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Alternative Measures of Livestock Dependency

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Livestock have grazed lands currently administered by the Forest Service (FS), Bureau of Land Management (BLM), and other federal agencies for over 100 years. But, permits to use these lands were not allocated to livestock operators until early in the 20th century. The allocation of these permits has a colorful history (Calef; Gates; Foss; and Clawson and Held). Grazing permits were issued to reduce or eliminate the overuse that occurs when a resource is used as a commons (Hardin). The criteria used to allocate grazing permits were primarily based on two concepts--commensurability and prior use (e.g., see Gates, chapter 11), which favored those operators who depended upon the use of public lands to "round out" the forage supplies needed to sustain a herd. Since that time, dependency has been an issue whenever changes have been proposed that would alter the amount of forage that a livestock operator could obtain from federal lands. Because declining economic activity in rural America has become a national issue, this issue is particularly important whenever changes are proposed in small economies that are perceived to depend upon the use of federal lands. Thus, the issue of dependency has become important, not only to the communities that may be affected, but to society in

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[1]An earlier version of this paper was prepared and presented at the annual meetings of the Society for Range Management in Albuquerque, New Mexico, on 16 February 1993.

[2]The authors are Professor and County Extension Agent, respectively, at Utah State University.

general. Unfortunately, dependency has become a catch phrase with few empirical applications concerning what this may mean in a rural setting.

Study Area

Several measures of dependency are available and each has advantages and disadvantages. Many of the measures that might be used are not available for large areas. As a result, a study was initiated in Wayne County, Utah, which outlines many of these measures.[3]

Wayne County is located in southern Utah, near the major national parks that have made Utah famous---Capitol Reef National Park bisects Wayne County. The county encompasses more than 1.5 million acres and is dominated by federal ownership (more than 85% of the land is managed by agencies of the federal government). Most of the private land is found in a high mountain valley. The growing season is short, so the primary crops grown are barley and forage crops. Livestock operators have permits to graze two national forests--Dixie to the south and Fishlake to the north. Livestock operators also have permits to graze BLM allotments located in two general areas---those in the upper valley where most of the residents of the county live and those on the desert south of Hanksville. Most residents have been in the area most of their life and a large share of the people are related through marriage(s).

Wayne County provided an opportunity to evaluate the dependency of livestock operations on federal lands. Some of the reasons why Wayne county can be

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[3]Data for Utah and/or the western states also will be used in this paper when available.

used stem from several related factors including: (1) a large share of the people use federal lands; (2) the county is dominated by federal lands; and (3) several adjustments in the use of federal lands have occurred during the last 25 years and further adjustments have been proposed.

Measures of Dependency

Number of Operators

One of the easiest measures of dependency is the measurement of the number of livestock operators who use federal lands. Current data on this topic are not available, but the latest national data (Table 1) suggest that only 8% of the livestock operators in the 16 western states have permits to graze lands administered by either the FS or BLM. The percentage is much higher in states where a large percentage of land is administered by federal agencies (e.g., 49% of the operators in Nevada). While only a small percentage of the livestock operators nationally have permits to graze federal lands the same can not be said for livestock operators in Wayne county. Only 9 livestock operators (7 percent) in Wayne County did not have one or more permits to graze livestock on FS or BLM administered lands in 1991.

Percentage of Feed

The most common measure of dependency that has been used in the literature is the percentage of feed obtained by livestock operators from public lands. For example, Godfrey and Pope estimated that livestock operators in the United States obtained about 2.6% of their feed in 1988 from public lands and the percentage of feed coming from public lands declined in almost every state between 1966 and 1988

Table 1. Number and Percentage of Livestock Producers in the 16 Western States with Forest Service and BLM Grazing, 1983

