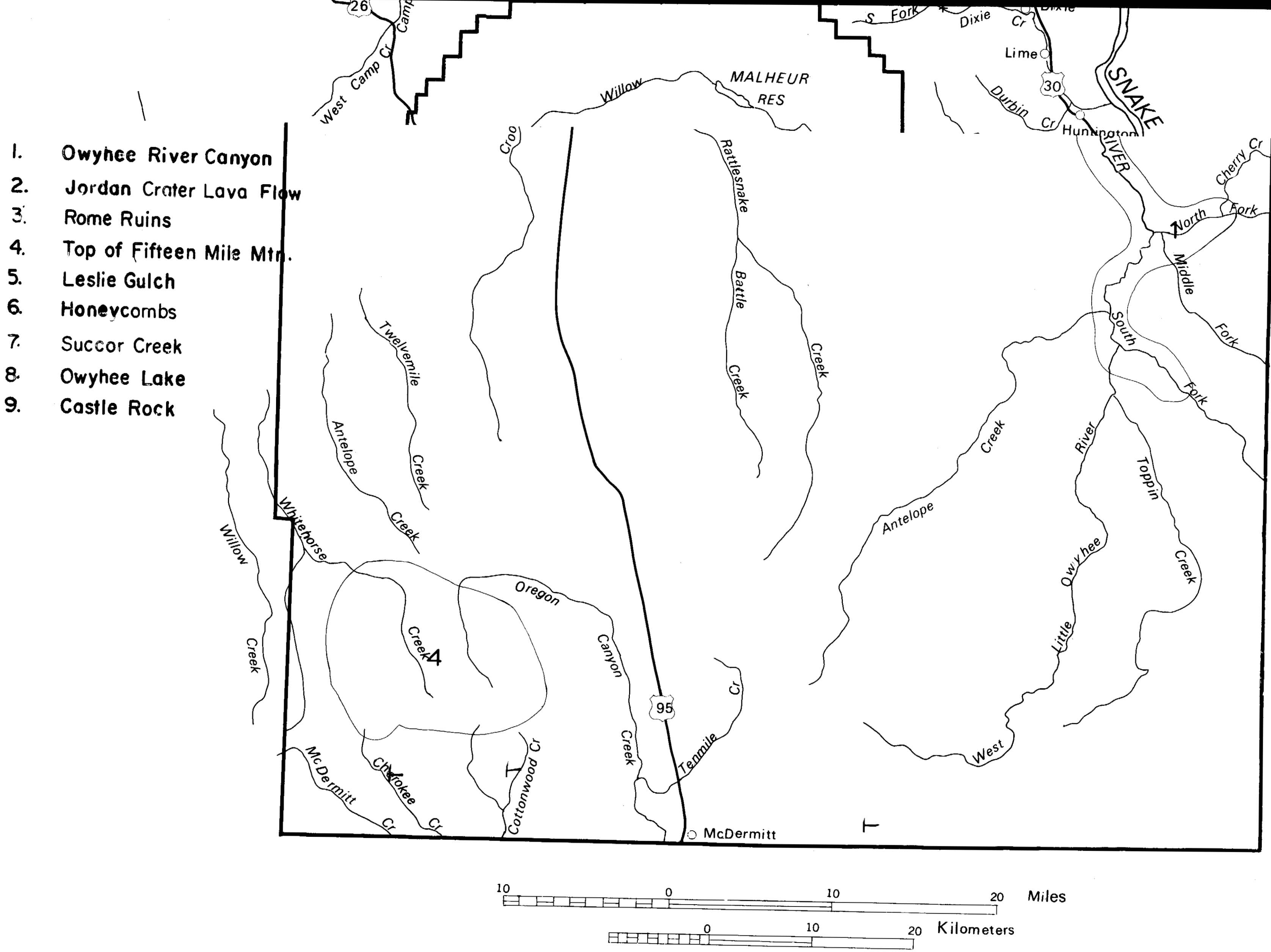

Figure 60.--Recreational facilities.

water and sanitation facilities presented more difficult problems than were expected. BLM pays costs of vandalism, maintenance, and garbage collections. The recreational public's user fees do not help defray those costs. Construction and maintenance of camping facilities have been changed to meet the needs of users as they were demanded, rather than in planned development in the hope of attracting users. For example, an accurate inventory of all the recreational facilities does not exist and we found no plans for short-range developments. Table 23 is incomplete.

Several conflicts between recreationists and other users resulted in major land use decisions for recreational benefits. The tendency for transients to leave gates open has resulted in construction of cattle guards. Stockmen rightly continue to complain about open gates. Cattle need to be eliminated from grazing and travelling through campgrounds, which requires fencing and cattle guards. The road system was expanded during the course of the program, giving recreationists greater access to hunting areas and other facilities; it also gives motorized cattle rustlers greater access. Increasing recreational use results in more wildfires which cost ranchers the forage and BLM the firefighting efforts. We find these problems to be relatively minor and that modifications in fencing and in pattern of grazing cause few difficulties. Stockmen, however, find vandalism on water, fences, and livestock to be a problem, but their complaint is against people, not necessarily recreationists.

Overall, the Vale District Program has benefited recreational users directly through increased roads and reservoirs, and indirectly through better wildlife habitats. Grazing use by livestock places few restrictions on recreationists. On the other hand, recreationists need to be more responsible than they now are.

