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# Sheep Production in 11 Western States

Hosein Shapouri

Abstract

Net cash returns of U.S. sheep producers were positive for the past 18 years, yet the industry in 1986 experienced the largest declines in number of sheep farms and in sheep population since 1942. Per capita consumption of lamb and mutton has trended downward since 1962, remaining below 4.5 pounds for the past 13 years. The 1986 USDA Farm Costs and Returns Survey indicates that the major sheep production practices of stock and range lambing have not changed significantly since 1980, and losses from disease and predators are high. Sheep production requires more fixed labor and operator time than any other livestock enterprises. Although sheep production is more profitable than cattle production, sheep producers require more net returns than do cattle producers to expand production.

Keywords: Sheep industry; 1986 sheep survey; costs and returns

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### Abstract

Net cash returns of U.S. sheep producers were positive for the past 18 years, yet the industry in 1986 experienced the largest declines in number of sheep farms and in sheep population since 1942. Per capita consumption of lamb and mutton has trended downward since 1962, remaining below 1.5 pounds for the past 13 years. The 1986 USDA Farm Costs and Returns Survey indicates that the major sheep production practices of shed and range lambing have not changed significantly since 1980, and losses from disease and predators are high. Sheep production requires more hired labor and operator time than any other livestock enterprises. Although sheep production is more profitable than cattle production, sheep producers require more net return than do cattle producers to expand production.

**Keywords:** Sheep industry, 1986 sheep survey, costs and returns.

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## Summary

This report summarizes the results of the 1986 Farm Costs and Returns Survey of sheep producers in 11 Western States. A sample of 339 sheep producers was surveyed. The survey data were collected by the National Agricultural Statistics Service and Economic Research Service, USDA. This report reviews the structure of the U.S. sheep industry and analyzes the 1986 Western States sheep survey.

Small flocks of sheep are kept to utilize the unused forages and pastures on many U.S. farms. The U.S. sheep industry has experienced the largest decline both in number of farms and sheep population during the past 50 years. The number of farms with fewer than 100 ewes declined most sharply. However, farms with more than 100 ewes increased nationally.

The number of lambs and sheep slaughtered has decreased with the decline in the sheep industry. Lamb and mutton consumption, like other red meat consumption, has been declining as a percentage of total meat and poultry consumption. Lamb and mutton are an expensive type of red meat, particularly so when compared with poultry meat, and are consumed by only a small segment of the population.

The sheep industry has benefited from U.S. Government programs. Wool receipts account for an average 20 to 30 percent of sheep producers' revenues. In many years, the wool incentive payments have been the difference between profits and losses for the U.S. sheep industry.

The 1986 Farm Costs and Returns Survey of sheep producers indicates that, in general, sheep production practices have not changed significantly from those reported in the last survey. The survey also found that shed and range lambing are the two principal systems used in sheep production. Range lambing was practiced by 62 percent of the operators. Medium and large producers prefer range over shed lambing because it is less expensive and requires less labor.

Lamb and sheep losses to predators and disease as a percentage of stock sheep and lambs are high, accounting for 12.7 percent of January 1, 1986, sheep inventory. Big losses to predators and disease motivated sheep producers to diversify their agricultural effort to other livestock enterprises.

Grazing in private and public pastures accounted for three-fourths of the feed used in sheep production. Nearly 80 percent of pastures grazed by sheep are private. Nonirrigated private pasture and ranges account for one-half of the total feed in the Western States. Hay and supplemental feed are used only during lambing or when pastures are not accessible due to weather.

Sheep production is no longer the prime income source for Western States sheep farms. Sheep, livestock, and crop production are complementary enterprises in the West.

Sheep production requires more hired and operator (management) time than other livestock enterprises. Labor outlays are ranked second to feed costs in sheep production.

Costs and returns estimates based on the 1986 Farm Costs and Returns Survey indicate that sheep production has been profitable. Cash returns have been large enough to cover all the cash expenses plus capital replacement expenses. However, the residual returns to risk and management turned negative in 1988 and 1989 due to the lower price of slaughter lambs.

The sheep industry requires higher returns than other livestock industries to encourage sheep producers to expand their production. The higher returns would compensate for problems associated with sheep production such as big losses to predators and diseases, large outlays for labor, and management constraints.

# Sheep Production in 11 Western States

Hosein Shapouri

## Introduction

Sheep production has been a profitable industry compared with beef cattle and hog production. Sheep enterprises have had positive net cash returns (cash receipts less total cash expenses plus capital replacement) for the past 18 years (1972-89). During the same period, the sheep and lamb inventory declined from 18.7 million to 10.9 million head. Sheep production has declined in all regions of the United States. Higher returns to sheep producers relative to cattle and hog producers and a decline in the sheep numbers indicate that the U.S. sheep industry faces many problems. The reasons include a high percentage of sheep losses due to diseases and predation, lack of skilled management, and higher use of scarce labor per ewe.

The major objectives of this report are to review briefly the structure of the U.S. sheep industry and to examine the importance of constraints and problems associated with sheep production. It focuses mainly on 11 Western States.

This report also summarizes information on costs and returns associated with commercial sheep production in the Western United States. Data for this study are based on a sample survey of the 1986 operations of 339 sheep producers. All data were collected by the National Agricultural Statistics Service (NASS) and Economic Research Service (ERS), U.S. Department of Agriculture (USDA), in early 1987.

## A Perspective on the U.S. Sheep Sector

Sheep convert forages into products such as meat, hide, and wool, for which there are few other uses (4).<sup>1</sup> On western pasture and ranges, sheep utilize forage that would otherwise have no market value. They consume herbs, weeds, and shrubs more readily than do cattle, require less frequent access to water, and have greater ability to graze in rough or steep terrain than other domesticated animals (7). Sheep are far more efficient than cattle as converters of feed and are among the most efficient domesticated ruminant animals in converting roughage. They blend well in various situations, from a supplementary farm enterprise to highly specialized enterprises.

On many farms in the United States, small flocks of sheep are kept to utilize forage on small acreage that cannot be cultivated. In addition, sheep consume byproducts of crop production that cannot be marketed or have no value.

### Location

Sheep are found in most of the United States, except in the Southeast where environmental conditions such as disease and parasites limit their production. Sheep production is concentrated in States west of the Mississippi River. Texas has 19 percent of the U.S. breeding ewe inventory, followed by

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<sup>1</sup>Underscored numbers in parentheses indicate items in the References section.



California (8 percent), Wyoming (7 percent), Montana (6 percent), and South Dakota (6 percent) (table 1). There had been a moderate shift of production to the West Central region during 1920-40, but there have been few shifts since 1940 (table 2).

### **Trend in Sheep Numbers**

Within the U.S. livestock industry, the sheep sector experienced the largest decline during the past 50 years (table 3). The inventory of all sheep and lambs declined from 56.2 million head in 1942 to 10.9 million head in 1989. Sheep population peaked in 1942 and steadily has trended downward, except for two plateaus in the 1950's and 1980's. Each liquidation phase was followed by about 11 years of relative stability. During liquidation phases, the declines in sheep and lamb inventories were 47 and 62 percent, respectively. Since 1980, the U.S. sheep population has been fluctuating between 10 and 13 million head.

The longterm downward trend in the sheep industry has been caused by internal rather than external factors. A combination of factors, many interrelated, has discouraged sheep production (9, 10, 11). Seasonal demand for lamb meat, low per capita consumption, low wool prices, substitution of manmade fibers for wool, increased problems with predators, lack of suitable labor, and little improvement in slaughtering and marketing infrastructure are the basic reasons for the decline of the sheep industry (7). Imports of both lamb meat and live animals show little effect on the U.S. sheep industry.

### **Flock Size**

The average U.S. sheep producer had 65 breeding ewes in 1989 (table 4). The average for the 11 Western States was 143 breeding ewes and for all other States it was 27 breeding ewes. The distribution of farms with sheep and breeding ewes shows that farms with fewer than 100 ewes accounted for 82 percent of total farms in 1987. Such a large number of farms with small flocks explains the low average national flock size. Yet, this large percentage of producers owns only about 20 percent of the total breeding ewes. Large producers, who accounted for 2.1 percent of all farms with a sheep enterprise, owned 48 percent of all sheep and breeding ewes in 1987 (table 5).

Large flocks are even more dominant in the 11 Western States. Flocks with 1,000 or more head are maintained by 5.5 percent of producers and contained 61 percent of breeding ewes in those States in 1987 (table 5).

Table 5 also measures the changes in number of farms and breeding ewes that took place between the 1978 and 1987 agricultural censuses. Both number of farms and sheep population declined during 1978-87 for farms with fewer than 100 ewes, by 4 percent in the Western States and 7 percent in the United States. The number of breeding ewes on the farms with fewer than 100 ewes declined by 1 percent in the Western States and 2 percent in the United States. In contrast, farms with more than 100 ewes increased both in the Western States and the Nation. The number of breeding ewes on the farms with more than 1,000 ewes also increased.