State	Total Producers[1]	No. of Producers With Federal Grazing FS	BLM	Total Federal	Adjusted Federal[2]	Federal % of Total[3]
Arizona	3,792	625	931	1,556	1,323	35
California	26,579	953	1,009	1,962	1,668	6
Colorado	16,127	1,842	1,908	3,750	3,188	20
Idaho	15,980	1,640	2,383	4,023	3,420	21
Kansas	47,008	---	11	11	11	*
Montana	15,980	1,308	4,023	5,340	4,539	29
Nebraska	39,555	114	39	153	153	*
Nevada	1,786	320	716	1,036	881	49
New Mexico	9,189	1,285	2,626	3,911	3,324	36
North Dakota	18,548	---	100	100	100	*
Oklahoma	58,236	28	11	39	39	*
Oregon	21,811	762	1,357	2,119	1,801	8
South Dakota	27,000	416	474	890	756	3
Utah	8,757	1,683	1,887	3,570	3,035	35
Washington	20,147	232	474	706	600	3
Wyoming	6,428	886	1,004	1,890	1,607	25
Total	336,765				26,445	8

[1]1982 Census of Agriculture, Table 11, pp. 218-224. Number of farms with cattle and calves.
[2]15% of permittees have both FS and BLM grazing.
[3]percentage of producers/state with federal permits.

*Less than 1%.

Source: Committee on Government Operations. Taken from Godfrey and Pope.

(Table 2). This national percentage is not indicative of specific areas or types of operators. For example, the percentage of feed for cattle operations in Utah decreased from 50% in 1950 to 24% in 1988, while the percentage for sheep remained essentially static (52% versus 46%). Large differences in the percentage of feed obtained exist for individual operators. For example, every livestock

Table 2. Percentage of Feed Coming From Federal Lands in the West and U.S., 1966 and 1988

State/Area	1966	1988
Arizona	27	24
California	4	4
Colorado	6	6
Idaho	17	14
Montana	7	7
Nevada	49	43
New Mexico	17	20
Oregon	13	11
Utah	28	24
Washington	2	2
Wyoming	16	16
11 western states	12	12
U.S.	3	2.6

Source: Data from University of Idaho with Pacific Consultants, Inc. 1988 Data Estimated Using: Public Lands Statistics, Forest Service Annual Grazing Report, and USDA, Agricultural Statistics. Table taken from Godfrey and Pope.

operator in Wayne County was identified and information was obtained concerning the number of animals owned and the amount of feed (AUMs) each person obtained from each of the agencies administering public lands used by livestock operators who reside in Wayne County [BLM, Forest Service (Dixie and Fishlake National Forests), Utah Department of Lands]. The total number of AUMs of forage needed by each operator was then determined. This amount was then divided into the number of AUMS of forage each operator obtained from public lands. These data indicate that the average producer in Wayne County was permitted to take about 38% of the forage needed for his/her herd from public lands.[4] However, the variation in the percentage of forage coming from federal lands was

[4]It should be noted that actual use in 1991 was less than the permitted use for most operators, primarily because a drought had reduced forage production on rangelands in the area. As a result, most operators had taken some amount of voluntary non use. If this drought had not occurred, the percentage of feed from federal lands would have been higher for most operators..

extreme--0 to nearly 100%. This suggests that dependency, if measured as a percentage of feed, must be considered on an individual basis.

Dependency by Source

While forage from public lands may not be important as a percentage of the total amount of feed needed by a livestock operation, it may be important during some seasons of the year because other sources of feed may not be available. The degree of seasonal dependency is often measured using a forage balance chart (see Workman, pages 147-154). This is especially important in those cases when feed during certain periods can be obtained inexpensively (e.g., aftermath that is available from hay and grain fields during the fall in Wayne County). These evaluations can also be used to develop linear programming models. These models have been used to estimate the value of forage during particular season(s) of the year and/or from a specific source (for example, see Hahn et al.). The shadow prices derived using linear programming models generally indicate that an AUM of forage is not of equal value throughout the year nor by source. This suggests that the dependency of a ranch operation on federal forage may be more important during some seasons than it is during other parts of the year. For example, a linear programming model for operators in Wayne County indicated that forage values varied from 0 to more than $50[5] (Table 3) per AUM. Several reasons can be given for these differences in shadow prices but, the season of use and the cost of obtaining these sources of forage