NATIONAL HERITAGE

Numerous items, located on public and private land in the Vale District and characterizing national history, should receive increased attention. Historical sites, such as the Oregon Trail from the mouth of the Boise River into Snake River through Vale to Farewell Bend of Snake River; Meek's Cutoff following the Malheur River west from Vale; the Boise-Jordan Valley-Winnemucca stage route; and the Oregon Central Military Road westward from Jordan Valley to the Rome Crossing and Camp Smith attracted people during 1976 but not many in other years. Old houses, stage stations, graves, and the like along these routes warrant an inventory and preservation. These trails should have signs for all to see and remember.

The archeological heritage in the Vale District has never been surveyed. Examinations in 1976 along the lower Owyhee River disclosed many unknown sites of former Indian occupations. Excavations in the Dirty Shame Rock Shelter southwest of the three forks of the Owyhee River uncovered artifacts of very early civilizations in the Western United States. The Vale District is a rich and promising area for further archeological exploration.

The range rehabilitation projects before 1969 did little to protect archeological values and may have inadvertently destroyed or damaged a few sites. Springs attracted early American man, as they do his counterpart today. Livestock, trails, and roads followed the routes from one water project to the next. Therefore, spring developments and reservoirs may have covered, destroyed, or damaged important sites. Onsite archeological examinations before treatments began about 1969. Archeological values must continue to be considered in locating range improvements. The Vale Program was finished before these national heritage values became great public issues; so now an intensive and immediate survey is needed to prevent further losses.

OCCUPANCY

Much less pressure exists in the Vale District than in other regions to allow building of houses, hotels, restaurants, and other structures for use by recreationists and by those who want a summer or retirement home. Coincident with increased recreational usage, more and more permits will be requested to build accommodating structures for them. This appears to be an issue related to the rangeland rehabilitation program only to the minor extent that it has increased recreational use.

MINING

Mineral resources on the Vale District do not contribute significantly to the local economy nor greatly influence other users. Historically, gold has been mined in Malheur County near Jordan Valley and the historic town of Malheur City, silver mining occurred in adjacent counties, and mercury deposits have been sporadically exploited. Small operations mine sand, gravel, and building stone. Geothermal power leases now suggest a potential resource. Currently, diatomite is mined near the town of Westfall with a significant impact on nearby vegetation. The existing mining laws permit removal of a large hill of diatomite located in the Bully Creek seeding. Mine spoil materials cover many acres, making the adjacent seeding only half usable (fig. 61). Rehabilitation of this site will be difficult.

WATERSHED

Lack of water of good quality limits agricultural and industrial development in the Vale District. Earlier sections of this report described the climate and effects of water on livestock distribution. The livestock industry and agriculture in Malheur County use water, amounting to about one-half million acre feet (617 million m^3) annually for irrigating pastures, haylands, and crops.

Precipitation limits average annual runoff from the Vale District to an estimated 114,425 acre feet (133 million m^3) (Bureau of Land Management 1974). Yearly amounts flowing down Bully Creek, 1,000-40,000 acre feet (1.2-4.9 million m^3), illustrate the high variability of the runoff. About 75 percent of the irrigation water used in the district comes from the Snake River. Not all irrigable lands in the district have sufficient water and no additional land appears to be susceptible to economic development. Municipal and industrial water is adequate.

Fewer than 250 parts per million (p/m) of dissolved solids occur in the upper Malheur River water. Near Willow Creek east of Vale, and in some of the poorest range in the district, the sediment concentrations vary from 1,000 to 5,000 p/m. Highly alkaline soils occur, contributing to an apparent erosion problem. Jordan Creek has increased sediments during the season of high runoff.

Erosion and its control formed a major thrust of the Vale Program. Although baseline sediments in streams and erosion due to natural processes are unknown, erosion was a problem before the program started.

