Bulletin No. 291 - Range Resources of Rich County, Utah

L. A. Stoddart

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Foreword

IN 1936 the Utah Agricultural Experiment Station organized project 179 entitled "A study of agricultural resources of Utah and their utilization." The project was divided into four sub-projects, A dealing with agricultural economics, B dealing with soil resources, C dealing with irrigational water resources, and D dealing with range resources.

Sub-project D, entitled "Range resources and condition of vegetation cover," was begun in 1936 with a survey of Duchesne and Uintah Counties, and the findings were published as Utah Station Bulletin No. 283, "Range conditions in Uinta Basin, Utah." The field season of 1937 was devoted to Wasatch County, and the data formed a part of the cooperative publication "Range conservation in Wasatch County, Utah," a western range survey report.¹ The field season of 1938 was spent in Rich County, and the findings are presented in the following report.

Acknowledgment is made of the assistance given by the U. S. Agricultural Adjustment Administration in permitting the use of its field data, and of the cooperation of the U. S. Forest Service in furnishing range survey data for the national forest lands within the county. E. L. Guymon, county agent for Rich County, furnished valuable material on the economic resources of the area.

Logan, Utah

March, 1940

¹—Published by U. S. Forest Service. Intermountain Region. mimeo.
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Description of Rich County

Geography

RICH COUNTY, with an area of somewhat more than 650,000 acres, is located in the extreme northeastern corner of the State of Utah and is bounded on the north by Idaho, on the east by Wyoming, and on the west and south by the Wasatch Mountain Range. The land drains to the east into Bear River, with the exception of the northern part, which drains into Bear Lake. Bear River and Bear Lake are important sources of irrigation water, water from one or both of these sources being used in southwestern Wyoming, southeastern Idaho, and northern Utah.

The topography of Rich County is generally rugged, especially the western portion of the county. Here the Wasatch Range, reaching elevations of over 9,000 feet, is characterized by steep slopes and sharply cut valleys. The lower lying lands, varying in elevation between about 6,000 and 7,000 feet, are mostly gentle slopes and rolling hills. The flood plains of Bear River, between 4 and 6 miles in width, are practically level, and constitute the chief area of cultivation.

Settlement

Rich County's first inhabitants were Indians, mostly of the Shoshone and Bannock tribes. It is known that the Indians used horses and, hence, they were in reality the first livestock operators in the valley. Just when these animals were introduced and how severely they grazed the ranges are unknown, but it is assumed that damage to the range, if any, was limited and localized.

White explorers first entered Rich County in 1811 but their visit was short lived. All were caught in an early snow storm and lost their lives (8).

Though many trappers doubtless frequented the region earlier, no white settlement took place in the vicinity of Rich County until 1863, at which time, early Mormon settlers headed by Charles C. Rich with ox-drawn prairie schooners and a few head of cattle arrived from Salt Lake City. These pioneers settled at the north end of Bear Lake (now Idaho), the Indians retaining lands to the south (now Rich County). The extremely severe winters following the arrival of the settlers resulted in much dissatisfaction, and they had great difficulty with their livestock. Generally, however, they were able to adapt themselves to the rigorous climate and their
farm lands increased and their few head of cattle multiplied to large herds. By 1870 the Indians had been crowded back, and the whites settled the southern end of the valley (1).

In 1864, the valley was made into a county of the territory of Utah. There were then three towns near Bear Lake, namely Lake-town, Garden City, and Meadowville, and in the southern end of the county, two more, Randolph and Woodruff.

Climate

Perhaps the most important feature in determining the agricultural status of the county is its climate. The extremely short growing season, coupled with a low rainfall, limits greatly the potential crop production and forces the populace to rely almost entirely upon the range as a source of agricultural livelihood.

The climatological records for Rich County are meager, being limited to the valley floor. The United States Weather Bureau records (5) show that Woodruff receives an average annual precipitation of only 9.17 inches, Randolph 10.23 inches, and Laketown 13.40 inches (table 1). These low precipitations coupled with a high evaporation make conditions for plant growth poor. The higher Wasatch Mountains probably receive 20 to 35 inches of precipitation. Much of the precipitation falls during the winter months as snow, and, hence, must be stored in the soil for use by plants during the growing season. The summer rains are often torrential in nature and are of little value to agriculture. Another factor which makes the lowland precipitation hazardous to crop production is its variability. For example the annual precipitation of Laketown has been as low as 7.53 inches and as high as 26.24 inches. Drought years are rather common and sometimes severe.

Temperatures for the county are surprisingly low (table 1). The mean annual temperature for the lower lands varies from 38.8 degrees F. at Woodruff to 42.0 degrees F. at Laketown. Woodruff has the shortest safe growing season of any official weather station in the State of Utah, being only 20.7 days. At Laketown this period is 62.8 days, which enables the production of some vegetables and fruits. In general, however, the short growing season throughout the county limits the farm production to hardy cereals and hays. Woodruff's lowest temperature of —50 degrees F. is 11 degrees lower than is reported for any other station in Utah and certainly indicates that low temperature is a factor to consider in planning the livestock industry of the county.
TABLE 1

Average monthly precipitation (inches) and temperature (degrees Fahrenheit) for U. S. weather stations in Rich County, Utah, from date of origin through 1930.*

<table>
<thead>
<tr>
<th></th>
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<td>Precipitation</td>
<td>feet</td>
<td>inches</td>
<td>inches</td>
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<td>inches</td>
<td>inches</td>
<td>inches</td>
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</tr>
<tr>
<td>Woodruff</td>
<td>6,343</td>
<td>.69</td>
<td>.77</td>
<td>.89</td>
<td>.78</td>
<td>1.00</td>
<td>.85</td>
<td>.82</td>
<td>.92</td>
<td>1.15</td>
<td>.54</td>
<td>.48</td>
<td></td>
<td>6.18—16.89</td>
</tr>
<tr>
<td>Laketown</td>
<td>5,988</td>
<td>1.36</td>
<td>1.25</td>
<td>1.29</td>
<td>1.41</td>
<td>1.39</td>
<td>.80</td>
<td>.62</td>
<td>.82</td>
<td>1.78</td>
<td>1.46</td>
<td>.96</td>
<td>.76</td>
<td>13.40</td>
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<td>Randolph</td>
<td>6,378</td>
<td>.72</td>
<td>.67</td>
<td>.79</td>
<td>.92</td>
<td>.94</td>
<td>.84</td>
<td>1.05</td>
<td>.94</td>
<td>1.14</td>
<td>1.08</td>
<td>.50</td>
<td>.64</td>
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<table>
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<th>feet</th>
<th>degrees</th>
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<th>degrees</th>
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<th>degrees</th>
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</thead>
<tbody>
<tr>
<td>Woodruff</td>
<td>6,343</td>
<td>15.6</td>
<td>18.8</td>
<td>28.7</td>
<td>39.7</td>
<td>47.5</td>
<td>55.1</td>
<td>61.5</td>
<td>60.1</td>
<td>51.4</td>
<td>40.9</td>
<td>29.0</td>
<td>17.8</td>
<td>38.8</td>
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<tr>
<td>Laketown</td>
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<td>21.4</td>
<td>22.0</td>
<td>29.2</td>
<td>43.5</td>
<td>49.7</td>
<td>57.7</td>
<td>65.3</td>
<td>63.5</td>
<td>54.2</td>
<td>43.6</td>
<td>33.2</td>
<td>24.1</td>
<td>42.0</td>
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</tbody>
</table>