[5]The shadow prices shown in Table 3 are only some of those derived for operators in Wayne county. The shadow prices derived for other operators were often different from those shown because each operator faced different constraints. This large amount of variation makes it difficult to determine "the value of forage" for more than one operator. The paper by Godfrey and Nielsen found in this publication outlines some of the problems associated with the use of shadow prices.

are particularly important. For example, private pastures in Wayne County are some of the first and last areas that can be grazed, they are generally the most productive grazing lands (AUMs per acre) and the variable costs of using these lands are much lower than they are for other sources of forage. As a result, they generally have the highest shadow price. Some federally administered lands would be expected to have high shadow prices because few substitutes exist for their use during some periods of time. However, the variable costs of obtaining this forage may be high. For example, the variable costs of grazing desert BLM lands (near Lake Powell) are high, in excess of $20 per AUM for some operators.[6] But, the value of forage from these lands is relatively high because the primary substitute (the only substitute in most cases) for this forage is feeding hay. These results suggest that the value of forage (an economic measure of forage dependency) is affected by the cost(s) of obtaining a specific type of forage and the need for that source during particular periods of time.

Employment

Most of the measures of dependency outlined above have been reported in the literature by others. The amount of work has been done on how the use of public lands by livestock may affect the citizens in an area is very limited. In an effort to address this issue, every adult in Wayne County was identified and data were assembled concerning their occupation (Figures 1 & 2). These data indicate that even a community which is dominated by agriculture and public lands, only two families were solely dependent on livestock production for their livelihood, and neither of

[6]Some operators, who had permits to graze near Lake Powell during the winter months, would travel as much as 150 miles each way from their home to an allotment.

Table 3. Shadow Prices for Sources of Forage in Wayne County, Utah, 1991

	$ per AUM
Fishlake	$14.17
Dixie	12.17
Parker Mtn.	15.17
BLM Desert	10.62
BLM (home)	12.99
Private pasture	57.21
Aftermath	28.61

these operations obtained more than 50% of the feed for their livestock operation from public lands.

The most common pattern of employment and income for families in Wayne County involved livestock raising with some type of off-farm employment. While data were not available that indicate the total income of any single household in Wayne County, the income and employment data available suggest that few families could survive on the basis of their livestock ***or*** their off-farm employment. Both sources of income are commonly necessary. This suggests that if reductions in grazing on public lands result in the loss of livestock operations,[7] some individuals in Wayne County would move elsewhere because the income obtained from off-farm employment is not sufficient to sustain these families. It should also be noted that many of these operators would also be forced to "give up" ranching if they lost their off-farm source(s) of income. Thus, the loss of either farm (ranch) or nonfarm income in Wayne County could cause both the farm and nonfarm sectors to decline. This

[7]Essentially, if off-farm income is available, no empirical data are available concerning the level of income necessary for an operator to sustain his/her operation. This level is likely to vary by operation because some operators are more willing to sacrifice personal comforts in order to "keep the ranch/farm" than are other operators.