The average flock size for western producers declined from 194 ewes in 1978 to 162 in 1987. Of the western producers, 69 percent have fewer than 100 head of sheep and breeding ewes, 26 percent have 100 to 999 head, and 5 percent have 1,000 or more head. Operations with more than 1,000 head accounted for 61 percent of breeding ewes in 11 Western States in 1987.

Commercial sheep operations are very important to the U.S. industry (table 6). Flocks with 1,000 or more head were maintained by 2 percent of producers and accounted for more than 50 percent of total sheep and lambs in all census years.

Table 1--Number and share of breeding ewes, by State and U.S. total, 1976-90

State	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
<i>1,000 head</i>															
Arizona	286	281	266	270	246	240	235	201	178	148	161	144	182	185	170
California	811	770	780	838	839	850	854	800	796	770	725	685	685	632	620
Colorado	452	426	380	393	425	400	394	365	350	310	295	300	320	355	375
Idaho	460	420	376	369	361	386	389	357	308	246	250	245	247	220	223
Montana	416	371	372	380	400	420	455	459	465	472	410	410	430	434	490
New Mexico	454	429	546	432	468	468	468	452	435	391	355	342	367	384	373
Oregon	268	247	262	282	280	310	350	322	292	285	275	285	320	280	279
South Dakota	552	510	523	534	550	590	565	520	530	480	413	434	453	430	441
Texas	1,900	1,865	1,800	1,667	1,675	1,700	1,605	1,580	1,410	1,410	1,300	1,400	1,370	1,250	1,490
Utah	481	475	450	460	491	500	505	476	465	420	400	375	390	405	407
Wyoming	887	835	780	755	745	750	750	710	735	590	570	530	590	555	571
11 Western States	6,967	6,629	6,535	6,380	6,480	6,614	6,570	6,242	5,964	5,522	5,154	5,150	5,354	5,130	5,439
All other States	2,328	2,202	2,145	1,986	2,053	2,166	2,241	2,101	1,972	1,909	1,804	1,897	1,996	2,056	2,210
U.S. total	9,295	8,831	8,680	8,366	8,533	8,780	8,811	8,343	7,936	7,431	6,958	7,047	7,350	7,186	7,649
<i>Percent</i>															
Arizona	3.08	3.18	3.06	3.23	2.88	2.73	2.67	2.41	2.24	1.99	2.31	2.04	2.48	2.57	2.22
California	8.73	8.72	8.99	10.02	9.83	9.68	9.69	9.59	10.03	10.36	10.42	9.72	9.32	8.79	8.11
Colorado	4.86	4.82	4.38	4.70	4.98	4.56	4.47	4.38	4.41	4.17	4.24	4.26	4.35	4.94	4.90
Idaho	4.95	4.76	4.33	4.41	4.23	4.40	4.42	4.28	3.88	3.31	3.59	3.48	3.36	3.06	2.92
Montana	4.48	4.20	4.29	4.54	4.69	4.78	5.16	5.50	5.86	6.35	5.89	5.82	5.85	6.04	6.41
New Mexico	4.88	4.86	6.29	5.16	5.48	5.33	5.31	5.42	5.48	5.26	5.10	4.85	4.99	5.34	4.88
Oregon	2.88	2.80	3.02	3.37	3.28	3.53	3.97	3.86	3.68	3.84	3.95	4.04	4.35	3.90	3.65
South Dakota	5.94	5.77	6.03	6.38	6.45	6.72	6.41	6.23	6.68	6.46	5.94	6.16	6.16	5.98	5.77
Texas	20.44	21.12	20.74	19.93	19.63	19.36	18.22	18.94	17.77	18.97	18.68	19.87	18.64	17.39	19.48
Utah	5.18	5.38	5.18	5.50	5.75	5.70	5.73	5.71	5.86	5.65	5.75	5.32	5.31	5.64	5.32
Wyoming	9.54	9.45	8.99	9.02	8.73	8.54	8.51	8.51	9.26	7.94	8.19	7.52	8.03	7.72	7.47
11 Western States	74.96	75.06	75.29	76.26	75.94	75.33	74.57	74.82	75.15	74.31	74.08	73.08	72.84	71.39	71.11
All other States	25.04	24.94	24.71	23.74	24.06	24.67	25.43	25.18	24.85	25.69	25.92	26.92	27.16	28.61	28.89
U.S. total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: [23].

Table 2--Distribution of stock sheep and lambs on farms, January 1, selected years, 1920-90

Region <sup>1</sup>	1920	1930	1940	1950	1960	1970	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	<i>Percent</i>																
West Coast	14.4	14.1	11.0	9.7	9.7	10.0	13.8	3.8	14.3	14.0	14.3	14.8	15.0	14.4	14.4	13.4	12.5
Mountain	43.0	40.8	35.1	34.4	32.4	37.9	37.9	37.2	37.4	37.2	38.0	35.7	36.0	34.3	35.4	36.3	35.2
West North Central	10.6	11.4	15.2	14.0	22.1	17.7	16.4	17.3	17.5	17.5	17.9	18.2	17.2	18.1	18.0	18.3	18.6
West South Central	10.2	14.8	21.8	25.7	19.2	21.1	20.4	20.2	19.1	19.9	18.6	19.9	19.7	20.9	19.9	18.9	20.8
East North Central	11.6	10.2	9.6	8.4	9.4	8.3	5.7	5.6	5.6	5.5	5.3	5.5	5.8	5.8	5.4	5.6	5.5
East South Central	3.5	3.1	3.4	3.7	3.1	1.0	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Northeast	3.5	2.5	1.6	1.5	1.7	1.7	1.9	1.9	2.2	2.1	2.2	2.3	2.4	2.5	2.5	2.9	3.0
Southeast	3.2	3.1	2.3	2.6	2.4	2.3	3.7	3.7	3.7	3.6	3.3	3.3	3.5	3.6	3.9	4.2	4.0
All regions	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

<sup>1</sup>West Coast: California, Oregon, Washington.

Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming.

West North Central: Iowa, Kansas, Missouri, Minnesota, North Dakota, South Dakota.

West South Central: Arkansas, Louisiana, Oklahoma, Texas.

East North Central: Illinois, Ohio, Michigan, Wisconsin.

East South Central: Alabama, Kentucky, Mississippi, Tennessee.

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.

Southeast: Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia.

Sheep producers market four different commodities: feeder lambs, spring lambs for slaughter, cull sheep for slaughter, and wool. Seventy-five percent of marketings are fed lambs. Slaughter lambs account for 15 percent of marketings, and cull ewes make up the remaining 10 percent.

### Seasonality of Production

U.S. lambs have a distinct seasonal pattern of production in the spring and fall. Average monthly lamb slaughter was highest in March for the past 20 years. Lamb slaughter increased to its peak in March and then declined in April through June before increasing to its second peak in October (fig. 1). The slaughter pattern for mature sheep is different from that of slaughter lambs. Mature sheep are culled after the weaning of the lambs in the early summer or in the fall.

### Lamb Consumption

Lamb and mutton consumption is equal to domestic production plus changes in cold storage stocks and net trade (table 7). Mutton consumption accounted for less than 5 percent of total lamb and mutton consumption (14). Domestic lamb production is by far the largest source of supply. Imports account for about 5 to 15 percent of total U.S. consumption.

Per capita consumption of lamb and mutton peaked in 1945 at 6.5 pounds retail weight. Lamb and mutton consumption reached a record low of 1.3 pounds per person retail weight both in 1979 and 1987. In 1988, lamb and mutton consumption increased to 1.4 pounds, due mostly to increases in both domestic production and imports.

Per capita lamb and mutton consumption has decreased faster than per capita beef and pork consumption (table 8). Red meat consumption has, however, been losing its market share to poultry consumption. The increase in total meat (red meat and poultry) consumption has come primarily