*Data taken from U. S. Weather Bureau records.
Soils

The soils of Rich County have not been intensively surveyed, but they may be roughly classified into three main soil groups (4). The higher land in the Bear River Range is made up largely of rocky and shallow soils belonging to the Underwood-Babb series. These soils are heterogeneous but for the most part may be said to be stony loams. They are not highly productive for cultivated crops but make good grazing land. These soils are typical of much of the higher country in Utah and are found extensively within the national forests.

The lower land around Bear Lake is made up of the chestnut soils in the Walla Walla series. This series is characteristically fertile but easily eroded. Soils on the lake ridge east of Bear Lake and those of the Bear River valley are chestnut soils in the Hyrum-Bingham-Avon series. These soils are formed from alluvial outwash material and are subject to severe erosion. However, in many places the soil contains so much clay that erosion is not serious except during torrential storms.

Data gathered during the survey show almost half of the soils in the county to be medium in texture and gravelly. Heavy clay soils are rare but light sandy soils occur over about a fourth of the county.

Soil erosion has been classed\(^1\) as severe on only about 10 percent of the area of Rich County and as being moderate on 80 percent (6). While this is not an alarming situation, it does call for careful land use to avoid further intensifying the damage. Perhaps the most serious aspect of the problem so far as Rich County is concerned is that surface runoff always accompanies soil washing. Unless water percolates into the ground it is lost to plants, and a county whose lands are inherently as arid as those of Rich County can ill afford to lose water by excess runoff.

Land Ownership

The ownership pattern in Rich County is complex. Patented land areas are small because of the limited acreage that early settlers were allowed to take up under the old homestead laws, and because, in the early range days, ownership of small land areas surrounding favorable water holes was all that profitable agriculture required. Many ranchers obtained ownership of alternate sec-

\(^1\)—By the U. S. Resettlement Administration. Land Planning Office.
tions of land, presumably on the surmise that the presence of this
owned land would tend to discourage other ranchers from grazing
on the interspersed public land, and, hence, their own usage would
be comparable to that on the private land. Because of the com-
plicated checkerboard land-ownership pattern, many trespass cases
and arguments resulted.

The approximate land division is shown in table 2.

TABLE 2.

<table>
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<tr>
<th>Ownership class</th>
<th>Acres</th>
<th>Percent of county</th>
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<tr>
<td>Patented lands</td>
<td>368,304</td>
<td>56.6</td>
</tr>
<tr>
<td>Private</td>
<td>332,554</td>
<td>51.1</td>
</tr>
<tr>
<td>State</td>
<td>35,750†</td>
<td>5.5</td>
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<tr>
<td>Federal lands</td>
<td>235,375</td>
<td>36.2</td>
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<tr>
<td>Division of grazing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Grazing district no. 1.)</td>
<td>194,076</td>
<td>29.8</td>
</tr>
<tr>
<td>National forest</td>
<td>37,388‡</td>
<td>5.8</td>
</tr>
<tr>
<td>Miscellaneous government</td>
<td>3,911</td>
<td>0.6</td>
</tr>
<tr>
<td>Incomplete homestead</td>
<td>46,650</td>
<td>7.2</td>
</tr>
<tr>
<td>Total</td>
<td>650,329</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*—Data from Dept. Agr. Econ. Utah Agr. Exp. Sta.
†—According to the Rich County Planning Board this acreage was 46,900
in 1939 (9).
‡—According to the Rich County Planning Board this acreage was 44,800
in 1939 (9).

Population

The population of Rich County is small compared with other
counties in Utah. The United States census (3) for 1930 shows a
population of 1,873 people, or one person for about 350 acres of
land, compared to one person for about 100 acres for the state of
Utah. The Rich County population has been static or decreasing
slightly since 1900.

Economic Status

Rich County has 380 families most of which reside on farms.
Of the 273 farms, 239 are operated by the owners, 10 by managers,
and 24 by tenants (7). The financial status of the county is not
encouraging. Its indebtedness exclusive of city and school bonds is
approximately 1,473,650 dollars, or about 780 dollars per capita
compared with an assessed valuation in 1937 of 2,324,150 dollars
While the debt per unit of valuation is remarkably high, it is not unusual when compared with other Utah counties. The debt per capita, however, is unusually high and is cause for considerable concern. This poor financial status is evidenced by ill kept buildings and few modern improvements. For example, of the 414 homes, 298 are in need of general repair, 283 are without modern bathrooms, 271 without modern kitchens, 73 without electricity, 91 without running water, and 348 without telephone.

Highways into the county are generally good and are open to travel throughout most of the year. Though the county is inadequately served by railroads, this is not a seriously limiting factor in its development because of the comparative ease of marketing livestock, the chief crop, by trucking or driving to the railroad.

Range Survey Methods

Cooperating Agencies

The field work for the Rich County range survey was begun in 1927 and 1928 when the U. S. Forest Service surveyed the national forest. Additional work on private lands was conducted by the U. S. Agricultural Adjustment Administration in the summer of 1937. The field work was completed by the Agricultural Adjustment Administration and the Utah Agricultural Experiment Station in 1938.

Range Forage Types

All major range forage types throughout the county were demarcated. Type segregation was determined entirely by the plant species dominating, and not by quantity of forage, ownership, or use. Nine types were located within Rich County, namely meadow, perennial forb (weed), sagebrush, mountain browse, conifer, pinion-juniper, aspen, greasewood, and desert shrub. In addition to the above range types, the cultivated lands, including dry croplands and all artificially irrigated lands were delimited but were not surveyed for forage capacity.