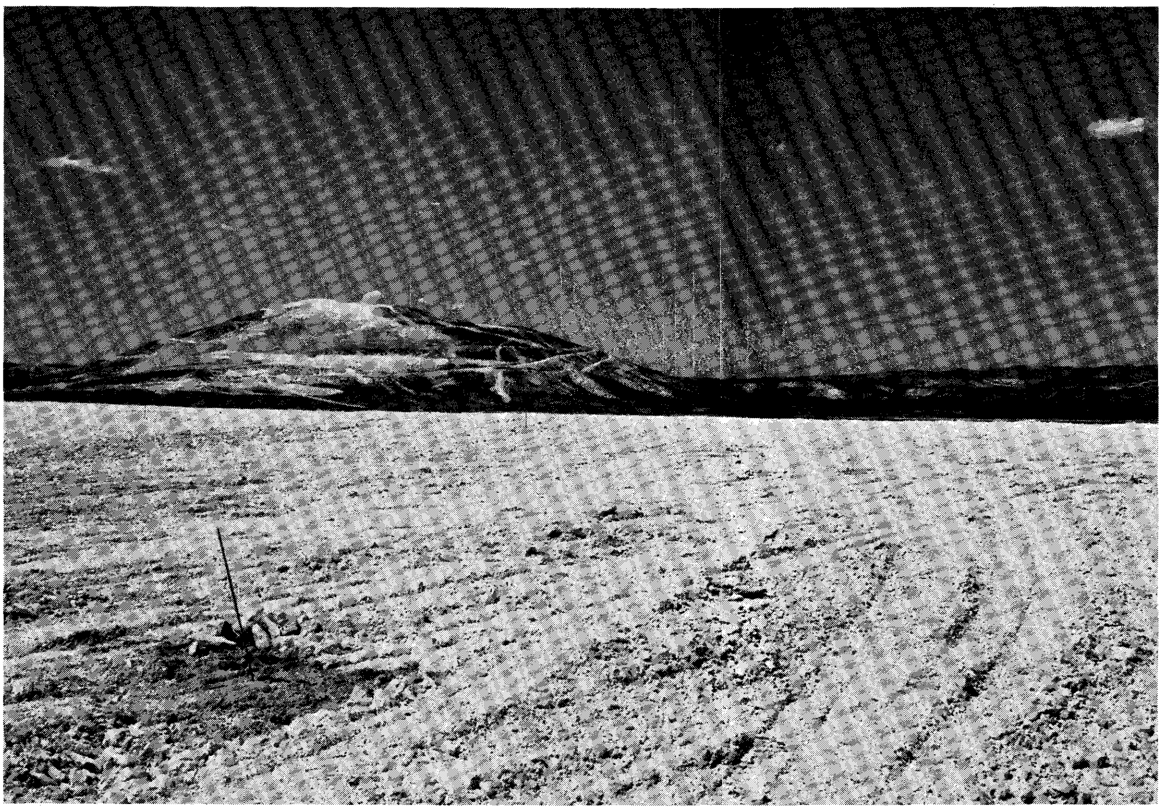

Figure 61.--Strip mining for diatomite will eliminate the hill in the background. The spoil covers a seeding of crested wheatgrass in the foreground.

Soil surface conditions provide the first line of defense against excessive runoff and erosion. Live vegetation and litter retard runoff and increase infiltration. Less of the water that enters the soil is lost by evaporation and more used by plants, appears in springs, or filters to the groundwater when the soil is covered. The extent to which the Vale District Program reduced erosion and changed the pattern of water discharge through increased soil cover should be evident in altered flows of the Malheur and Owyhee Rivers, in less sedimentation of streambeds, healing of gullies, and less sheet erosion. The only flow data available, to our knowledge, comes from regular water measurements in the Malheur and Owyhee Rivers. The highly variable nature of the flows masks any changes in flow that might be due to the rehabilitation program.

Only local areas, for example, Sand Hollow with unstable soil and a naturally high erosion rate, still have active gully formation. Nearly all the district shows evidence of past erosion. Gullies healing with sagebrush and perennial grass in the bottoms are common (fig. 62). No documentary evidence of decreased sediment input into the Snake and Owyhee Rivers could be found, but such a reduction certainly exists because of the healing gullies.

The Jordan Valley plot referred to previously, where nearly all grazing has been excluded for 40 years, serves as a benchmark for the evaluation of the interaction of grazing and sheet erosion. No significant erosion occurs either inside or outside the fence, the plants tend to be pedestalled in the exclosure, but this is due to the natural accumulation of organic matter within the plant bases and not to erosion.