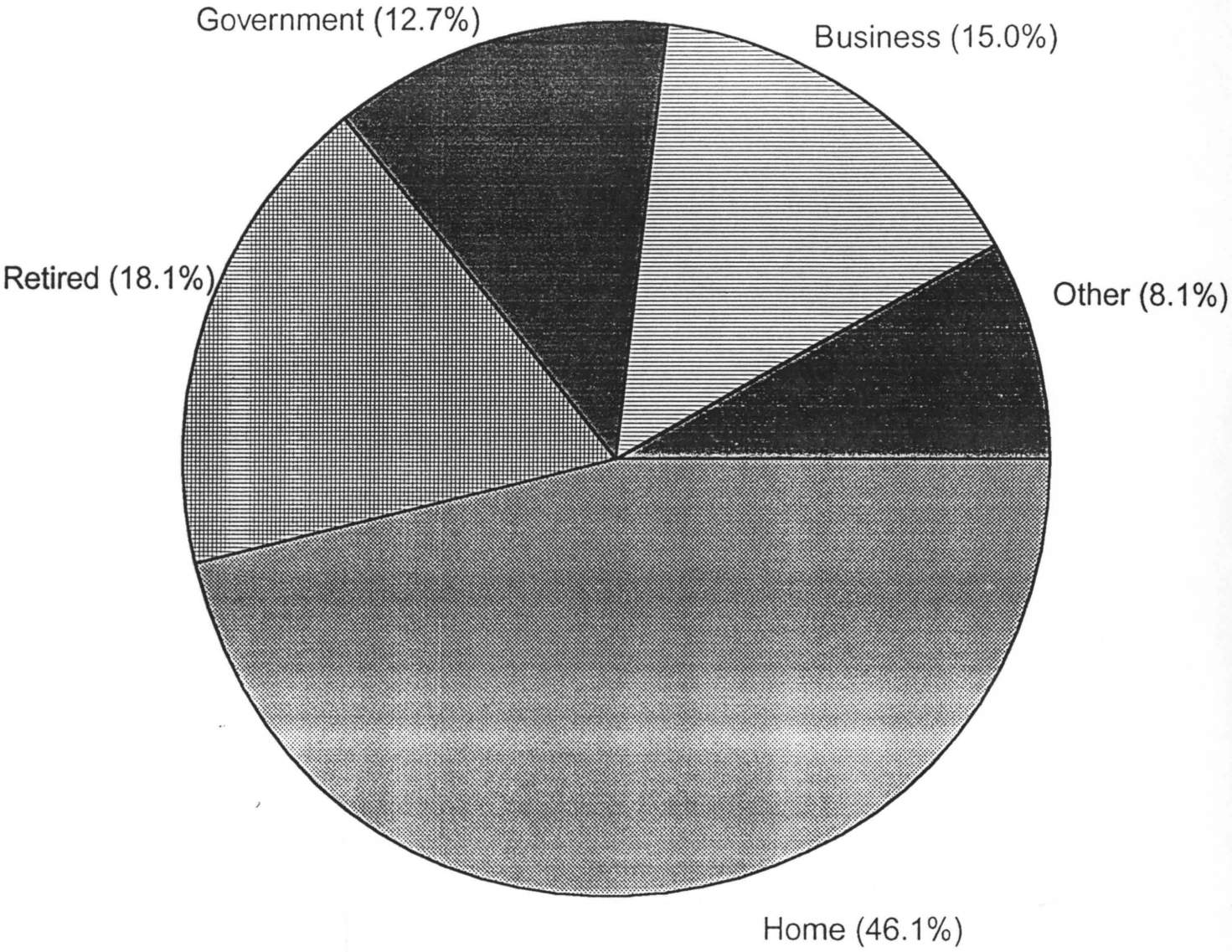

Figure 1. Employment of Females in Wayne County Utah, 1991.