Table 3--Sheep inventory, 1940-89

Year	All sheep	Breeding ewes	Lamb crop	Animals on feed	Commercial sheep and lamb slaughtered	Average liveweight slaughtered	Lambing rate
	----- 1,000 head -----					Pounds	Percent
1940	52,107	35,707	31,082	5,841	21,000	86	87.05
1941	53,920	36,419	32,610	6,479	21,727	88	89.54
1942	56,213	37,361	32,312	6,867	25,007	89	86.49
1943	55,150	37,303	30,924	6,954	26,497	90	82.90
1944	50,782	33,991	28,642	6,512	24,793	89	84.26
1945	46,520	31,280	27,024	6,911	24,068	94	86.39
1946	42,362	27,619	24,489	6,837	22,234	93	88.67
1947	37,498	24,790	21,858	5,693	18,207	93	88.17
1948	34,337	23,013	19,594	4,851	16,897	94	85.14
1949	30,943	20,976	18,298	4,003	13,376	93	87.23
1950	29,826	20,057	17,905	3,644	12,852	95	89.27
1951	30,633	20,446	17,978	3,382	11,075	97	87.93
1952	31,982	20,952	18,479	4,038	13,962	97	88.20
1953	31,900	21,648	19,497	4,307	15,967	95	90.06
1954	31,356	21,471	20,340	4,277	15,920	95	94.73
1955	31,582	21,321	20,214	4,445	16,215	96	94.81
1956	31,157	21,323	20,336	4,267	15,993	95	95.37
1957	30,654	20,976	19,810	4,306	14,957	96	94.44
1958	31,217	21,208	20,686	4,050	14,164	98	97.54
1959	32,606	21,832	21,120	4,498	15,180	99	96.74
1960	33,170	22,406	21,012	4,321	15,899	99	93.78
1961	32,725	22,199	20,782	4,405	17,190	98	93.62
1962	30,969	21,252	19,712	4,250	16,837	97	92.75
1963	29,176	20,028	18,516	4,054	15,822	98	92.45
1964	27,116	18,723	16,994	3,661	14,595	99	90.77
1965	25,127	17,502	16,312	3,284	13,006	100	93.20
1966	24,734	16,850	15,881	3,278	12,737	102	94.25
1967	23,953	16,230	15,017	3,276	12,791	101	92.53
1968	22,223	15,290	14,444	3,115	11,884	102	94.47
1969	21,350	14,707	13,723	2,995	10,691	104	93.31
1970	20,423	13,923	13,465	2,990	10,552	104	96.71
1971	19,731	13,609	12,998	2,785	10,729	104	95.51
1972	18,739	12,909	12,559	2,894	10,301	105	97.29
1973	17,641	12,049	11,500	2,873	9,597	107	95.44
1974	16,310	11,058	10,509	2,625	8,847	105	95.04
1975	14,515	10,083	9,857	2,079	7,835	104	97.76
1976	13,311	9,314	8,888	1,884	6,714	109	95.43
1977	12,722	8,850	8,573	1,731	6,356	108	96.87
1978	12,395	8,588	7,927	1,623	5,369	112	92.30
1979	12,365	8,366	7,974	1,579	5,017	114	95.31
1980	12,699	8,533	8,257	1,622	5,579	112	96.77
1981	12,947	8,780	8,820	1,649	6,008	110	100.46
1982	12,997	8,811	8,580	1,564	6,449	111	97.38
1983	12,140	8,343	8,214	1,661	6,619	112	98.45
1984	11,559	7,936	7,838	1,718	6,759	111	98.77
1985	10,716	7,431	7,500	1,586	6,165	114	100.93
1986	10,145	6,958	7,396	1,487	5,635	117	106.29
1987	10,572	7,047	7,289	1,513	5,200	119	103.43
1988	10,945	7,348	7,206	1,581	5,293	124	98.07
1989	10,858	7,187	7,739	1,717	5,465	124	107.68

Source: (78).

Table 4--Average number of breeding ewes per operation, by State, 1976-89

State	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
	<i>Head</i>													
Arizona	867	826	760	692	547	480	522	447	356	269	268	262	364	411
California	184	160	156	161	140	129	119	114	133	128	117	114	105	100
Colorado	181	178	165	164	163	160	171	166	146	124	113	130	133	161
Idaho	256	221	198	194	181	175	162	137	110	98	100	98	99	110
Montana	181	177	177	181	174	175	182	170	166	169	146	146	154	161
New Mexico	349	306	390	309	312	293	293	283	272	261	237	244	306	320
Oregon	61	56	60	61	57	60	65	56	53	56	55	59	63	55
South Dakota	95	91	97	95	98	105	101	100	95	89	84	92	101	105
Texas	211	207	200	175	180	179	169	176	157	160	153	165	163	152
Utah	200	207	196	200	205	200	194	183	179	168	174	170	186	193
11 Western States	194	185	183	173	169	165	160	154	148	141	135	138	143	143
All other States	27	27	27	25	25	25	26	25	24	24	24	25	26	27
United States	76	75	75	72	71	70	69	66	66	63	62	62	65	65

Source: (23).

Table 5--Farms with sheep and breeding ewes by flock size in the West and the United States, 1978 and 1987<sup>1</sup>

Census year/flock size	Farms with sheep		Ewes 1 year and older	
	West	United States	West	United States
<i>Percent</i>				
1978:				
1-99	73.3	89.1	9.5	21.5
100-999	22.2	9.2	32.5	32.0
1,000 and over	4.5	1.7	58.0	46.5
Total	100.0	100.0	100.0	100.0
1987:				
1-99	68.9	82.2	8.6	19.9
100-999	25.6	15.7	30.8	32.6
1,000 and over	5.5	2.1	60.6	47.5
Total	100.0	100.0	100.0	100.0

<sup>1</sup>West includes Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, South Dakota, Texas, Utah, and Wyoming.  
Source: (25).

Table 6--Farms with sheep and lambs by flock size in the West and United States, 1978 and 1987<sup>1</sup>

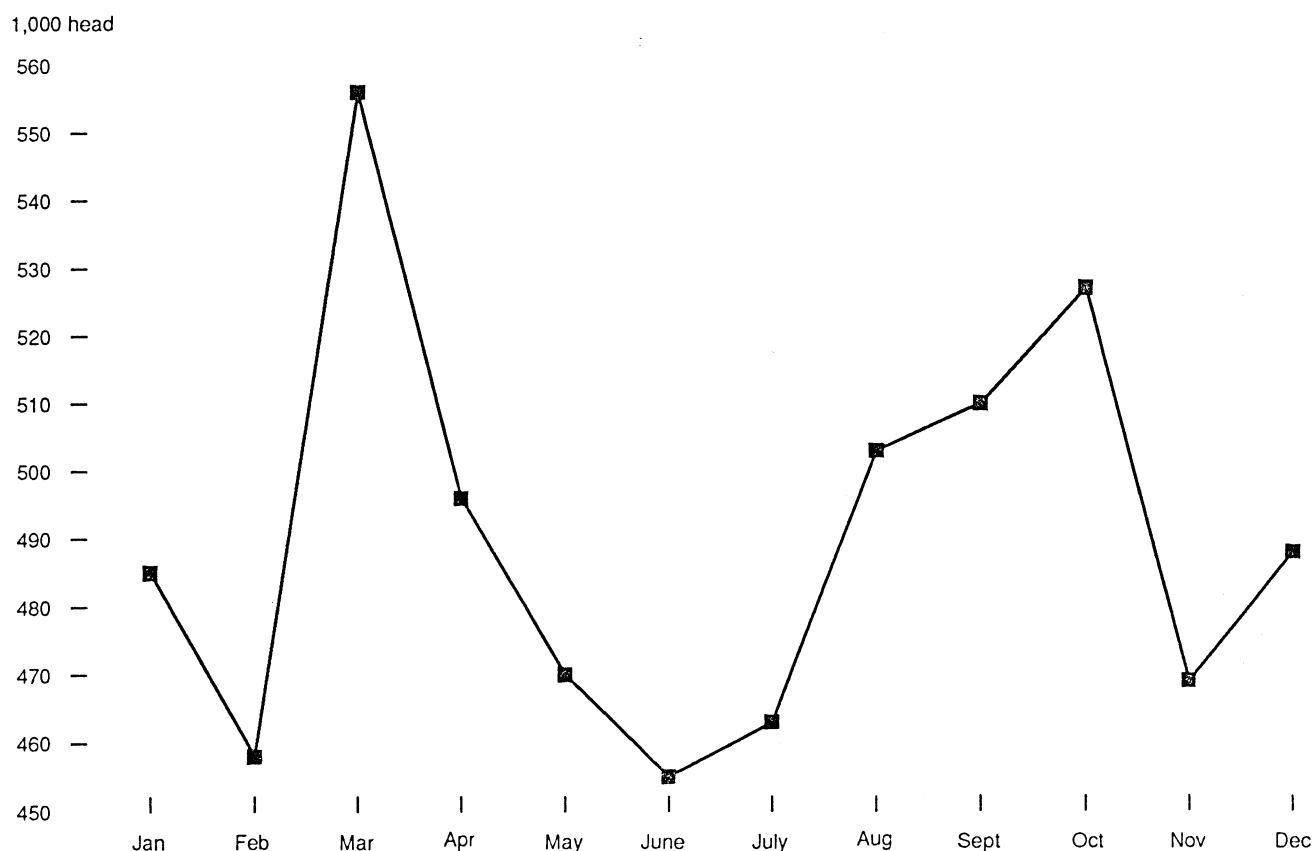
Census year/flock size	Farms with sheep and lambs		Sheep and lambs	
	West	United States	West	United States
<i>Percent</i>				
1978:				
1-24	40.8	51.3	1.4	4.0
25-99	28.4	32.1	5.2	12.2
100-299	16.1	10.4	9.6	13.2
300-999	8.8	4.0	16.7	16.4
1,000-2,499	3.7	1.4	20.5	17.4
2,500 and over	2.2	.8	46.6	36.8
Total	100.0	100.0	100.0	100.0
1982:				
1-24	42.3	50.2	1.5	4.2
25-99	28.1	32.7	5.5	12.8
100-299	15.7	10.9	10.1	14.2
300-999	8.4	4.0	16.8	16.2
1,000-2,499	3.5	1.4	20.4	16.8
2,500 and over	2.1	.8	45.7	35.8
Total	100.0	100.0	100.0	100.0
1987:				
1-24	40.8	49.6	1.7	4.4
25-99	30.1	33.8	6.1	13.5
100-299	15.2	10.5	10.2	14.0
300-999	8.5	4.0	17.5	16.7
1,000-2,499	3.5	1.4	21.1	17.2
2,500 and over	1.9	.7	43.4	34.2
Total	100.0	100.0	100.0	100.0

<sup>1</sup>West includes Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, South Dakota, Texas, Utah, and Wyoming.  
Source: (25).