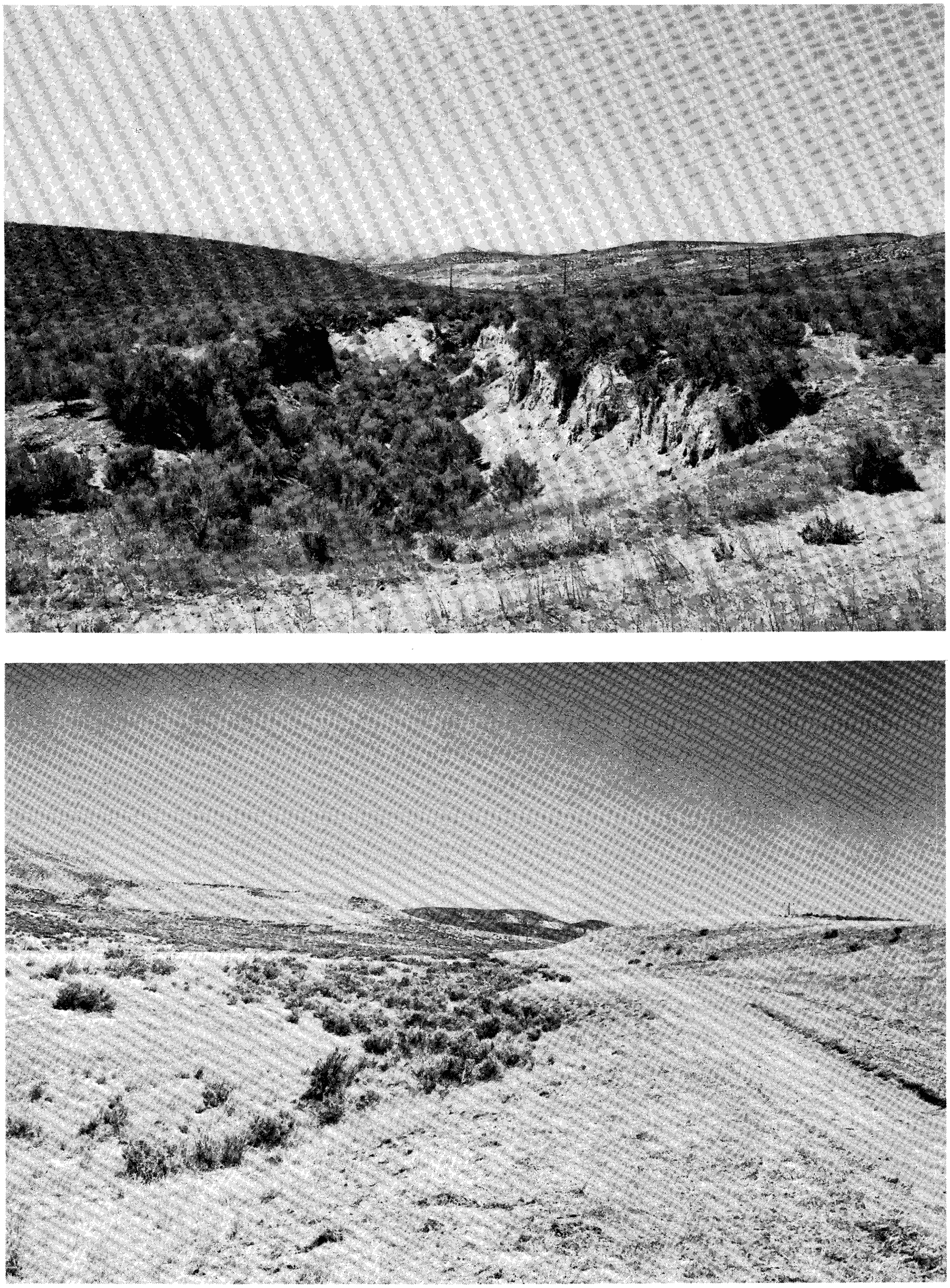

Figure 62.--Gullies due to excessive runoff being healed with big sagebrush and grasses. Note that the road in lower photo shows little evidence of erosion.

The district soils appeared well stabilized in 1975. Halting of excessive erosion, as a first priority in the Vale District Program, has been accomplished over a vast majority of the district lands. This benefit to the life of the reservoirs, to the aquatic life, to the quality of water, and to all downstream users of water, although unmeasurable in dollars, has great value. Recreational vehicles may cause as much soil damage and erosion as any other use (fig. 63).

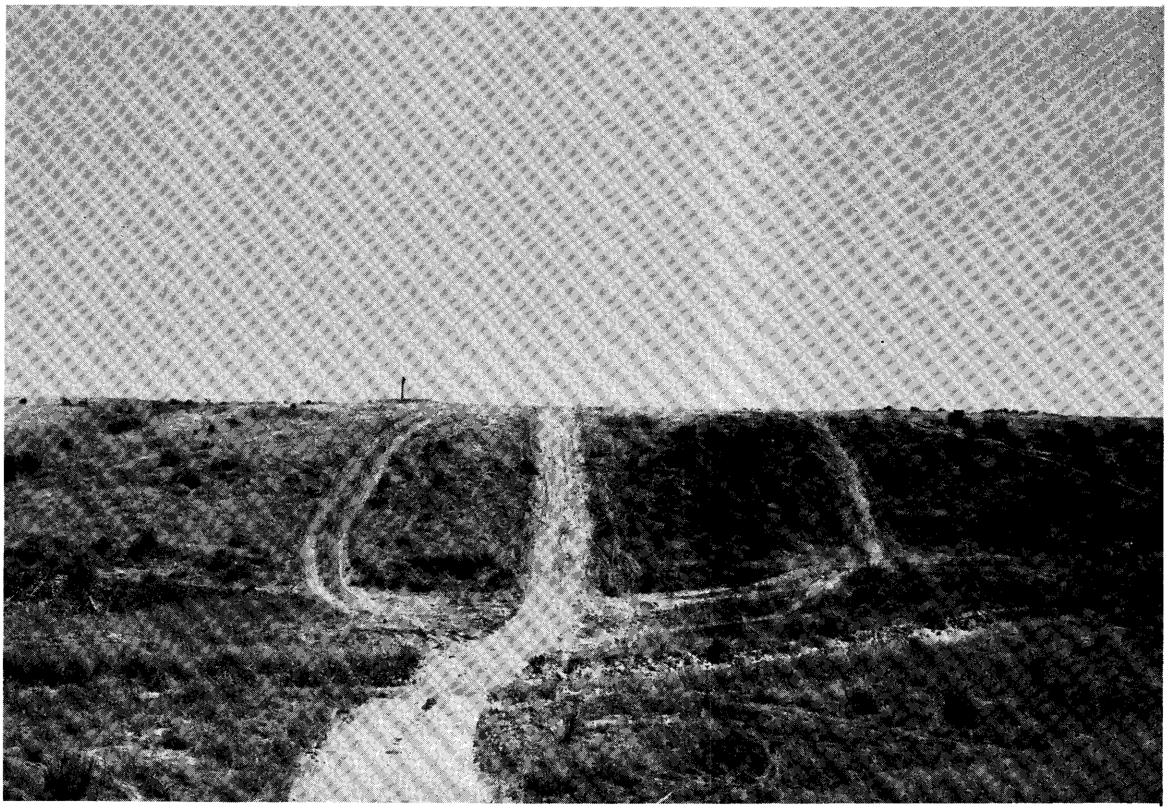

Figure 63.--Damage to soil and vegetation caused by recreational vehicles.

Costs and Benefits of the Vale District Program

The Vale Program presents a remarkably complex set of problems in economic analysis which, with the exception of strictly forest uses, encompass most situations encountered in evaluating the multiple uses of natural resources. Grazing by livestock dominates the economic and multiple use nature of the program.