Type Analysis

Standard type analysis methods were followed in all field work and palatability tables approved by all federal and state agencies concerned with range work in the intermountain region were used in compilation. Briefly, the sampling method involved
a determination of the total quantity of forage produced on sample areas together with the plant species composition in percent. The palatability or forage-value-index for each forage type is calculated from the weighted average palatability of all plant species composing the type. This palatability is multiplied by the density of the plant cover and again by the number of acres in the type to obtain an index of the total edible forage on the range — the forage-acre-factor. It was assumed for purposes of calculating the grazing capacity that one forage acre would support four cattle or twenty sheep for one month. These figures are somewhat arbitrary and might be subject to adjustment as further information is obtained.

Supplementary Data

On each area studied data were gathered on various features which directly or indirectly influence the grazing use of the land. Observations made included (1) plant vigor, determined by size, abundance of reproduction, and other evidences of good health; (2) relative productiveness of the land, determined mainly by soil and moisture conditions; (3) kind, location, season, and adequacy of water available for stock; (4) kind, abundance, and suggested control for poisonous plants; (5) proper grazing season and class of stock; (6) species, abundance, and importance of wildlife present; (7) type of soil, and (8) kind and severity of soil erosion present.

Range Survey Results

Former Vegetation

HISTORICAL records concerning grazing conditions in Rich County are rather rare, but all indicate that forage was at one time plentiful. An early Mormon historian reports (1) "... the hills which are covered with fine grasses and promise well for grazing." Another pioneer (2) told how "... the grass looked like a waving grain field" east of Bear Lake. Of Randolph an early report (2) says: "... surrounded by excellent grazing land."

Further evidence of the former excellence of Rich County ranges is the fact that early grazing conditions were such that most early settlers made no effort to own range land because of the abundance of excellent free grazing. These settlers objected strenuously to the building of the first fences because they saw no need or justification for range protection. Even fencing of meadow land was condemned.
Present Vegetation

The present flora of Rich County is typical of many mountain valleys of Utah in both quality and quantity. The vegetation belts, caused by precipitation and temperature, are found chiefly in a north and south direction, paralleling the Bear River and the Wasatch Mountain Range (fig. 1).

The high mountains on the western and southern edges of the county are generally forested either by coniferous trees or by aspen.2

The conifer type includes all areas dominated by evergreen trees. The conifers are small and relatively sparse, having little value for timber. Two sawmills are operating in the region, but their output is small. Most range of this type is grazed during the summer, and it is generally considered good where the tree growth is not too dense.

The aspen type in Rich County, occurring as it does in the higher mountain slopes and valleys, receives a high precipitation which together with the open nature of the aspen cover, makes the undergrowth lush and abundant. Though the aspen itself is not rated high as a forage, the associated species are especially palatable. Among the important plants are wild geranium (Geranium), bluebells (Mertensia), snowberry (Symphoricarpos), elderberry (Sambucus), brome grass (Bromus), and wheatgrass (Agropyron). This area is the chief summer range, being grazed generally between June 15 and October 15. Most of the area contains adequate stock water and is luxuriantly vegetated, furnishing excellent grazing for both sheep and cattle. The aspen type is second only to the meadows as a source of forage. The mountains which support the conifer and aspen types are frequently steep and rocky, and, hence, the accessibility of the forage is sometimes limited, especially on the conifer type.

On the more gently sloping hills and plains below the forested land is a huge sagebrush type extending with amazing uniformity as far as one can see. This sagebrush type is the most extensive

2—Over much of the mountains these two types are intermingled, first one and then the other dominating, presumably because of topography, soil, or former fires. This same mingling occurs where the aspen of the higher lands meets the sagebrush of the lower lands. Because of the complicated interspersion of these types, the transition areas were frequently lumped together and analyzed as a unit, in which case they were mapped according to the type which dominated. The greater detail on the national forest survey permitted segregation of the types with more accuracy than was deemed advisable on the survey outside the national forest.
Fig. 1. Natural vegetation, Rich County, Utah.
RICH COUNTY, UTAH
RANGE TYPE MAP
1938
RANGE RESOURCES IN RICH COUNTY

type in Rich County and occupies most of the area between the high mountains and the irrigated lands on the valley floor. About 437,000 acres, or two-thirds of the county, are dominated by this one unbroken type. In field work, for purposes of simplification, the type was subdivided along survey lines and analyzed as a number of smaller types. This sagebrush type is the great spring and fall range for which Rich County is noted. It is generally grazed from about May 1 to June 15 and again from October 15 until heavy snowfall — usually December 15 to January 1. The vegetation is mostly sagebrush (Artemisia tridentata), rabbitbrush (Chrysothamnus), and the more drought resistant grasses (Agropyron, Sitanion, Poa).

Though grazing has been severe and the vegetation has suffered notably from recent drought years, it is still in fair condition. Almost everywhere climax grasses still remain, though they are reduced in abundance and vigor. Undoubtedly, the unpalatable sagebrush has greatly increased its abundance at the expense of more valuable grasses. This change is especially obvious in local areas such as the high east slopes to the east of Bear Lake and the higher foothills of the southern tip of Rich County where protected areas indicate that at one time the vegetation was almost pure grass, sagebrush being scarce or perhaps even absent over large areas. With careful grazing there is reason to believe that these grasses would greatly increase in abundance and that sagebrush would, in time, be suppressed, leaving the type much more similar to what it must have originally been — a sagebrush type underlain by a dense grass cover, the grass being the dominant and, possibly, the sole occupant of the better areas.

The sagebrush type gives way in the southern end of the county to the desert shrub type in which rabbitbrush (Chrysothamnus) rather than sagebrush dominates. Winterfat (Eurotia) and snakeweed ( Gutierrezia) are important associated species. Originally this region was probably covered with a good stand of grass, only remnants of which remain. In the past, it is reported to have been one of the most productive ranges in the county. Now, however, due to the severe drought, continued over-grazing, and too early grazing, its carrying capacity has been greatly reduced. One resident tells how "there used to be enough dry grass at Wasatch each fall to fill the cattle as full as ticks, when they were trailing in from Morgan County."

Along Bear River and extending in narrow strips up many of the major and minor side drainages through the sagebrush and
desert shrub types is a meadow type. Similar meadows occur in small mountain valleys.