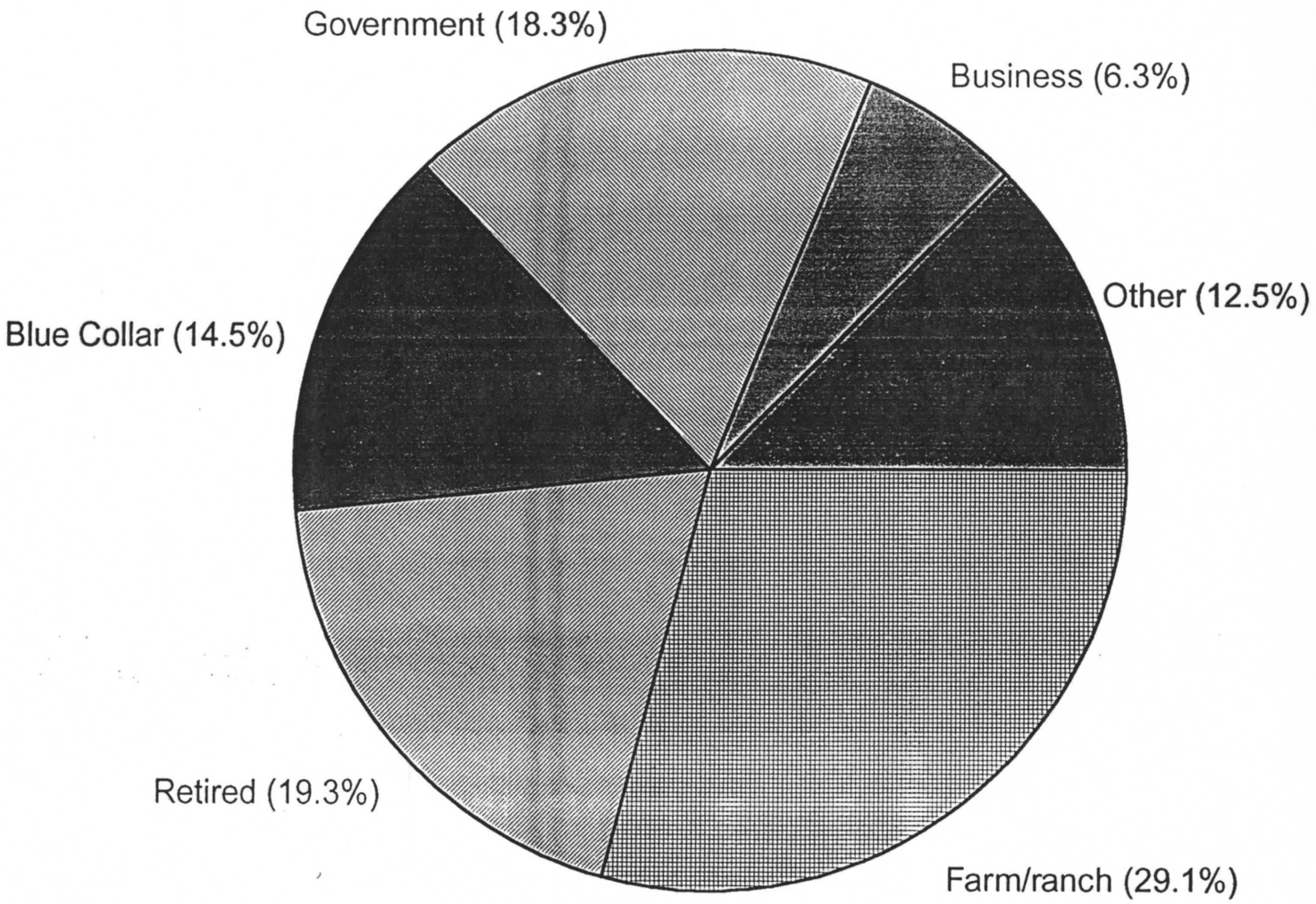

Figure 2. Employment of Males in Wayne County Utah, 1991.

suggests that an evaluation of dependency from a social point of view is more complex than is commonly thought. It also suggests that the livestock sector in some rural communities is closely linked to other sectors in the economy.

Interindustry Analysis

The most common method used to show the interaction that exists between one sector (e.g., livestock production) and other sectors in an economy is an input-output (I/O) model. These models have been developed for many areas and have been used by several authors to estimate how changes in one sector will affect other sectors. Some of these impacts are illustrated in Table 4. These data suggest the largest income and employment multipliers in Wayne county are associated with the range livestock sector ----only a food manufacturing sector (cheese plant) had a higher multiplier. This suggests that changes in this sector would have the largest impact on county level employment, income, and output. Income

The most economically meaningful measure of dependency is income because it is the social variable that allows persons to obtain goods and services desired. It is, however, the most difficult data to obtain. The data for Wayne County indicate that it is a relatively poor county Only San Juan, Emery, and Iron Counties had lower per capita personal income in 1991 than Wayne county and two of these counties (Emery and San Juan) border Wayne County.