The question "Was the Vale Program a cost effective investment of Federal funds?" does not yield to simple analysis. Two Ph. D. dissertations have considered livestock production and use of forage for a few years and on only a portion of the district (Nielsen 1965, Godfrey 1971). Other publications (Nielsen et al. 1966; Stevens and Godfrey 1972, 1976) also discuss the economics of rangeland rehabilitation on the Vale District for livestock production.

Stevens and Godfrey (1976) in their analysis of the economics of the Vale Program included only 20 of the 147 allotments for the period 1960-69. Data from individual projects were readily available for that timespan and those areas. They found rehabilitation costs per acre to be $4.57 ($11.29/ha) for spraying, $7.59 ($18.75/ha) for spraying and seeding, and $12.96 ($32/ha) for plowing and seeding. Improvements on native range cost $0.32/acre ($0.79/ha) (table 24). Per acre (0.405 ha) costs varied for several reasons. The period 1960-69 covered nationwide fluctuations in price levels. Costs were functions of project size, and travel or other difficulties resulted in a few projects having extremely high costs. The incomplete data available for the entire program and for most specific projects suggest that Stevens and Godfrey selected the most accurate data obtainable.

Table 24--*Average costs of range improvements per acre*[1/] *on 20 Vale District, Bureau of Land Management, allotments between 1960 and 1969*[2/]

Improvement	Spraying	Spraying and seeding	Plowing and seeding	Native range
		Dollars		
Rehabilitation	2.23	4.69	8.56	--
Fencing and cattle guards	.95	1.20	2.03	0.16
Water development	.57	1.16	1.76	.14
Other	.82	.53	.61	.01
Total	4.57	7.58	12.96	.33

[1/] 1 acre equals 0.405 hectare.

[2/] From Stevens and Godfrey (1976).

Many economic analyses remain undone. We will not attempt a detailed cost/benefit analysis of specific practices and benefits within the Vale Program. That has been started by others, and it deserves separate funding and more attention than we can give it. We take an overview by attempting to evaluate the importance of several economic factors by drawing attention to areas needing further study and by advancing results which are pertinent to the question above on cost effectiveness of the whole district program. Benefit/cost analyses of the separate projects and of the separate management practices should be done to facilitate further study into interactions, trade-offs, and decisionmaking.

Three inherent rangeland conditions and the assumptions based on them alter the analysis of benefits and costs. First, the benefits accruing from a project do not depend on independent production functions; for example, forage removal by livestock affects subsequent forage productivity. Forage production increased on untreated pastures because of the additional use made of the treated areas. The native pastures also improved in response to enlightened management of livestock without the introduction of treated areas or without capital investments in rehabilitation practices. Since only 10 percent of the Federal rangeland in the district received any kind of land treatment, an increase in potential productivity of the whole district appears slight. The main result of the Vale Program could have been to speed the rate of recovery, not the extent of it. Stevens and Godfrey (1976) attempted to deal with this problem in their simple model to explain the interdependency of pasture treatments.

A second assumption or condition is that the Vale Program was conceived, justified, and established as a coordinated set of practices for increasing forage production over the entire district. For example, a proposed project in the north may not have been on as favorable a site as one in the south; yet the northern site was selected to spread the benefits throughout the district. Thus, cost/benefit analysis of an individual project may not truly indicate its worth within the whole program. This point is especially important because livestock may be shifted from one part of the district to another.

Third, the results from the whole district program form the basis of analysis--just as a whole ranch operation must be used to determine ranch profits. A benefit/cost analysis of a range practice on Federal land may be used in a study of both a ranch business and the district program. The conclusion reached in the two situations may be completely different because the benefits occur in two different systems; for example, the benefits of water development on the Federal land have different values in the contexts of ranch and district. One does not measure the other.

Our estimate of the effectiveness of the Vale Program as an investment of public funds used a simple economic analysis--we estimated and compared cost effectiveness under alternative management plans (fig. 64).