Included in the meadow type are all natural grasslands which are subirrigated and, hence, produce a water-loving type of vegetation. The plants are chiefly bluegrass (Poa), redtop (Agrostis) sedges (Carex), rushes (Juncus), and similar genera.

This type has been greatly increased in area and productivity along Bear River by artificial irrigation and now totals almost 75,000 acres. The high forage yield of this type is the key to the grazing welfare of Rich County. Most of the Bear River meadows are cut for hay, but practically all are grazed thereafter and the smaller arms of meadow, too narrow to cut, are grazed all year save during the periods of heavy snow. Though this heavy use has in many areas resulted in severe damage these meadows still furnish feed, despite their comparatively small size, for a major number of the stock.

In addition to the above, there are four vegetation types which are of only local importance in Rich County, namely: mountain browse, pinon-juniper, greasewood, and perennial forb.

Mountain browse includes all broad-leaved shrubs which grow in high foothills and mountains as opposed to desert shrubs which grow in the drier lowlands. The most important plants are snowberry (Symphoricarpos), oak (Quercus), serviceberry (Amelanchier), mountain mahogany (Cercocarpus), and chokecherry (Prunus). This type occurs chiefly between the aspen type and the sagebrush type in Rich County and is highly productive though not extensive.

Pinon-juniper is a type dominated by small far-spaced evergreens, chiefly Utah juniper. This type is not abundant in Rich County, and it is not considered good range because of the steep, rocky slopes upon which it occurs and because of the low forage production.

Greasewood (Sarcobatus) as a type is found only in the alkaline bottom lands of Rich County. The type is limited in both extent and forage value. Associated with the greasewood are some good forage plants including saltbush (Atriplex), and some of the alkali-tolerant grasses (Sporobolus, Spartina, Distichlis), but they are not abundant.

Perennial forbs are broad leaved (non-grasseous) herbs. This type occurs only in small areas within the mountains. The species are chiefly such plants as bluebells (Mertensia), dock (Wyethia), wild geranium (Geranium), and vetches (Vicia).
Productiveness of Range Land

The potential forage production of the Rich County ranges is determined largely by climate and soil. Of these factors, climate is usually the limiting one, especially in the valley floor. Soil becomes a limiting factor only in the rather rare cases where it bears excessive alkali and in cases where it is shallow and rocky. The climate, especially precipitation and temperature, is not favorable to plant growth. Only in the higher mountains is precipitation sufficient for normal plant growth, and ranchers should appreciate the limitations which nature has placed upon the productiveness of the land. Under no conditions of management and care could Rich County be made a heavy producing region except for local areas where irrigation is practicable. Observations on Rich County range lands other than national forest ranges showed only 8.7 percent of the area to be potentially above average in productivity, 55.7 percent was considered average, and 35.6 was considered inherently low in productivity (fig. 2). Most of the national forest ranges are of average or above average productivity.

![Graph](image)

Fig. 2. (a) Potential productiveness, and (b) present condition of range lands in Rich County compared to general productiveness and condition of western ranges.

Condition of Vegetation

By condition of vegetation is meant the vigor of the plants, their evidence of good growth, and abundance of reproduction. These factors are determined by the productivity of the site, together with the amount of damage that has been done to the plant by heavy or unseasonal grazing. Condition of vegetation is vitally important to a range because the yield of the range is proportionate to the
quantity of herbage produced by individual plants. A plant in poor condition expends most of its energy in maintenance, and, therefore, cannot produce a reasonable quantity of forage. The range vegetation found in Rich County was placed into one of three classes based upon the expected condition as normal or average, this being determined primarily by existant climatic and soil conditions.

Observations showed only 10.1 percent of the range supporting vegetation in above normal condition, 63.5 percent in normal condition, and 26.4 percent in below normal condition (fig. 2).

**Density of Vegetation**

Density of vegetation is used as a key to quantity of forage produced. The denser the herbage the greater is the volume of livestock feed available. Density is also a valuable index to the protection offered the soil from forces which tend to erode it, dense vegetation being a good protection and less dense vegetation a poor protection. Density is expressed as the percent of the ground area that is covered by vegetation.

The Rich County range lands excluding national forest and irrigated meadow have an average vegetation density of 14.7 percent, the distribution of which can be seen in fig. 3. Most meadow land has a density of between 50 and 70 percent and, while no figures are available, the national forest ranges are also of good density.

**Range Grazing Capacity**

The estimated grazing capacity for each type was compiled from the field survey and the proportion of the total grazing
obtained from each type was determined. The acreages and grazing capacities of all major vegetation types are shown in table 3.

TABLE 3.
Acreage and grazing capacity of all range lands by type exclusive of cultivated lands, in Rich County Utah, 1938

<table>
<thead>
<tr>
<th>Range type</th>
<th>Area</th>
<th>Percent of total county area</th>
<th>Grazing capacity</th>
<th>Requirement for one animal month forage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meadow†</td>
<td>2,977</td>
<td>.46</td>
<td>2,170</td>
<td>1.37</td>
</tr>
<tr>
<td>Perennial forb</td>
<td>323</td>
<td>.05</td>
<td>37</td>
<td>8.72</td>
</tr>
<tr>
<td>Sagebrush</td>
<td>436,712</td>
<td>67.15</td>
<td>63,783</td>
<td>6.85</td>
</tr>
<tr>
<td>Mountain-browse</td>
<td>13,597</td>
<td>2.09</td>
<td>3,412</td>
<td>3.98</td>
</tr>
<tr>
<td>Conifer</td>
<td>17,579</td>
<td>2.70</td>
<td>4,205</td>
<td>4.18</td>
</tr>
<tr>
<td>Pinon-juniper</td>
<td>20,426</td>
<td>3.14</td>
<td>2,319</td>
<td>8.81</td>
</tr>
<tr>
<td>Aspen</td>
<td>42,676</td>
<td>6.56</td>
<td>14,113</td>
<td>3.02</td>
</tr>
<tr>
<td>Greasewood</td>
<td>4,824</td>
<td>.75</td>
<td>551</td>
<td>8.75</td>
</tr>
<tr>
<td>Desert shrub</td>
<td>38,599</td>
<td>5.93</td>
<td>5,929</td>
<td>6.51</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>577,713</td>
<td>88.83</td>
<td>96,519</td>
<td>5.98</td>
</tr>
</tbody>
</table>

*—An animal month is defined as one month of grazing for one individual animal of a mixed herd of cattle excepting those under 6 months of age. For statistical purposes one animal month may be considered as being equivalent to five sheep for one month.