Figure 1

Commercial lamb slaughter, by month, 1982-89 average



from poultry. Lamb and mutton consumption as a percentage of total meat consumption has been declining. Lamb consumption in recent years has accounted for about 1 percent of total red meat consumption and 0.6 percent of total meat consumption.

Lamb and mutton is consumed by only a small percentage of consumers. Consumption of lamb is higher during holiday periods associated with religious traditions and habits of consumers (2, 5, 12). The lack of a year-round consumer base, higher lamb prices relative to other red meat and especially to poultry, and lack of new product developments are some of the reasons lamb is losing its market share.

### Lamb Prices

Lamb prices follow a fairly consistent seasonal pattern. Seasonality in lamb prices arise from shortrun changes in supply-demand relationships. Lamb prices rise during spring months, peaking in May. Prices decline through summer and fall, hitting the low point near the end of the year (fig. 2). This pattern is due partly to seasonality in lamb production and consumption. The producer decision to take advantage of weather conditions and availability of pasture and feed supplies influences a large number of lambs to be marketed in summer and late fall, resulting in lower prices during this period. Survey results indicate that producers marketed their lambs in the fall, which does not coincide with high demand. To get higher prices, however, either producers or feedlot operators would have to hold the lambs until spring when demand is high. Supplies drop in late winter and spring.

Table 7--Lamb and mutton supply and utilization, carcass and retail weight, 1960-90

Year	Production			Begin- ning stocks	Imports	Total supply	Exports	Ending stocks	Total disap- pearance	Per capita	
	Commer- cial	Farm	Total							Carcass weight	Retail weight
----- Million pounds -----											
1960	754	15	769	15	87	871	2	12	857	4.7	4.2
1961	818	15	833	12	101	946	2	18	926	4.0	4.5
1962	795	13	808	18	143	969	3	15	951	5.1	4.5
1963	757	12	769	15	145	929	1	19	909	4.8	4.3
1964	703	12	715	19	79	813	2	13	798	4.2	3.7
1965	639	12	651	13	72	736	4	12	720	3.7	3.3
1966	639	10	649	12	136	797	5	17	775	3.9	3.5
1967	636	10	646	17	121	784	6	15	763	3.8	3.4
1968	592	10	602	15	147	764	7	14	743	3.7	3.3
1969	540	10	550	14	153	717	6	16	695	3.4	3.1
1970	540	11	551	16	122	689	7	19	663	3.2	2.9
1971	545	11	556	19	103	678	8	19	651	3.1	2.8
1972	533	10	543	19	148	710	7	16	687	3.3	2.9
1973	502	10	512	16	53	581	6	15	560	2.6	2.4
1974	453	11	464	15	26	505	8	14	483	2.3	2.0
1975	400	11	411	14	27	452	8	12	432	2.0	1.8
1976	361	10	371	12	36	419	4	15	400	1.8	1.6
1977	340	10	350	15	23	388	5	10	373	1.7	1.5
1978	301	9	310	10	39	359	3	12	344	1.5	1.4
1979	282	9	291	12	44	347	1	11	335	1.5	1.3
1980	310	8	318	11	33	362	2	9	351	1.5	1.4
1981	328	10	338	9	31	378	2	11	365	1.6	1.4
1982	356	9	365	11	21	397	2	9	386	1.7	1.5
1983	367	8	375	9	18	402	1	11	390	1.6	1.5
1984	371	8	379	11	20	410	2	7	401	1.7	1.5
1985	352	7	359	7	37	403	1	13	389	1.6	1.4
1986	331	7	338	13	41	392	2	13	377	1.6	1.4
1987	309	6	315	13	44	372	1	8	363	1.5	1.3
1988	329	6	335	8	51	394	1	6	387	1.6	1.4
1989	339	6	345	6	62	413	2	7	404	1.6	1.4
1990	330	6	336	7	63	406	1	7	398	1.6	1.4

Source: (18).

### Wool Production

Wool receipts make up about 20-30 percent of sheep producers' revenues. In general, a large percentage of the U.S. sheep flock is raised for meat, but high quality wool is also produced from wool breeds in the Western States. U.S. wool production has fallen dramatically. Wool production has declined even faster than sheep numbers, because the production drop was intensified slightly by a productivity drop. About 18 percent of revenue from raising sheep comes from the sale of wool, and 12 percent of that is from Government payments. The Government program guarantees a price level and this keeps wool price variation from affecting sheep producers. Consequently, changes in wool prices have only a minor effect on the number of sheep and the level of wool production. Shorn wool now accounts for almost all U.S. wool production (table 9). Pulled wool production declined

Table 8--Per capita disappearance of red meat and poultry, retail weight, 1955-88

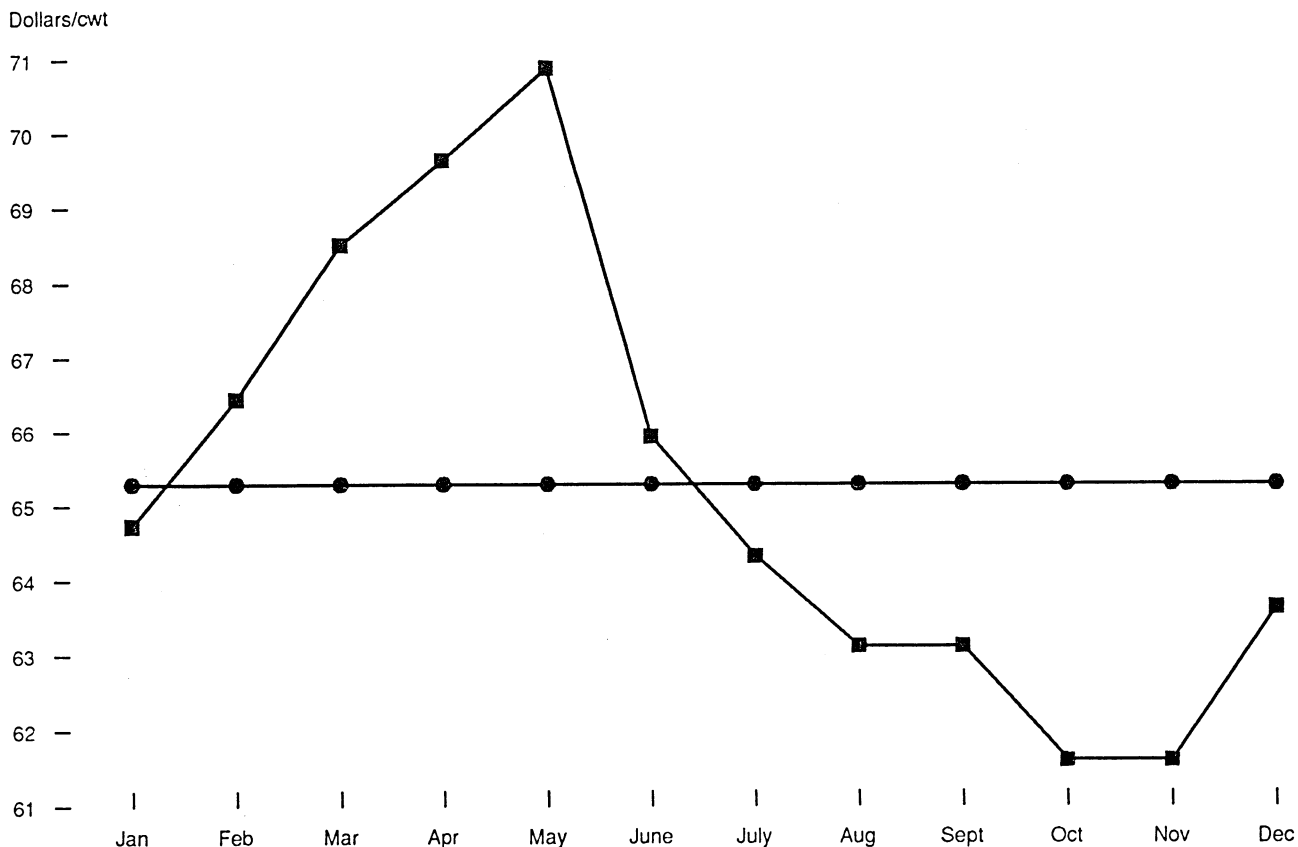
Year	Quantity per person				Percentage share per person			
	Lamb	Total red meat, excluding lamb	Total poultry	Total meat	Lamb	Total red meat, excluding lamb	Total poultry	Total meat
	----- Pounds -----				----- Percent -----			
1955	4.08	132.19	27.27	163.54	2.49	80.83	16.67	100
1956	3.91	135.12	30.36	169.39	2.31	79.77	17.92	100
1957	3.71	127.88	31.93	163.52	2.27	78.20	19.53	100
1958	3.69	122.50	34.97	161.16	2.29	76.01	21.70	100
1959	4.17	128.63	34.36	167.16	2.49	76.95	20.56	100
1960	4.22	129.64	34.14	168.00	2.51	77.17	20.32	100
1961	4.49	128.70	37.45	170.64	2.63	75.42	21.95	100
1962	4.54	130.51	37.09	172.14	2.64	75.82	21.55	100
1963	4.27	135.85	37.84	177.96	2.40	76.34	21.26	100
1964	3.70	140.69	38.81	183.20	2.02	76.80	21.18	100
1965	3.31	134.56	41.16	179.03	1.85	75.16	22.99	100
1966	3.52	137.10	43.72	184.34	1.91	74.37	23.72	100
1967	3.43	143.72	45.32	192.47	1.78	74.67	23.55	100
1968	3.31	147.37	44.93	195.61	1.69	75.34	22.97	100
1969	3.07	146.66	46.87	196.60	1.56	74.60	23.84	100
1970	2.90	149.44	48.67	201.01	1.44	74.34	24.21	100
1971	2.81	154.67	48.99	206.47	1.36	74.91	23.73	100
1972	2.93	150.52	51.04	204.49	1.43	73.61	24.96	100
1973	2.37	139.51	49.24	191.12	1.24	73.00	25.76	100
1974	2.03	149.35	49.80	201.18	1.01	74.24	24.75	100
1975	1.80	142.56	48.91	193.27	.93	73.76	25.31	100
1976	1.63	151.78	52.17	205.58	.79	73.83	25.38	100
1977	1.51	150.92	53.33	205.76	.73	73.35	25.92	100
1978	1.38	146.18	56.20	203.76	.68	71.74	27.58	100
1979	1.32	144.10	60.88	206.30	.64	69.85	29.51	100
1980	1.37	146.74	61.00	209.11	.66	70.17	29.17	100
1981	1.41	144.26	62.75	208.42	.68	69.22	30.11	100
1982	1.48	137.64	64.11	203.23	.73	67.73	31.55	100
1983	1.48	142.30	65.31	209.09	.71	68.06	31.24	100
1984	1.51	141.86	67.19	210.56	.72	67.37	31.91	100
1985	1.44	143.10	70.29	214.83	.67	66.61	32.72	100
1986	1.39	139.29	72.68	213.36	.65	65.28	34.06	100
1987	1.33	134.65	78.51	214.49	.62	62.78	36.60	100
1988	1.40	137.17	81.12	219.69	.64	62.44	36.92	100