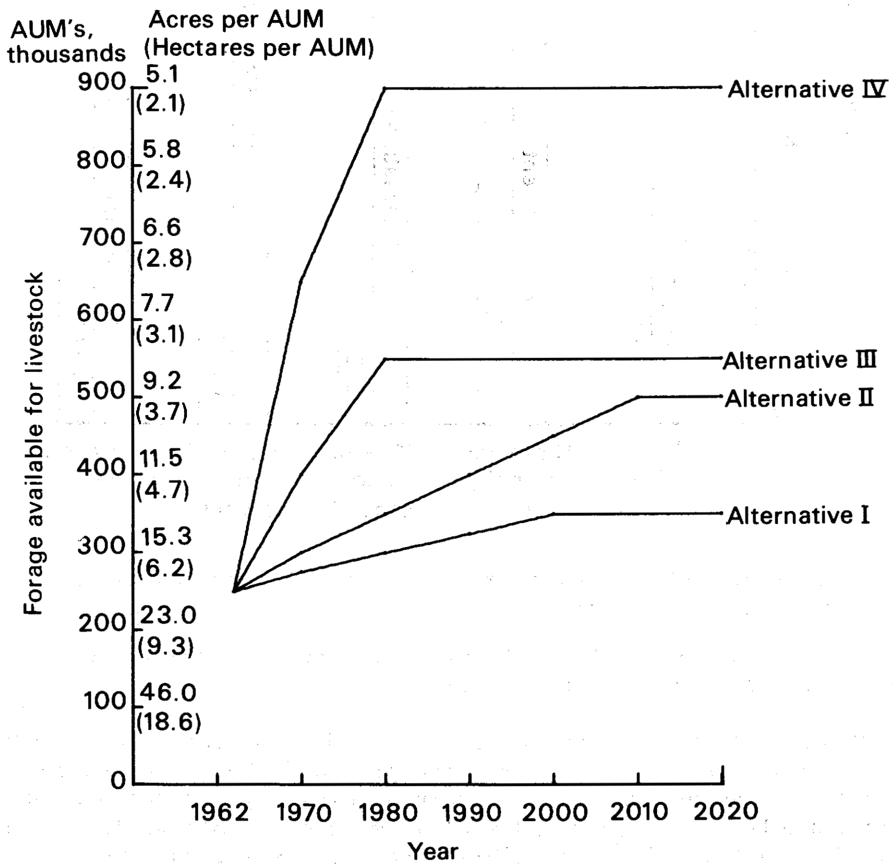

Figure 64.--Forage available for livestock under alternative management programs.

Estimation of forage production (Aum's) on the Vale District has been and will continue to be a largely subjective exercise. Before each project commenced, an estimate of grazing capacity was made by experienced field personnel. BLM annually estimates forage production (table 12) by adding estimated AUM's for individual allotments. Each allotment capacity, in 1975 for example, was the actual use (AUM's) adjusted upward or downward by the number of AUM's that would attain proper use. Management objectives and annual variability in production influence the objectives. Figure 65 gives estimated grazing capacity in acres per AUM for various treatments, untreated areas, and the Vale District as a whole.

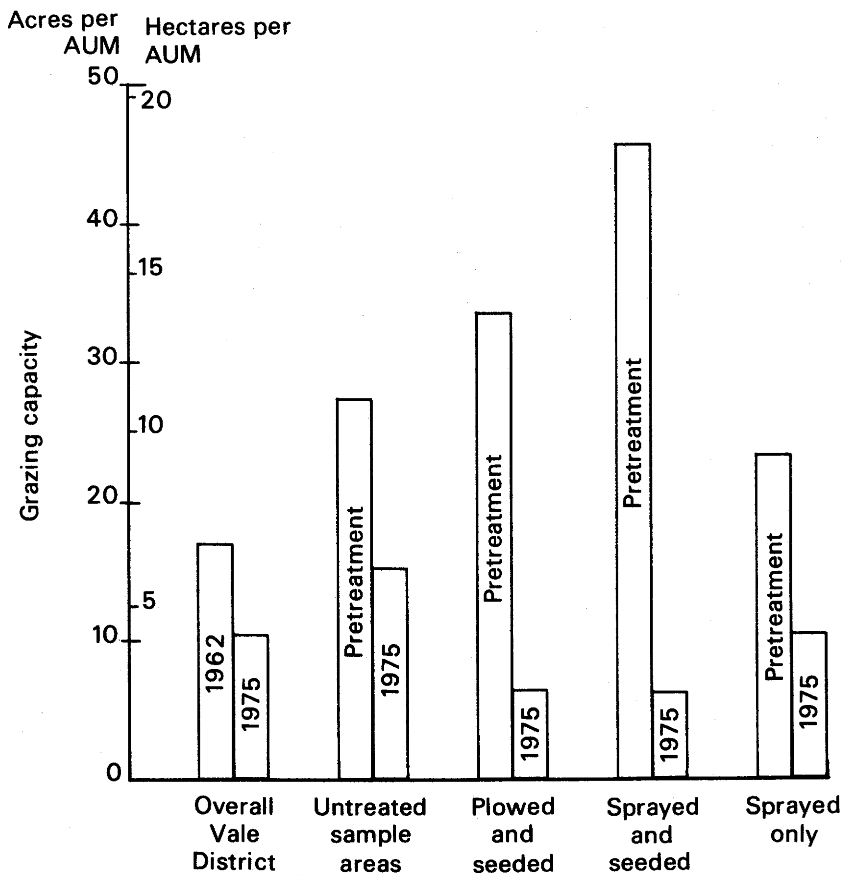

Figure 65.--Estimated grazing capacity before and after various land treatments.

These data form the basis for the estimates of potential grazing capacity under the four alternative management plans (fig. 64).

Alternative I defines recommendations by BLM as objected to by lessees before the Vale Program started. This alternative provided the incentive for the Vale Program. Proper range use was to be attained solely by limitations on grazing permits. Presumably the range would slowly improve. AUM's would remain low for many years. Alternative II was initially the same as Alternative I, with the important addition of water developments and fencing to attain better animal distribution. Alternative III is our estimate of the effects of the Vale Program.

Alternative IV estimated the results of the Vale Program as first proposed if it had been completed in its original form. Alternative IV probably was overly optimistic even if full funding had been available. Table 25 gives estimated costs and benefits of the four alternative levels of management. All values are discounted at a 5-percent rate to a 1962 constant year.