†—Includes only small areas of natural meadow interspersed with range land and does not include the large irrigated meadows where intensive pasturage and hay cutting take place.

It can be seen that about 89 percent of the total land area of Rich County, excluding Bear Lake, is native range land. The remaining 11 percent is cultivated land and town sites. The range land, not including irrigated meadows and croplands, has an estimated grazing capacity of 96,519 animal months\(^3\) or 8,043 animals year long. Of this, almost two-thirds is obtained from the sagebrush type. The sagebrush type together with the aspen type furnishes over 80 percent of the total forage yield.

\(^3\)—An animal month is defined as one month of grazing for one individual animal of a mixed herd of cattle, excepting those under six months of age. For statistical purposes one animal month may be considered as being equivalent to five sheep for one month.
Supplemental Forage Production

In Rich County, an estimated 74,973 acres are devoted, in the main, to intensive crop production. This area includes all cultivated land, both irrigated and nonirrigated, all artificially irrigated but noncultivated land (meadows and pastures), and townsites. About 54,825 acres are irrigated. An estimated 45,426 acres are native irrigated meadow, 37,885 acres of which are cut for hay and 7,541 of which are harvested only by grazing animals (6). The hay lands average a yield of about one ton per acre. About 6,600 acres of alfalfa, yielding an average of 0.8 tons per acre, are grown in the county. A total hay production of 47,777 tons from 44,485 acres was reported in the 1930 census (3). The hay is fed to range or dairy stock within the county, practically none being shipped out. In general, feeding is on a maintenance basis, only about 300 cattle and 500 lambs being fattened within Rich County.

The 1930 census (6) shows a production of 1,004 acres of barley and 2,081 acres of wheat, most of which is produced on dry land. The yield in bushels was 41,742 and 35,820 respectively. The acre yield of wheat averages about 15 bushels on the dry lands east of Bear Lake, 22 bushels on dry land around Laketown, and 30 bushels on irrigated lands. Practically all of the barley and some wheat are fed to livestock.

An important source of stock forage is the irrigated pasture lands, most of which are in native grasses. Generally, these pastures are merely meadows which do not produce sufficient forage to warrant cutting for hay, often because of poor water rights. Their grazing capacity is determined largely by the quantity of water available and the methods of grazing employed. The better pastures support about two and one-half animal months per acre when grazed from May 1 to October 1.

Total Forage Production

The total yield and the grazing value obtained from the cultivated and irrigated lands in Rich County are difficult to calculate. The total feed derivable from Rich County lands as closely as can be approximated, is given in table 4. Of the total animal months of forage available the cultivated lands contribute 194,279 and the range lands 96,519. Hay lands, alone, furnish 159,257 animal months. The total forage supply in Rich County from all sources is estimated at 290,798 animal months.
TABLE 4.

Forage yield in animal months obtainable in Rich County, Utah, including acreage and yield.

<table>
<thead>
<tr>
<th>Source</th>
<th>Acreage</th>
<th>Yield</th>
<th>Animal months forage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range land</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National forest</td>
<td>43,937</td>
<td>14,176</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>533,776</td>
<td>82,343</td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native</td>
<td>37,885*</td>
<td>47,777 tons*</td>
<td>159,257†</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>7,541*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>1,004*</td>
<td>41,742 bu.*</td>
<td>5,134‡§</td>
</tr>
<tr>
<td>Wheat</td>
<td>2,081*</td>
<td>35,820 bu.*</td>
<td>2,829‡§</td>
</tr>
<tr>
<td>Pasture</td>
<td>7,541**</td>
<td></td>
<td>11,885**</td>
</tr>
<tr>
<td>Aftermath</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td>45,426</td>
<td></td>
<td>14,680§</td>
</tr>
<tr>
<td>Grain</td>
<td>3,085</td>
<td></td>
<td>494§</td>
</tr>
<tr>
<td>Total</td>
<td>633,765</td>
<td></td>
<td>290,798</td>
</tr>
</tbody>
</table>

*—From U. S. Census, 1930.
†—Calculated at 0.3 tons per animal month for maintenance.
‡—Estimated all barley fed and \( \frac{1}{2} \) of all wheat fed.
§—Based upon conversion figures and feed value figures as calculated by Dept. of Agr. Econ., Utah Agr. Exp. Sta.
**—Based on pasture survey made by Utah Agr. Exp. Sta. (6).

Seasonal Use of Range

An important consideration of the grazing resources of Rich County is the seasonal distribution. Throughout the survey, observations were made to determine the proper grazing season. Often the proper season of use differs from the actual season of use, sometimes seriously and sometimes not so seriously. For example, much of the range that might be classed as spring range could be used during the summer period in order to balance properly the program of the rancher. The classification, therefore, is somewhat flexible, but in general the season of use which is recommended has definite advantages. No differentiation was attempted between spring and fall use, since most ranges are grazed during both of these seasons rather than either alone.

No range in Rich County is classified as winter range since the cold weather and heavy snowfall prohibit grazing between about January 1 and May 1 depending upon the current weather conditions. During this four-month period livestock are either fed
in the cultivated valleys within the county or moved into winter range areas outside the county.

Ranges properly used for the four months between about June 15 and October 15, again dependent upon current weather conditions, were classified as summer range. Most of these ranges are within the national forests where the grazing season is carefully regulated but many private holdings also include summer range.

Ranges were classified as spring-fall ranges if they were properly used during the four months from about May 1 to June 15 and again from October 15 to January 1. The fall usage is generally limited by snowfall since only locally is water for livestock a problem.

Of the total 577,713 acres of range land in Rich County, 106,963 were classified as summer range and 470,750 as spring-fall range. Available for summer use are 32,184 animal months of forage as compared to 64,335 animal months available for spring-fall use. Placing this on a season-long basis, 4 months for each seasonal class shows ample range for 8,046 animals during the summer season and 16,084 during the spring-fall season.

Despite the apparent deficiency of summer range in Rich County there is no serious range balance problem. The county is bordered on the south and west by excellent summer range that is used to supplement the Rich County range. Most of the pasture land and aftermath from hay lands are grazed during the summer and fall. The entire lack of winter range is, of course, offset by an abundance of hay and some grain which is available during that season. Because of the large amount of forage that comes from cultivated lands rather than range land, no seasonal feed shortage exists in Rich County despite the fact that the range forage is not well balanced in season of availability.