Source: (20).

from 10-15 percent of total production during the 1950's and 1960's to about 1 percent in 1989. The drop reflects the growing demand for the pelts with the wool intact due to superior quality of U.S. sheepskins and their use in garment manufacturing. Shorn wool production declined more than 75 percent from 388 million pounds, greasy, in 1942 to about 90 million pounds in 1989. Average U.S. fleece weights have been below 8 pounds since 1984.

Figure 2

Lamb farm prices, by month, 1982-89 average



### Wool Prices

The price of wool differs among breeds of sheep and types of wool. The U.S. sheep industry has moved from raising wool breeds to meat breeds. The price of wool is directly related to the staple length, diameter, and color of wool fibers (15).

Prices received by farmers for wool were fairly stable in the 1950's and 1960's. In the 1970's, wool prices fluctuated sharply and prices remained volatile during the 1980's. Annual average prices ranged from 20 to 138 cents a pound. It has been only through the wool incentive payment program that producer returns from wool have been stabilized in view of the wide movement in wool prices. The returns from the sale of shorn wool, including Government payments to wool producers to support their incomes, accounted for 35 percent of total cash receipts.

Farm-level wool prices for 1970-89 exhibited a fairly consistent seasonal pattern. The seasonal peak usually occurred during spring, particularly in June (table 10). Prices declined from July through September and increased again before they reached their seasonal low in February. Comparison of wool prices for the 1970-89 and 1950-69 periods revealed that wool price fluctuation increased sharply during the last two decades. According to the 1986 survey data, there was a 6- to 8-month lag between shearing and marketing the wool. Sheep are generally shorn in spring before lambing season starts, and wool is marketed in late fall and winter.

Table 9--Number of sheep shorn, wool yield, and production, 1950-88

Year	Number of sheep shorn	Greasy wool		Production greasy	
		Yield per fleece	Total production	Shorn	Pulled
	<i>1,000 head</i>	<i>Pound</i>	<i>1,000 pounds</i>	<i>----- Percent -----</i>	
1950	26,380	8.22	216,944	87.01	12.99
1951	27,347	8.34	228,091	89.80	10.20
1952	28,051	8.32	233,309	87.41	12.59
1953	27,845	8.34	232,258	84.62	15.38
1954	27,692	8.52	235,807	84.43	15.57
1955	28,149	8.57	241,284	85.29	14.71
1956	28,469	8.51	242,177	85.67	14.33
1957	28,415	8.41	239,101	87.68	12.32
1958	29,403	8.29	243,713	88.91	11.09
1959	30,763	8.45	259,939	88.28	11.72
1960	31,081	8.54	265,277	88.76	11.24
1961	30,454	8.51	259,161	88.25	11.75
1962	29,193	8.45	246,636	89.19	10.81
1963	27,264	8.53	232,446	88.98	11.02
1964	25,455	8.34	212,333	89.43	10.57
1965	23,756	8.48	201,463	89.63	10.37
1966	22,923	8.51	195,053	89.00	11.00
1967	22,056	8.57	188,984	89.40	10.60
1968	20,759	8.55	177,396	89.64	10.36
1969	19,584	8.46	165,749	90.65	9.35
1970	19,163	8.43	161,587	91.40	8.60
1971	19,063	8.41	160,156	93.03	6.97
1972	18,770	8.44	158,506	94.23	5.77
1973	17,425	8.25	143,738	94.73	5.27
1974	15,956	8.23	131,382	95.84	4.16
1975	14,403	8.30	119,535	95.22	4.78
1976	13,536	8.21	111,100	95.82	4.18
1977	13,217	8.12	107,328	97.77	2.23
1978	12,719	8.09	102,942	99.04	.96
1979	13,069	8.02	104,867	99.15	.85
1980	13,263	7.95	105,419	99.01	.99
1981	13,493	8.14	109,787	98.96	1.04
1982	13,199	8.04	106,129	99.07	.93
1983	12,865	8.00	102,886	99.04	.96
1984	12,284	7.77	95,471	98.96	1.04
1985	11,158	7.88	87,941	98.88	1.12
1986	10,852	7.82	84,829	98.83	1.17
1987	10,921	7.75	84,669	98.83	1.17
1988	11,465	7.78	89,235	98.89	1.11

Source: (15).

Table 10--Monthly wool prices, 1970-89

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual average
<i>Cents per pound</i>													
1970	35.6	35.7	36.5	37.5	36.6	37.5	37.1	34.2	31.6	32.5	31.7	28.2	35.4
1971	25.3	24.6	23.3	22.9	21.2	21.3	17.7	17.9	18.9	17.0	17.9	16.8	19.6
1972	17.7	19.6	24.2	29.1	34.5	39.4	39.2	38.4	35.8	50.9	52.5	49.3	35.0
1973	78.0	77.3	90.4	86.1	82.3	84.5	83.0	78.8	83.7	74.3	70.1	70.6	82.7
1974	78.4	70.0	66.1	62.5	60.6	59.7	61.1	52.5	48.7	49.6	45.8	43.5	59.2
1975	40.9	33.7	36.7	43.6	48.0	46.7	48.0	46.2	44.8	52.8	47.4	43.3	44.8
1976	50.7	58.4	59.5	64.4	65.1	68.1	68.3	67.0	68.2	70.8	71.2	69.5	66.0
1977	72.9	72.5	72.4	72.5	71.9	73.7	72.3	70.4	66.4	71.3	70.5	69.3	72.0
1978	72.6	68.9	71.2	73.7	73.9	76.2	74.8	74.6	72.7	77.1	81.2	73.5	74.5
1979	78.7	77.3	79.5	86.9	88.0	89.4	87.7	81.8	84.9	87.5	89.0	86.5	86.3
1980	82.1	86.8	93.5	92.2	86.6	86.5	85.8	85.5	84.7	89.4	92.1	90.9	88.1
1981	84.6	88.3	91.8	101.0	99.8	101.0	94.4	84.8	84.3	87.3	91.1	84.2	94.5
1982	73.1	52.9	63.6	83.6	76.5	68.0	77.0	64.2	56.6	70.7	54.7	55.5	68.6
1983	50.1	57.1	56.0	65.7	65.0	63.5	62.7	59.6	57.2	66.4	70.1	64.1	61.3
1984	58.4	67.1	79.3	87.9	86.5	86.6	82.3	78.5	74.3	80.2	67.5	69.4	79.5
1985	59.2	58.7	61.0	67.9	68.5	69.8	64.0	60.2	59.5	66.6	58.5	56.8	63.3
1986	52.2	54.4	61.9	70.0	73.7	75.5	67.5	65.9	57.5	69.7	64.0	59.4	66.8
1987	58.7	69.1	78.7	99.7	106	108.0	87.0	83.1	93.6	95.5	84.1	81.4	91.7
1988	75.2	93.3	118.0	153.0	165	161.0	133.0	128.0	111.0	135.0	116.0	101.0	138.0
1989	107.0	123.0	130.0	135.0	139	139.0	120.0	105.0	97.7	100.0	100.0	80.5	122.0

Source: (15).