Table 25--*Forage values, improvement and maintenance costs, and benefit/cost ratios for 4 alternative management levels*

Item	Alternative I	Alternative II	Alternative III	Alternative IV
		Million dollars		
Forage value discounted to 1962:				
$3.00/AUM	17.6	20.5	26.2	39.4
$1.51/AUM	8.8	10.25	13.1	19.7
Improvement costs discounted to 1962	0	1.4	7.0	13.0
Maintenance costs discounted to 1962	0	2.2	2.2	2.2
Total cost discounted to 1962	0	3.6	9.2	15.2
Dollar value of forage increase:				
$3.00/AUM	0	2.9	8.6	21.8
$1.51/AUM	0	1.45	4.3	10.9
Benefit/cost:				
$3.00/AUM	--	.8	.9	1.4
$1.51/AUM	--	.4	.5	.7

During the course of the Vale Program, many different amounts have been given for the cost. The amount budgeted was to have been $12,392,280 for land treatment, $2,019,080 for administration, and a third amount for miscellaneous expenses, resulting in a total of $16,230,460 (Bureau of Land Management [n.d.]). Yet the text of the proposal states $12,392,280 as the total cost of the rehabilitation program but $7,775,000 was added to that for roads and recreational development. This is the probable source of the statements that the Vale Program cost $20 million. Fulcher (1975) correctly called the Vale Program a proposed $16.5 million project. The value of $16,230,000 spent over 7 years discounted to 1962 at 5 percent is $13.0 million (table 25).

The money actually spent is not known because a separate accounting for the Vale Program was never made. Then new money was added onto the regular operating budget for the district giving a total of $11.6 million for range conservation for 1962-73 (table 10). BLM personnel did not separately account for time spent on either normal or Vale Program activity. Thus, only a rough estimate of the Vale Program expenditures can be made. Improvement practices themselves were funded elsewhere, as noted in table 10, and all BLM districts received about $200,000 per year for 1963-73. Therefore, a base program budget has been deducted from the total Vale appropriations for a better estimate on new money. Administrative and maintenance costs are more elusive, and some persons question whether or not the Vale Program contributed significantly to administrative costs. The original proposal contained an item of $288,000 per year for administration and supervision. Discounted expenditures were $7 million without administrative and maintenance costs, or $9.2 million including maintenance and administration (table 25).

Costs to the Government were not covered by grazing fees of $0.30/AUM in 1963, which increased to $1.51 in 1976 (table 26). An AUM, the amount of forage needed to maintain one mature cow with calf or its equivalent for 1 month, was worth more than the fee charged by BLM. The real worth depends on the efficiency of the individual operator, costs of alternative sources of forage, livestock prices, seasonal forage availability, and forage quality. An underevaluation of forage on Federal lands is reflected by existence of a capitalized value when the grazing permit is attached to private property. Such properties sell for a higher price than comparable land without Federal permits. Land assessors in the Vale area estimated the capitalized value of a permit at $25/AUM in 1975. A study by BLM (Rumpel 1974) showed that an AUM on private land was worth $5. Stevens and Godfrey (1976) estimated leased forage to cost about $3/AUM during the period 1960-69. A standard appraisal technique prices a Federal AUM at 60 percent of a private AUM because of increased uncertainty and costs of grazing of public lands. This study uses $3 as the market value for a Federal AUM on the Vale District (table 25).

Table 26--*Fees for grazing on the Vale District, Bureau of Land Management, 1960-76*

Grazing year	Dollars per animal unit month	Grazing year	Dollars per animal unit month
1960	0.22	1969	0.44
1961	.19	1970	.44
1962	.19	1971	.64
1963	.30	1972	.66
1964	.30	1973	.78
1965	.30	1974	1.00
1966	.33	1975	1.00
1967	.33	1976	1.51
1968	.33		

At $3/AUM the Vale Program, although it was not designed to be a cost-effective investment, appears to have been a sound investment of Federal funds with a benefit/cost ratio close to unity even including administrative costs (alternative III, table 25).

All three alternative levels of improvement would have given benefit/cost ratios greater than 1 at $3/AUM except for the high cost of maintenance. Most maintenance costs are incurred in monitoring and maintaining water developments. Since the three levels of improvement, II, III, and IV, include the same amount of water development, a continued yearly cost of $200,000 was assumed for each or discounted to 1962 prices at $2.2 million.

Alternatives I and II, the lower levels of management, were politically unacceptable and ecologically questionable because of the long predicted time for vegetational changes. Alternative IV, we believe, would have been cost effective. At $1.51/AUM, the present grazing fee, no level of management returns the money that BLM spent on rehabilitation (table 25).

Thus far, this discussion of benefits and costs is based on forage values for livestock. Other users also benefited from the vegetational rehabilitation in the Vale Program. If one considers the AUM price at $3, the other benefits cost only about $600,000. If the $1.51 price is used, the other benefits cost $5 million (table 25, alternative III), which seems to us to be a low price for the highly vigorous condition of animals and plants, and a countryside with little serious erosion compared with greatly deteriorated conditions 15 years ago. We find that the wise use of public funds in the Vale Program produced exceptional results that are sound both biologically and economically. It is a truly remarkable result for a first attempt on so large an area and great expenditure. Under the existing systems of management, the range continues to improve (fig. 66). The flexibility and alternatives in management continue to widen.

Public Opinion

Public opinion supported the Vale Program in its beginning, as shown early in this report, but not without some dissent. Little doubt ever existed that the proposed program would help the community. Skeptics argued against the mixtures of project treatments and doubted the ability of BLM to finish the job without massive errors. After all, a program of such a large scale had never been attempted. Crested wheatgrass was a relative newcomer to the district; and cheatgrass, despite all its problems of variable production and poor palatability, at least was a familiar forage resource. The business community generally supported the proposal, but the ranching group was doubtful.