Poisonous Plants

Stock poisoning in Rich County is not a serious problem despite the relative abundance of some poisonous plant species. Among the important species, approximately in order of their abundance, are arrowgrass (Triglochin), loco (Astragalus), horsebrush (Tetradymia), waterhemlock (Cicuta), deathcamas (Zygaenunus), and chokecherry (Prunus). No accurate record or information is available concerning the number or cause of livestock deaths from poisonous plants since stockmen, in general, are not acquainted with either the plants or the symptoms of their poisoning.
Arrowgrass (*Triglochin maritima*) is perhaps the most abundant poisonous plant but is seemingly not recognized nor feared by stockmen. It occurs in almost all meadows and is either consumed by pasturing animals or harvested as hay in large quantities each year. Undoubtedly some loss occurs from this plant but regular and abundant losses seem to be entirely absent.

Water hemlock (*Cicuta occidentalis*) is found along most irrigation ditches and streams. The old "ox-bow" lakes of Bear River, especially, are frequently filled with this plant. Usually animals do not graze these areas until rather late in the summer, at which time the tops are practically nonpoisonous and the soil is sufficiently dry that the highly poisonous underground tubers are not easily removed. Stock losses, therefore, appear to be a rarity.

Spineless horsebrush (*Tetradymia canescens*), while occurring in scattered clumps over most of the spring-fall ranges, is abundant only in the high slopes east of Bear Lake. There is no definite information on stock losses from this plant, but in past years heavy loss in the region would suggest that this plant be regarded with suspicion. Chokecherry (*Prunus melanocarpa*), which is also abundant there, may be contributing to the stock losses.

Loco and deathcamas are rather low in palatability and hence are generally grazed heavily only in the early spring when other forage is scarce. It is assumed that at this season losses from these two plants are common but deaths in large numbers are seemingly rare.

Without further study and evidence of losses no especial concern over poisonous plants seems justified in Rich County, since losses are rare and of scattered occurrence.

Livestock Production

Agriculturally, Rich County is primarily devoted to livestock production, having 90.9 cattle per farm as compared to 16.3 for the State of Utah. The ranches vary greatly in size, ranging from less than one section to over 50,000 acres. Many ranchers produce ample native hay to support their stock during the winter months. Others produce alfalfa and grain in addition to native hay but generally these crops are distinctly secondary in importance.

Practically all livestock owners operate on a seasonal program in which stock summer on the high mountains, winter on the home ranch or on winter ranges outside the county, and pass the spring and fall periods on intermediate lands. Most ranchers have grazing permits for national forest lands during the summer and for public
domain grazing districts during the spring and fall months. Most ranchers also own sizable tracts of range land, chiefly used for spring and fall grazing. The range land is, in general, unfenced.

Most operators run either sheep or cattle alone, but the majority of the public lands are grazed by both classes.

Range sheep in Rich County are largely Rambouillet, though Hampshire blood is common, especially among rams. The quality of the ewes is fair but more attention to breeding and selection for conformation would increase greatly the efficiency of both wool and mutton production.

The range sheep are run in bands of about 1,200 head and usually are accompanied by one herder and one camp mover. Lambing takes place on the spring range from the first of April until about the middle of June, generally without the use of sheds or any other protection. Because of this and the frequent spring storms, lamb losses are heavy. The average range lamb crop is 70 to 75 percent as compared to 100 percent for Rich County farm flocks and 76 percent for Utah range sheep (6).

Several thousand sheep are wintered within Rich County on hay, chiefly alfalfa hay. Practically all of the remaining Rich County owned sheep winter on the Red Desert of Wyoming or on Utah deserts. Winter losses are high for animals wintered within the county because of heavy snows and insufficient attention to stock shelters.

Under normal conditions about 25,000 cattle are owned in Rich County, though in 1938 there were not over 16,500 head of beef cattle and 1,350 head of dairy cattle. This abnormally low stocking is primarily the result of the federal drought cattle-purchasing program in 1935, at which time 6,700 head of cattle and 13,000 head of sheep were sold from Rich County lands. The livestock numbers seem to be increasing, however, and it is presumed that they will soon return to normal.

Rich County has many well-bred cattle, mostly Hereford, which graze the ranges and, especially, the pastures and hay meadows, (fig. 4). These good animals are outnumbered, however, by crossbred or low-grade stock. Though pure bred bulls are common on the range the cows are frequently of such poor grade as to be inefficient in beef production and, hence, in forage utilization. It should be remembered that a well-bred animal will dress a

4—Data from E. L. Guymon, county agent.
5—The county planning report of 1939 estimates 16,266 beef cattle of which 5,600 range outside the county (9).
higher percent of marketable meat which commands a higher price per pound. Greater production and higher income are thus attained by well-bred animals from a unit quantity of feed.

In general, the cattle remain in the county throughout the year and spend the eight summer months on range land and the four winter months on hay in the valley ranches. About 3,000 head, however, winter in the valley on hay but summer on Wyoming range lands. The death loss from all beef cattle wintering within the county is about 5 percent. In general, the animals are in good condition when they leave the winter feed lots.

The average calf crop for the county is only about 60 percent, the result, in the main, of poor condition, insufficient number, and poor distribution of bulls. It is the practice to leave bulls with the herd throughout the grazing season. Calves are born throughout the year and, hence, death loss resulting from poor condition of the mother and bad climatic conditions is high.

Dairying is not an important industry in Rich County, straight dairy farms producing only 2.9 percent (1930) of the annual income, but recently there has been a large increase in milk cows and milk production, and the possible future development of this industry is great. There are modern creameries available at Randolph, Woodruff and Laketown.

---Data from E. L. Guymon, county agent.
Livestock Numbers

Accurate records of past use of range lands in Rich County are not available because the free ranges were grazed by anyone at any time, and many animals moved into and out of the county as climate and abundance of forage demanded. However, an estimation of past grazing can be obtained from the census of livestock ownership (table 5), though these records are not entirely accurate.