### Wool Incentive Program

Early farm legislation did not recognize wool as one of the "basic" commodities. The Agricultural Adjustment Act of 1933 did not cover wool (15). The Agricultural Adjustment Act of 1938 authorized and implemented the price support loan programs for wool for the first time. Price supports became mandatory for wool as a result of a law passed in 1947, and such support was continued in the Agricultural Act of 1948.

The National Wool Act of 1954 established a new price support program for wool. The rationale stated in the act was: "wool is an essential and strategic commodity which is not produced in quantity and grades in the United States to meet the domestic needs and that the desired domestic production of wool is impaired by the depressing effects of wide fluctuation in the price of wool in the world markets." The act was to support wool prices at a level fair to both producers and consumers.

Under the new act, shorn wool was to be supported between 60 and 110 percent of parity price, if payments were used, and between 60-90 percent, if loans and purchases were to be used. The support price was originally intended to be set at a level that would encourage annual production of 300 million pounds of shorn wool, greasy basis. Pulled wool was to be supported at a level in relationship to shorn wool. The Secretary of Agriculture was charged with setting the support price for shorn wool after consulting with producer representatives and considering changes in costs associated with sheep production.

The support price was set at 62 cents a pound for shorn wool for 1955, which was 19 cents higher than the market price received by producers (table 11). Before 1955, market prices were near or even above the support price. The combination of a high level of support and loans and purchases



Table 11--Marketing year prices and payment rates of wool, 1950-89

Year	Support price	Average market price received by producers	Payment rates	
			Shorn lamb	Unshorn lamb
	<i>Cents per lb. greasy</i>	<i>Percent</i>	<i>---- \$/cwt live lamb ----</i>	
1950	45	62.1	NP	ND
1951	51	97.1	NP	ND
1952	54	54.1	NP	ND
1953	53	54.9	NP	ND
1954	53	53.2	NP	ND
1955	62	42.8	44.86	0.77
1956	62	53.7	15.46	.33
1957	62	53.7	15.46	.33
1958	62	36.4	70.33	1.02
1959	62	43.3	43.19	.75
1960	62	42.0	47.62	.80
1961	62	42.9	44.52	.76
1962	62	47.7	29.98	.57
1963	62	48.5	27.84	.54
1964	62	53.2	16.54	.35
1965	62	47.1	31.63	.60
1966	65	52.1	24.76	.52
1967	66	39.8	65.83	1.05
1968	67	40.5	65.43	1.06
1969	69	41.8	65.07	1.09
1970	72	35.5	102.82	1.46
1971	72	19.4	271.13	2.10
1972	72	35.0	105.71	1.48
1973	72	82.7	NP	NP
1974	72	59.1	21.83	.52
1975	72	44.7	61.07	1.09
1976	72	65.7	9.59	.25
1977	99	72.0	37.50	1.08
1978	108	74.5	44.97	1.34
1979	115	86.3	33.26	1.15
1980	123	88.1	39.61	1.40
1981	135	94.5	42.86	1.62
1982	137	68.4	100.29	2.74
1983	153	61.3	149.59	3.67
1984	165	79.5	107.55	3.42
1985	165	63.3	160.66	4.07
1986	178	66.8	166.47	4.45
1987	181	91.7	97.38	3.57
1988	178	138.0	28.99	1.60
1989	177	122.0	45.08	2.20

ND = No data.  
NP = No payment.  
Source: (15).

increased Government-owned wool stocks to over 50 percent of a year's production. To lower the wool stocks, direct payments instead of loans and purchases were authorized as a method of supporting income. As a result, the market price fell below the support price. The initial level of 62 cents set by Congress continued until 1966 when it was increased to 65 cents. Annual adjustments were made up to 1970. At that time, it was set at 72 cents. It was kept frozen at this level by congressional action through 1976. The incentive payment rates, explained below, were 99 cents in 1977 and increased to \$1.81 by 1987.

### **Wool Incentive Payments**

There are two types of payments for wool production: for shorn wool and for unshorn lambs sold (4, 5, 7). The payment rate for shorn wool is equal to the difference between the support price and the annual U.S. average price received by farmers for shorn wool divided by the annual average U.S. price. This ratio is multiplied by the net proceeds from the sale of shorn wool for each producer to determine the amount of his or her incentive payment. This payment to wool producers is supposed to encourage the production of higher quality wool that can be sold at premium prices. Therefore, the incentive payment per pound of shorn wool sold varies among producers because it depends on the price the producer received for his or her wool in the market.

The unshorn lamb payment rate is calculated by taking 80 percent of the difference between the support price for shorn wool and the U.S. annual average price received by producers from shorn wool, and then multiplying the results by five. The factor of five is an estimate of the pounds of wool produced per hundredweight of live lamb (15). The unshorn lamb payment is determined by multiplying the payment rate times the hundredweight of lambs sold. For lambs sold for additional feeding before slaughter, the second owner can receive payments only on weight added while the animals are in his or her possession.

Payments to producers have varied over the years as wool prices have fluctuated. They ranged from zero to 271.1 percent of the value of wool sold by producers during the 1970's and from 29 to 167 percent during the 1980's (table 11). Producers received incentive payments equal to 167 percent of the value of their wool sales in 1986. The support price that year was \$1.78 and the national average market price for wool was 66.8 cents.

### **Profitability of the Sheep Industry**

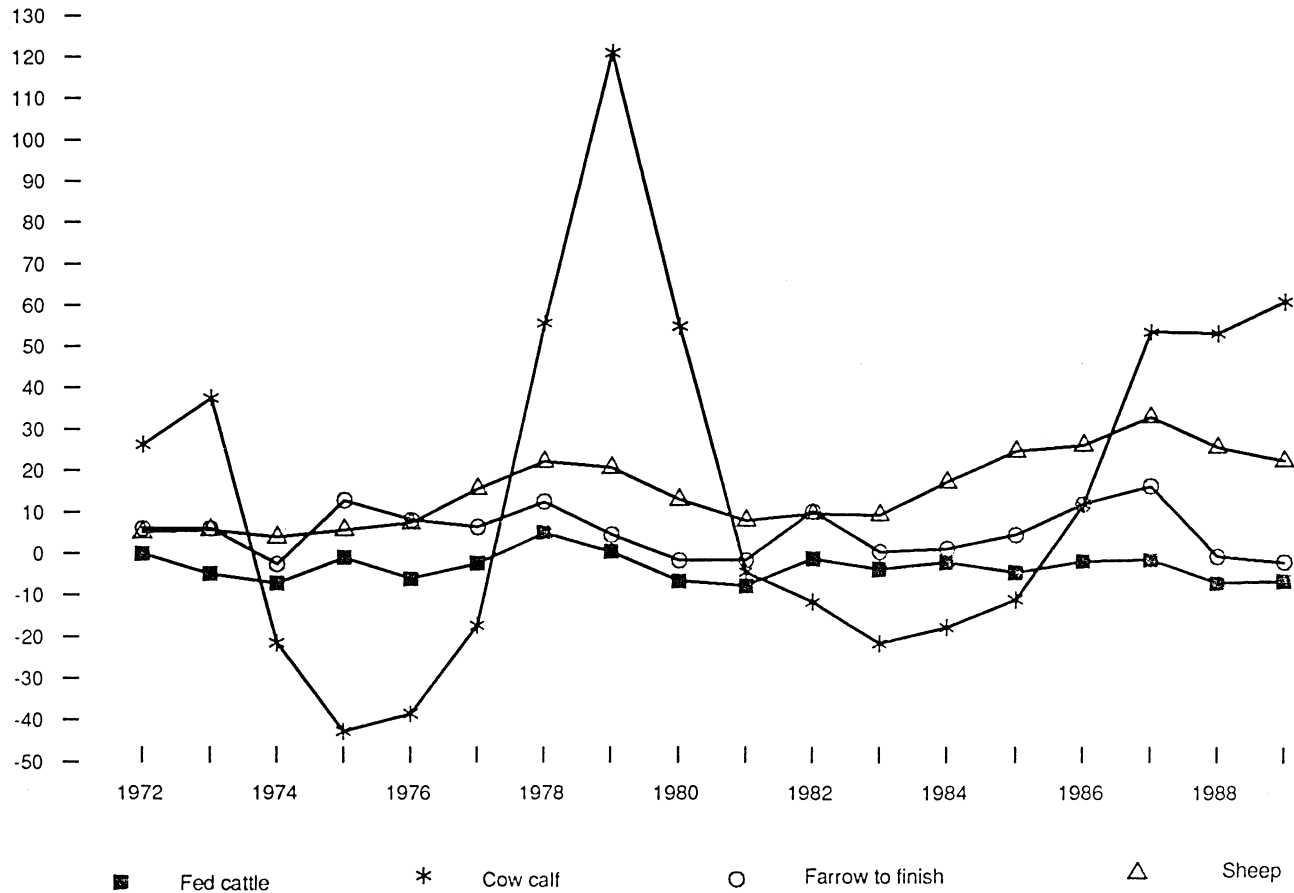
Sheep production has traditionally been a profitable business (fig. 3). Cash receipts were large enough to cover all cash expenses during the past 18 years (table 12). Total economic costs for sheep producers have generally increased since 1972 except for drops in 1977, 1983, 1985, and 1986, mostly due to lower feed expenditures (table 13). Total economic costs per ewe in 1989 were 123 percent higher than costs in 1972. Lamb and wool prices have kept pace with rising production costs. Cash receipts declined in 1989, but not as much as between 1987 and 1988. Total cash receipts in 1989 were 170 percent higher than in 1972.