The Ontario Democratic Club, reflecting the ranching community in Malheur County, drafted a letter to the congressional sponsors of the appropriation expressing concern that many acres (hectares) of crested wheatgrass were to be planted to the exclusion of the proven forage producer, cheatgrass. The letter urged that the major thrust of the Vale Program should be to provide additional water developments. The criticisms led the local congressional leaders to insist that land treatment start immediately. Continued funding of the Vale Program may well have hinged on early demonstrations of successful conversion of big sagebrush to grassland.

Public reaction to Federal regulation of use on the free range evolved from resentment, through legal attempts to reduce the authority of BLM, to resigned acceptance, and recently, to a spirit of cooperation. The majority of livestock producers in the Vale District no longer consider BLM an adversary. Abundance of grass aids this relationship. However well accepted the overall rehabilitation program, everyone finds fault with some aspect of Federal regulation.

We sampled public opinions on the current program and asked specifically about future concerns. Our sample is impressionistic and not quantitative because most of the information came from casual conversations with people and from newspaper accounts, letters, and BLM records. Eight formal interviews were held with people having a wide variety of interests. Individual reaction cannot be given so our comments aim for interpretation of general public reactions.

The BLM did an excellent job in selling the Vale Program. Tours with the Advisory Board, user groups, and range management professionals contributed to knowledge of the BLM efforts and to a feeling of participation by the community. Dissemination of information continues, and the program is still regarded as a success. Critical opinion exists, however, in certain areas.

Figure 66.--Top, crested wheatgrass and a dead big sagebrush plant (Bureau of Land Management photo). Bottom, bluebunch wheatgrass plant and big sagebrush illustrate range conditions on most of the Vale District.

Dissent centers around lack of forage to satisfy obligated demand in the northern resource area, especially around Vale and Ontario. Cheatgrass still persists over thousands of acres and some reseedings of crested wheatgrass have failed. Abundant forage in the southern area brings forth suggestions from the north for reallocation of use permits. Regions with land treatment failures are reservoirs of adverse opinion.

A second area of concern lies in increasing demands from recreationists and wildlife advocates for less grazing by domestic animals and more attention to their own interests. When BLM accedes to these pressures, relationships with the livestock interests become strained. Stockmen claim that attitudes toward wild horses go beyond biological reasonableness and that current court decisions on environmental impact statements restrict rangeland rehabilitation and food production more than they should. Livestock people recognize that poor practices were largely to blame for 75 to 100 years of range deterioration but they point with pride and take part of the credit for much range improvement in recent years, which they claim that other user groups refuse to recognize. Pressures by those groups for land formerly believed not useful for anything but livestock grazing will continue and were recognized by all. The livestock interests have become skeptical of continued BLM support; yet they know that interests other than for livestock will play an increasing role in the land use of the Vale District. BLM has recognized this fact in the Advisory Board which now has members representing several user interests. Balance among these groups will become increasingly difficult to attain. We note that environmentalists' and protectionists' views about the Vale District from outside are more intense than those from within the district.

Plant Names

Nomenclature for common and scientific plant names used in the text follows Hitchcock and Cronquist (1973).

Common name	Scientific name
Alfalfa, Nomad	*Medicago sativa*
Bitterbrush, antelope	*Purshia tridentata*
Bluegrass, Sandberg	*Poa secunda*
Cheatgrass	*Bromus tectorum*
Cherry, wild	*Prunus* spp.
Clover, strawberry	*Trifolium fragiferum*
Clover	*Trifolium* spp.
Cottonwood, black	*Populus trichocarpa*
Fescue, Idaho	*Festuca idahoensis*
Greasewood, black	*Sarcobatus vermiculatus*
Halogeton	*Halogeton glomeratus*
Hawthorn	*Crataegus* spp.
Hopsage, spiny	*Grayia spinosa*
Indian ricegrass	*Oryzopsis hymenoides*
Junegrass, prairie	*Koeleria cristata*
Juniper, western	*Juniperus occidentalis*
Larkspur	*Delphinium* spp.
Mountain-mahogany	*Cercocarpus ledifolius*
Mustard	*Brassica* spp. and *Sisymbrium* spp.
Needlegrass	*Stipa* spp.
Needlegrass, Thurber	*Stipa thurberiana*
Needle-and-grass	*Stipa comata*
Pine, ponderosa	*Pinus ponderosa*
Rabbitbrush	*Chrysothamnus* spp.
Sweetclover, yellow	*Melilotus officinalis*
Sage, bud	*Artemisia spinescens*
Sagebrush, big	*Artemisia tridentata*
Sagebrush, low	*Artemisia arbuscula*
Shadscale	*Artiplex confertifolia*
Squirreltail	*Sitanion hystrix*
Thistle, Russian	*Salsola kali*
Wheatgrass, bluebunch	*Agropyron spicatum*
Wheatgrass, crested	*Agropyron cristatum* and *Agropyron desertorum*
Wheatgrass, fairway crested	*Agropyron cristatum*
Wheatgrass, pubescent	*Agropyron trichophorum*
Wheatgrass, standard crested	*Agropyron desertorum*
Wheatgrass, tall	*Agropyron elongatum*
Wheatgrass, western	*Agropyron smithii*
Wildrye, giant	*Elymus cinereus*
Willow	*Salix* spp.

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