Table 5.
Numbers of various classes of livestock owned in Rich County, Utah, 1920-1938 (U. S. census except 1939 figures)

<table>
<thead>
<tr>
<th>Stock class</th>
<th>1920</th>
<th>1925</th>
<th>1930</th>
<th>1935</th>
<th>1939*</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sheep</td>
<td>29,213</td>
<td>41,102</td>
<td>111,766</td>
<td>92,751</td>
<td>36,950</td>
</tr>
<tr>
<td>All horses and mules</td>
<td>2,840</td>
<td>2,186</td>
<td>2,635</td>
<td>2,549</td>
<td>1,400</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>371</td>
<td>420</td>
<td>1,258</td>
<td>1,265</td>
<td>1,460</td>
</tr>
<tr>
<td>All cattle</td>
<td>25,661</td>
<td>20,067</td>
<td>24,941</td>
<td>16,755</td>
<td>16,266</td>
</tr>
<tr>
<td>Total animal units†</td>
<td>34,343</td>
<td>30,473</td>
<td>49,929</td>
<td>37,854</td>
<td>25,056</td>
</tr>
</tbody>
</table>

*County planning report (9). These figures, especially the sheep estimate seem low though the 1939 tax assessment roll shows only 38,304 sheep and 10,401 range cattle. These assessment figures are estimated by the county agent to be 80 percent of the actual number.
†—Calculated at 5 sheep, 1 horse or mule, or 1 bovine equal to one animal unit.

Some interesting facts can be established from studying stock ownership records for the past twenty years. There has been a definite tendency toward an increase in sheep at the expense of range cattle. Dairy cattle, conversely, have increased rapidly in numbers. The number of horses has remained approximately constant.

The period about 1930 was a peak period in livestock numbers. This abnormal stocking followed by a period of abnormally low precipitation resulted in great reductions in livestock numbers, which was accentuated by the federal emergency drought purchases. The 1935 census, then, shows a definite drop in stock population.

Range Grazing Use

The actual range use in Rich County is dependent not only upon livestock population but also upon the production of forage crops on cultivated lands. The livestock numbers as shown in table 5 in no way can be termed as representative of the use of
range lands. Further, the numbers presented in this table represent livestock owned within the county and not those actually fed within the county. Studies on intercounty and interstate movement of livestock (6) indicate that livestock owned within Rich County obtain approximately 106,838 animal months of forage from other counties or states and that livestock owned in other counties or states obtain about 21,792 animal months of forage from Rich County. This means that Rich County owned livestock receive a balance of forage equivalent to 85,046 animal months from ranges outside the county. Based on the 1935 estimate (the last census estimate) of feed necessary for Rich County owned livestock (454,248 animal months) there would then be only 369,202 animal months actually obtained in Rich County.

Of the estimated 369,202 animal months of forage obtained in Rich County, the cultivated lands furnish the majority. The estimated feed production of these lands is shown in table 4. The acreage and yield figures as obtained by the United States Census are assumed to be fairly accurate, but the feed value of these yield units cannot be accurately determined. A reasonable estimate, however, shows 194,279 animal months forage produced on cultivated lands, including hay, pasture, grain, and aftermath. Grazing land must, then, furnish the remaining 164,023 animal months of forage.

Calculations from the field data show that under existing conditions the capacity of the range lands is only 96,519 animal months, indicating a tremendous deficiency. It should be re-emphasized, however, that data on stock ownership and on the value of feed produced on cultivated lands are subject to considerable error and this error is, in turn, all absorbed by the figure on number of animals supported on range land. It likewise should be noted that compared with some past years the 1935 stocking is high. If the stock ownership figure for 1925, an abnormally low figure, were used in calculation, it would actually show an excess forage production in the county. The estimate for 1939 would also show an excess. Assuming a continuance of present supplemental forage production, Rich County could own safely in the neighborhood of 31,320 animal units, or about 83 percent of the 1935 livestock ownership estimation.

It should be pointed out that the data on range grazing capacity are not of a permanent nature but that under proper stocking and management the capacity will increase and might ultimately exceed the present grazing use.
Marketing Livestock

Livestock from Rich County are mostly shipped by rail from Montpelier, Idaho, 37 miles north of Laketown; Sage, Wyoming, 17 miles east of Randolph; and Almy, Wyoming, 18 miles southeast from Woodruff. Most of the livestock is marketed in the Ogden and Denver yards.

Water for Livestock

Livestock water is not a serious problem in Rich County. Probably the greatest shortage is on the high benchlands east of Bear Lake where reservoir development would doubtless be of benefit. Bear Lake, Bear River and its many tributaries, and the numerous springs along the Wasatch Range and foothills are adequate sources of water. Snowbanks are used as a source of water on many of the spring ranges, especially by sheep, and although this is not a desirable nor dependable a source it has proved adequate over large areas.

Wildlife

Rich County has no especial problem concerning the grazing of big game on range lands. Deer and elk are abundant on the summer ranges but here they generally do not compete a great deal with domestic animals since they frequent the higher and less accessible areas. Most of these game animals do not winter on the Rich County lands and hence no serious problem exists except in local areas where private spring range receives considerable damage from deer.

Perhaps the most serious range problem is the grazing of the ground squirrel (Citellus armatus) and the jack rabbit (Lepus townsendii). These two rodents are chiefly grass eaters and are found in great abundance on the spring and fall range lands. Although these animals have always inhabited the county, they have greatly increased in numbers and adequate control measures are essential.

Soil Erosion

Erosion in Rich County has not progressed sufficiently to have caused great damage, but its operations are becoming evi-
dent over much of the county and give warning of damage that will result if present use is continued. Survey records on range lands other than national forest show evident sheet erosion on 90.5 percent of the area and evident wind erosion on 5.4 percent. The study likewise showed gully erosion to exist on 80.4 percent of the area, but the gulleys were rarely deep or of frequent occurrence (fig. 5).

![Bar Chart]

Gully Erosion

Fig. 5. Gully erosion on range lands in Rich County, Utah.

The soils of Rich County are gravelly so that even with depleted vegetation they can absorb a large part of the precipitation, but, if depletion continues and the soil structure becomes further broken down with increasing erosion, serious soil losses are inevitable. The control of this problem is a comparatively easy matter when erosion has not progressed far, but after it has become severe, control is extremely difficult. Most of Rich County is at present not severely eroded but land owners should have a keen appreciation of the soil depletion that will surely accompany further misuse of range lands.
Suggestions for Improving Range Management

Range Revegetation

The ranges of Rich County were naturally high in grass content, and most of them have a fair stand of grass remaining. Because of the existence of these "seed plants" and because of the comparatively low and undependable precipitation in Rich County, reseeding generally is neither advisable nor desirable. In small problem areas in the more favorable sites, such as abandoned dry-farm lands, reseeding would doubtless give excellent results. Small seedings of crested wheatgrass have already shown the suitability of that species to this type of land. Less favorable range lands, however, could best be rejuvenated by the initiation of correct grazing management, including control of both season and intensity of use.