Although returns to sheep producers have been higher than for cattle and hogs, the sheep and lamb inventory has been declining rapidly. High returns above cash expenses should encourage the sheep industry to expand.

Figure 3

Cash receipts less cash expenses of U.S. livestock producers, 1972-89

Dollars/cwt or head of animal



Production in the Western States

Sheep production in the 11 Western States is divided into 5 regions to aid in identifying differences in production and management practices. Ewe inventories in each region are:

Region	1986 breeding ewes 1,000 head
Pacific <sup>1</sup>	502.3
Intermountain <sup>2</sup>	1,183.1
Northern Plains <sup>3</sup>	699.9
Southwest <sup>4</sup>	537.9
Texas	795.7
<b>Total</b>	<b>3,719.0</b>

<sup>1</sup>Includes coastal mountain ranges of California and Oregon.

<sup>2</sup>Includes Colorado, Idaho, western Montana, Oregon, Utah, and Wyoming.

<sup>3</sup>Includes eastern Montana, Wyoming, Nebraska, and South Dakota.

<sup>4</sup>Includes Arizona, California, and New Mexico.

Table 12--U.S. sheep production cash costs and returns, all sizes of operation, 1972-89

Item	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	
<i>Dollars per ewe</i>																			
<b>Cash receipts:</b>																			
Slaughter lambs (31.9 lbs)	9.85	12.00	13.00	14.53	15.65	17.46	19.91	21.03	20.46	16.03	16.60	16.39	19.93	21.58	20.84	22.64	20.36	19.51	
Feeder lambs (26.6 lbs)	6.99	8.58	8.06	9.27	11.35	12.57	17.72	18.41	15.74	13.30	13.49	12.30	15.02	18.48	18.76	23.19	21.06	19.54	
Cull ewes (29.1 lbs)	1.72	3.30	2.63	2.56	3.30	3.45	4.70	5.52	3.55	3.43	3.05	2.17	3.20	6.06	5.97	6.69	6.76	6.74	
Wool (10.0 lbs)	2.60	6.15	4.39	3.32	4.88	5.35	5.54	6.42	6.55	7.45	6.28	6.72	8.81	6.84	7.34	10.05	15.17	13.43	
Wool payment	2.75	0	.96	2.03	.47	2.01	2.49	2.13	3.19	6.30	10.05	9.47	9.47	10.99	12.22	9.77	4.41	6.07	
Unshorn lamb payment	.75	0	.26	.55	.13	.55	.66	.71	.76	.88	1.50	1.56	1.81	2.21	2.42	1.94	.87	1.21	
<b>Total</b>	<b>24.66</b>	<b>30.03</b>	<b>29.32</b>	<b>32.26</b>	<b>35.78</b>	<b>41.40</b>	<b>51.02</b>	<b>54.21</b>	<b>50.25</b>	<b>47.39</b>	<b>50.97</b>	<b>48.61</b>	<b>58.24</b>	<b>66.16</b>	<b>67.55</b>	<b>74.28</b>	<b>68.63</b>	<b>66.50</b>	
=====																			
<b>Cash expenses:</b>																			
<b>Feed--</b>																			
Grain (0.74 bu)	1.11	1.79	2.77	2.56	2.36	1.92	1.99	2.24	2.56	2.13	2.14	2.38	2.52	2.01	1.60	1.39	2.00	2.16	
Protein supplements (.38 cwt)	1.76	3.82	2.82	2.31	2.31	2.83	2.85	3.21	3.64	3.38	3.16	3.60	3.39	3.40	3.68	3.80	4.30	4.54	
Salt and minerals (7.0 lbs)	.13	.14	.15	.17	.19	.21	.23	.26	.32	.35	.37	.38	.38	.40	.40	.40	.40	.42	
Hay (.10 ton)	2.24	2.55	2.99	3.74	3.89	2.89	2.69	2.45	2.93	3.53	3.71	3.65	3.74	3.90	2.93	2.85	3.89	3.48	
Pasture	1.81	2.07	2.14	2.14	2.19	2.18	2.41	2.70	3.05	3.19	3.11	3.16	3.43	3.31	3.29	2.89	3.12	3.36	
Public grazing	1.25	1.31	1.41	1.41	1.65	.73	.73	.93	1.13	1.11	.91	.70	.71	.67	.68	.67	.77	.93	
Crop residue	.05	.05	.05	.05	.05	.05	.05	.04	.05	.06	.05	.06	.06	.05	.05	.05	.05	.06	
<b>Total feed costs</b>	<b>8.34</b>	<b>11.74</b>	<b>12.34</b>	<b>12.39</b>	<b>12.64</b>	<b>10.82</b>	<b>10.95</b>	<b>11.84</b>	<b>13.68</b>	<b>13.75</b>	<b>13.45</b>	<b>13.93</b>	<b>14.23</b>	<b>13.74</b>	<b>12.63</b>	<b>12.05</b>	<b>14.53</b>	<b>14.95</b>	
<b>Other--</b>																			
Veterinary and medicine	.60	.62	.59	.62	.59	.61	.66	.73	.83	.91	.98	.99	1.04	1.05	1.08	1.10	1.13	1.22	
Livestock hauling	.66	.73	.66	.72	.66	.71	.76	.87	1.00	1.12	1.18	1.20	1.25	1.28	1.25	1.23	1.27	1.36	
Marketing	.15	.16	.15	.16	.15	.16	.17	.19	.22	.24	.26	.27	.28	.29	.29	.30	.32	.34	
Ram death loss	.13	.14	.15	.17	.18	.19	.26	.34	.33	.31	.29	.28	.27	.27	.27	.33	.30	.28	
Shearing and tagging	.58	.62	.68	.75	.79	.84	.90	.98	1.06	1.14	1.18	1.21	1.23	1.24	1.30	1.20	1.26	1.30	
Fuel, lubrication, and electricity	.50	.53	.74	.82	.87	.93	.98	1.28	1.75	1.98	1.93	1.82	1.49	1.53	1.12	1.17	1.19	1.38	
Machinery and building repairs	2.57	2.62	2.82	2.98	2.87	1.22	1.32	1.45	1.59	1.74	2.19	2.29	2.26	2.39	2.30	2.35	2.44	2.54	
Hired labor (1.42 hr)	2.72	2.98	3.41	3.67	4.15	4.32	4.62	5.05	5.44	5.83	6.05	6.22	6.34	6.49	6.78	6.53	6.76	6.99	
Miscellaneous	.44	.47	.52	.57	.60	.64	.69	.77	.87	.96	1.02	1.04	1.08	1.12	1.15	1.17	1.25	1.32	
<b>Total, variable cash expenses</b>	<b>16.70</b>	<b>20.60</b>	<b>22.07</b>	<b>22.84</b>	<b>23.49</b>	<b>20.44</b>	<b>21.31</b>	<b>23.51</b>	<b>26.77</b>	<b>27.98</b>	<b>28.53</b>	<b>29.25</b>	<b>29.47</b>	<b>29.40</b>	<b>28.17</b>	<b>27.43</b>	<b>30.45</b>	<b>31.68</b>	
<b>General farm overhead</b>	<b>.98</b>	<b>1.33</b>	<b>1.19</b>	<b>1.33</b>	<b>1.57</b>	<b>1.82</b>	<b>2.40</b>	<b>2.89</b>	<b>3.06</b>	<b>3.20</b>	<b>4.47</b>	<b>2.86</b>	<b>3.74</b>	<b>3.25</b>	<b>3.38</b>	<b>4.46</b>	<b>3.43</b>	<b>3.48</b>	
<b>Taxes and insurance</b>	<b>.90</b>	<b>.92</b>	<b>.97</b>	<b>1.04</b>	<b>1.26</b>	<b>1.19</b>	<b>1.20</b>	<b>1.45</b>	<b>1.55</b>	<b>1.57</b>	<b>1.80</b>	<b>1.82</b>	<b>1.70</b>	<b>1.82</b>	<b>2.38</b>	<b>2.75</b>	<b>2.82</b>	<b>2.87</b>	
<b>Interest</b>	<b>1.05</b>	<b>1.52</b>	<b>1.31</b>	<b>1.46</b>	<b>2.20</b>	<b>2.33</b>	<b>3.96</b>	<b>5.56</b>	<b>5.84</b>	<b>6.69</b>	<b>6.55</b>	<b>5.32</b>	<b>5.99</b>	<b>6.87</b>	<b>7.43</b>	<b>6.69</b>	<b>6.18</b>	<b>5.82</b>	
<b>Total, fixed cash expenses</b>	<b>2.93</b>	<b>3.78</b>	<b>3.47</b>	<b>3.82</b>	<b>5.03</b>	<b>5.35</b>	<b>7.57</b>	<b>9.90</b>	<b>10.45</b>	<b>11.47</b>	<b>12.82</b>	<b>10.00</b>	<b>11.43</b>	<b>11.94</b>	<b>13.19</b>	<b>13.90</b>	<b>12.43</b>	<b>12.17</b>	
<b>Total, cash expenses</b>	<b>19.63</b>	<b>24.38</b>	<b>25.54</b>	<b>26.66</b>	<b>28.52</b>	<b>25.79</b>	<b>28.87</b>	<b>33.41</b>	<b>37.22</b>	<b>39.45</b>	<b>41.35</b>	<b>39.25</b>	<b>40.90</b>	<b>41.34</b>	<b>41.36</b>	<b>41.33</b>	<b>42.88</b>	<b>43.85</b>	
<b>Cash receipts less cash expenses</b>	<b>5.03</b>	<b>5.64</b>	<b>3.78</b>	<b>5.60</b>	<b>7.26</b>	<b>15.61</b>	<b>22.14</b>	<b>20.80</b>	<b>13.03</b>	<b>7.94</b>	<b>9.62</b>	<b>9.36</b>	<b>17.34</b>	<b>24.82</b>	<b>26.19</b>	<b>32.95</b>	<b>25.75</b>	<b>22.65</b>	
Capital replacement	2.19	2.32	2.52	2.75	2.90	2.84	3.89	4.90	5.12	5.69	6.58	6.95	7.38	7.61	7.53	7.83	7.96	8.14	
<b>Total, cash expenses &amp; replacement</b>	<b>21.82</b>	<b>26.70</b>	<b>28.06</b>	<b>29.42</b>	<b>31.42</b>	<b>28.64</b>	<b>32.76</b>	<b>38.31</b>	<b>42.34</b>	<b>45.14</b>	<b>47.93</b>	<b>46.20</b>	<b>48.28</b>	<b>48.95</b>	<b>48.89</b>	<b>49.16</b>	<b>50.84</b>	<b>51.99</b>	
<b>Net cash receipts</b>	<b>2.84</b>	<b>3.33</b>	<b>1.26</b>	<b>2.84</b>	<b>4.36</b>	<b>12.76</b>	<b>18.26</b>	<b>15.90</b>	<b>7.91</b>	<b>2.25</b>	<b>3.04</b>	<b>2.41</b>	<b>9.96</b>	<b>17.21</b>	<b>18.66</b>	<b>25.12</b>	<b>17.79</b>	<b>14.51</b>	