The data in Table 5 show that income in Wayne County increased during the decade of the 1980s, but most of this increase came from farm rather than nonfarm sources. Farm income increased more than 3.5 times while nonfarm income increased just less than 1.4 times. It should be noted that the increase in nonfarm

Table 4. Some Preliminary and Selected Multipliers for Wayne County

Sector	Output	Income	Employment
Range cattle	1.85	1.85	2.05
Sheep & lambs	1.46	1.63	1.64
Grain	1.30	1.12	1.30
Food processing	1.70	2.10	2.50
Lumber/sawmills	1.55	1.12	1.40
Transportation	1.31	1.09	1.31
Retail trade	1.35	1.02	1.18
Eating & drinking	1.21	1.10	1.19
Lodging	1.16	1.05	1.29
Services	1.11	1.03	1.21
Schools	1.67	1.05	1.18
Other government	1.25	1.05	1.29

income ($2,756) was more than the increase in farm income ($2,324), but growth in income was much faster in agriculture. Most of this increase was due to livestock production, which is the dominant sector in Wayne County. These data also suggest that the rural counties[8] in Utah (e.g., Wayne, Beaver, Sanpete, Rich) became more dependent on farming during the 1980s. Thus, while farming is not a major source of income in many counties, it became more important in rural Utah during the 1980s.

[8]Most of these counties are also dominated by federal land ownership and livestock production.

Table 5. Farm and Nonfarm Earnings (thousands of dollars) for Counties in Utah, 1980 and 1990

	1980			1990			Change in %
	Farm	Nonfarm	Farm %	Farm	Nonfarm	Farm %	1980-1990
Beaver	1,365	16,541	7.62	11,295	26,266	30.07	22.45
Box Elder	12,101	205,175	5.57	30,739	499,961	5.79	0.22
Cache	15,569	239,901	6.09	29,493	564,103	4.97	-1.13
Carbon	771	154,072	0.50	2,670	202,042	1.30	0.81
Daggett	636	5,264	10.78	684	6,675	9.29	-1.48
Davis	7,499	815,373	0.91	16,060	1,674,144	0.95	0.04
Duchesne	3,340	69,866	4.56	14,445	93,135	13.43	8.86
Emery	432	101,858	0.42	6,840	120,971	5.35	4.93
Garfield	949	223,843	3.83	5,231	28,767	15.39	11.56
Grand	744	53,282	1.38	782	49,390	1.56	0.18
Iron	1,283	73,880	1.71	12,864	154,329	7.69	5.99
Juab	328	23,070	1.40	4,587	32,137	12.49	11.09
Kane	382	12,213	3.03	1,913	27,976	6.40	3.37
Millard	8,153	25,914	23.93	16,592	94,176	14.98	-8.95
Morgan	2,053	17,330	10.59	4,741	25,080	15.90	5.31
Piute	1,239	3,308	27.25	3,050	3,416	47.17	19.92
Rich	1,217	4,207	22.44	6,886	5,694	54.74	32.30
Salt Lake	11,474	4,712,579	0.24	12,477	9,526,423	0.13	-0.11
San Juan	2,048	55,548	3.56	5,902	68,955	7.88	4.33
Sanpete	2,139	34,911	5.77	19,998	75,703	20.90	15.12
Sevier	3,829	73,229	4.97	10,583	114,577	8.46	3.49
Summit	3,498	54,395	6.04	9,074	165,540	5.20	-0.85
Tooele	2,152	171,706	1.24	6,262	304,141	2.02	0.78
Uintah	3,190	130,614	2.38	12,900	175,574	6.84	4.46
Utah	8,620	911,262	0.94	23,743	2,120,998	1.11	0.17
Wasatch	1,486	29,939	4.73	4,226	52,283	7.48	2.75
Washington	3,031	80,418	3.63	4,819	314,586	1.51	-2.12
Wayne	917	7,328	11.12	3,241	10,084	24.32	13.20
Weber	4,261	717,303	0.59	10,762	1,519,717	0.70	0.11
State	104,706	8,824,329	1.17	292,859	18,056,843	1.60	0.42

Conclusions

The above illustrates several things. First, each of the measures of dependency outlined above evaluates this concept from a different point of view. None of these measures is clearly superior to another because they depend upon the question being asked--what is important to a decision? Second, no one measure of livestock dependency is sufficient. Third, the degree of dependency, using any one of the measures, varies widely. As a result, the use of any or all of these measures may be important to decision makers who administer federal lands when changes in livestock use on public lands are being proposed.

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