The surprisingly general custom of burning range land contributes, also, to its low production. Adequately controlled and scientifically managed burning might possibly be of value to the brush ranges of Rich County, but there is no doubt that the present promiscuous and off-season burning followed immediately by heavy grazing is extremely harmful.

Increased Supplemental Forage Production

The cultivated and irrigated lands of Rich County should be and generally are devoted entirely to the production of forage. The dependency of the livestock industry upon farm lands for maintenance of animals during the winter months together with the relatively poor market conditions for cash crops makes forage production the logical use of almost all of the tillable land. That this is economically sound is evidenced by the fact that of the total agricultural income of Rich County, livestock ranching accounts for 87.2 percent, whereas general farming accounts for but 3.9 percent.

A better distribution of livestock and grazing privileges among the rural population of Rich County would make for a better balance between farming and ranching. Despite the fact that this county has more livestock per farm than any other county in Utah, there are many small landowners with few or no animals. Large owners, whose land is adequately supported by large grazing privileges on public land, prohibit the desirable diversification that would accompany a more general ownership of livestock.
Since most of the arable land is already in native meadow and since these meadows are normally very productive, there is little to be gained by extensive change from this crop. The yield, however, can be greatly improved. Suggested considerations for this improvement are: (1) protection from excessive and too early grazing by livestock, (2) avoidance of too much and too prolonged application of irrigation water, (3) insurance of adequate drainage, especially on alkaline areas, and (4) use of fertilizers to insure maximum yield.

Most meadows are either harvested entirely or in part by livestock (fig. 6). One cutting of hay followed by grazing is a common practice. In general, this practice is desirable but too close utilization or too early utilization will inevitably result in decreased density as well as a replacement of better species by species of lower value. These meadows are the key to successful agricultural endeavor in Rich County and the successful management and perpetuation of them should be foremost in the aims of the people.

The production of alfalfa and grains to supplement natural meadows in forage production is desirable. These crops thrive in most of Rich County provided they can be given occasional

Fig. 6. Rich County meadows support many animals.
irrigation, and if properly managed, may produce more and better forage than do the natural meadows. The planting of many depleted meadows to these crops would doubtless greatly increase the forage production of the county.

The devotion of any sizable land area to the production of crops which are neither fed to livestock nor consumed by people within the county seems inadvisable in view of the value of the cultivated land to the range balance of the county. The optimum management of, and hence production from, the range land in Rich County relies absolutely upon dependable supplemental feed production, especially in the early spring months. Supplemental feeding for even a week or two longer in the spring and a corresponding delay in opening the spring range would greatly benefit both the range and the stock. Grazing during the early spring is far more detrimental to the plants than at any other season and the forage is not so valuable to the grazing animal. Also, poisonous plant losses are abnormally high on ranges which are grazed too early.

Livestock Management Practices

Poor livestock breeding practices are probably the most serious management problem to which Rich County ranchers should give attention. There is little seasonal control in cattle breeding, the bulls being turned on the ranges in early spring and allowed to remain the entire summer. As a consequence, calves are dropped throughout most of the year. Early calves are subjected to severe weather conditions and are born while the cow is in poor flesh. Late calves are so young and in such poor condition at the beginning of winter that the losses are high. The high death loss resulting from the lack of seasonal breeding, together with a high percentage of dry cows, results in an abnormally low calf production.

Sheep breeding likewise is often spread over too long a time period. This prohibits proper care of lambing ewes and encourages high death loss. The use of a sufficient number of vigorous rams to insure breeding of a reasonable percent of the ewes within a period of 4 to 5 weeks would materially increase the lamb crop.

Since both calf and lamb crop are so closely correlated with ranch income, great care should be exercised to insure the maximum yield. To bring this about the following suggestions merit consideration: (1) A greater number of bulls and rams, not less
than one bull per 25 to 30 cows and not less than one ram per 50 to 60 ewes. (2) A maintenance of good condition of breeding stock during the breeding season and of females during gestation by insuring ample feed. (3) Use of breeding pastures, where topography is relatively level and feed is abundant. (4) A definite breeding season and elimination of cows and ewes not breeding during that season. (5) Careful attendance to the herd during calving and lambing.

Summary

1. Investigations were conducted in 1938 to determine the range resources of Rich County, Utah, and to study the relationship of these resources to the agricultural welfare of the county.

2. Rich County has an area of somewhat more than 650,000 acres, about 90 percent of which is range land. The climate is dry and cold. The vegetation is chiefly sagebrush, though the higher mountains are forested and the river bottoms support a highly productive meadow.

3. Over half of the land in the county is privately owned and almost one-third is in public domain. Economic conditions are generally poor, the populace of 1,873 bearing a debt of about 780 dollars per capita.

4. The range lands of Rich County were found to be low in potential productivity, and, through misuse, the condition of the vegetation has been reduced far below the normal. The average density of plant cover was only 14.7 percent (excepting national forests) and over 80 percent of the land had a visible acceleration of erosion little of which, however, had reached a serious state.

5. By standard reconnaissance the range lands (excluding irrigated meadows) of Rich County were found to have a grazing capacity of about 96,519 animal months. Cultivated lands, including irrigated pastures and hay meadows, produce an estimated 194,279 animal months of forage per year. The total forage production is estimated at 290,798 animal months or 24,231 animal units yearlong. Though two-thirds of the range capacity is on spring-fall range and all of the remainder is on summer range this lack of seasonal balance is not serious.

6. The livestock census of past years indicates that the total numbers are decreasing, and that at the time of the last official
census (1935) the forage capacity of the range and cultivated land was 83 percent of the livestock population.

7. Poisonous plants, shortage of stock water, and range damage from wildlife, while locally important, were not found to be serious problems in Rich County.

8. Suggestions for improving the range production of Rich County include:
   (a) Careful attention to the capacity and correct season for grazing the range.
   (b) Improved production methods on irrigated meadows to insure a dependable and maximum yield, and
   (c) Initiation of a stock breeding and management program that will result in high lamb and calf crops.

Literature Cited

8. Utah. State Department of Public Instruction. Utah — Resources and activities. Salt Lake City, Utah, 1933.

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