Source: (79).

Table 13--U.S. sheep production economic costs and returns, all sizes of operation, 1972-89

Item	1972	1973	1974	1975	1976	1977	1978	1979	1980
<i>Dollars per ewe</i>									
Total, cash receipts	24.66	30.03	29.32	32.26	35.78	41.40	51.02	54.21	50.25
=====									
Economic (full ownership) costs:									
Variable cash expenses	16.70	20.60	22.07	22.84	23.49	20.44	21.31	23.51	26.77
General farm overhead	.98	1.33	1.19	1.33	1.57	1.82	2.40	2.89	3.06
Taxes and insurance	.90	.92	.97	1.04	1.26	1.19	1.20	1.45	1.55
Capital replacement	2.19	2.32	2.52	2.75	2.90	2.84	3.89	4.90	5.12
Returns to operating capital	.37	.74	.87	.70	.62	.56	.81	1.18	1.52
Returns to other nonland capital	1.58	1.67	1.82	1.99	2.09	2.05	2.81	3.54	4.63
Land	3.10	3.76	4.86	5.59	6.07	6.44	6.87	7.95	9.44
Unpaid labor (2.1 hr)	4.12	4.62	5.42	5.75	6.42	6.58	6.75	7.38	6.40
Total, economic costs	29.96	35.96	39.72	41.98	44.42	41.93	46.03	52.79	58.49
Residual returns to management and risk	-5.3	-5.9	-10.4	-9.7	-8.6	-.5	5.0	1.41	-8.24
=====									
	1981	1982	1983	1984	1985	1986	1987	1988	1989
<i>Dollars per ewe</i>									
Total, cash receipts	47.39	50.97	48.61	58.24	66.16	67.55	74.28	68.63	66.50
=====									
Economic (full ownership) costs:									
Variable cash expenses	27.98	28.53	29.25	29.47	29.40	28.17	27.43	30.45	31.68
General farm overhead	3.20	4.47	2.86	3.74	3.25	3.38	4.46	3.43	3.48
Taxes and insurance	1.57	1.80	1.82	1.70	1.82	2.38	2.75	2.82	2.87
Capital replacement	5.69	6.58	6.95	7.38	7.61	7.53	7.83	7.96	8.14
Returns to operating capital	1.93	1.58	1.28	1.44	1.13	.76	.83	1.05	1.27
Returns to other nonland capital	4.11	4.52	4.36	4.95	2.72	2.72	3.24	3.77	4.16
Land	9.75	10.13	9.26	8.86	6.56	5.44	5.81	6.61	7.13
Unpaid labor (2.1 hr)	6.97	7.14	7.33	7.70	7.77	8.13	7.48	7.93	8.20
Total, economic costs	61.21	64.75	63.11	65.24	60.26	58.51	59.83	64.02	66.93
Residual returns to management and risk	-13.82	-13.78	-14.50	-7.00	5.90	9.04	14.45	4.61	-.43

Source: (19).

## Management Practices

Sheep production and management systems vary greatly. Management practices in the Western United States are dictated by size, location, weather, and producer preferences. Location determines the amount of labor used, movement of sheep herds, water hauling, and other inputs. Weather conditions influence lambing practices and the lambing season. Sheep producers have some control over feeding programs. The sheep production survey of the Western States identified important differences in sheep production among the 11 States.

## Shed Lambing Versus Range Lambing

Shed and range lambing are two principal systems used in U.S. sheep production. Shed lambing is more expensive, requiring pens for ewes and enclosed sheds for lambs, supplemental feed during the cold months, and labor for intensive care. Labor is used to feed, move, and care for the ewes and

newborn lambs. This intensive care increases lambs saved per ewe and reduces losses of lambs and ewes to predators. In addition, shed lambing permits earlier lambing with the option of earlier marketing of lambs or sales at heavier weights.

The shed lambing system is widely used in the Intermountain and Northern Plains regions, while range lambing is the primary system used in Texas (table 14). Producers of medium and large operations generally prefer range lambing over shed lambing because labor and facilities costs are lower.

### Lambing Season

As in most livestock operations, sheep production has strong seasonality due to natural biological behavior. From a production viewpoint, it is more efficient to schedule lambing each year to come just before the spring grass begins to grow so that ewes and lambs can obtain most of their feed from pasture. Then, only some of the slower lambs need to be finished in feedlots. Most lambing occurs within 2-3 months. Slaughter lambs are marketed for only 2-4 months after they are weaned, but feeder lambs are marketed for another 2-4 months.

In recent years, large numbers of lambs have been sold as feeder lambs to feedlots after they are weaned in May and June rather than slaughtered immediately after weaning. This recent increased use of feedlots has resulted in a more even distribution of lamb slaughter with less seasonal variation during summer and fall seasons.

Lambing is highly seasonal in the 11 Western States (fig. 4). No lambs are born during July and August and only a few are born in September. January through May tend to be the most important months for lambing. Almost three-fourths of all lambs are born during the first 5 months of the year (table 15). Lambing season starts in September in Texas; October in the Pacific, Southwest, and Intermountain regions; and December in the Northern Plains.

Lambing seasons generally coincide with productivity of pasture and ranges. Since lambing season is tied closely to climatic conditions, patterns throughout the Western States are fairly stable over time.

### Shearing Season

Sheep are sheared in the Western States during February through May before lambing (table 16). In the Eastern States, sheep are sheared when the weather warms up, usually after lambing season.

Table 14--Management systems for lambing by region, 1986

Region	Shed lambled	Range lambled	Total
	<i>Percent</i>		
Pacific	41	59	100
Intermountain	63	37	100
Northern Plains	60	40	100
Southwest	21	79	100
Texas	4	96	100
Average	38	62	100

Source: 1986 Farm Costs and Returns Survey.



Figure 4

Lambs born by month, 1986

Percent of total lambs born

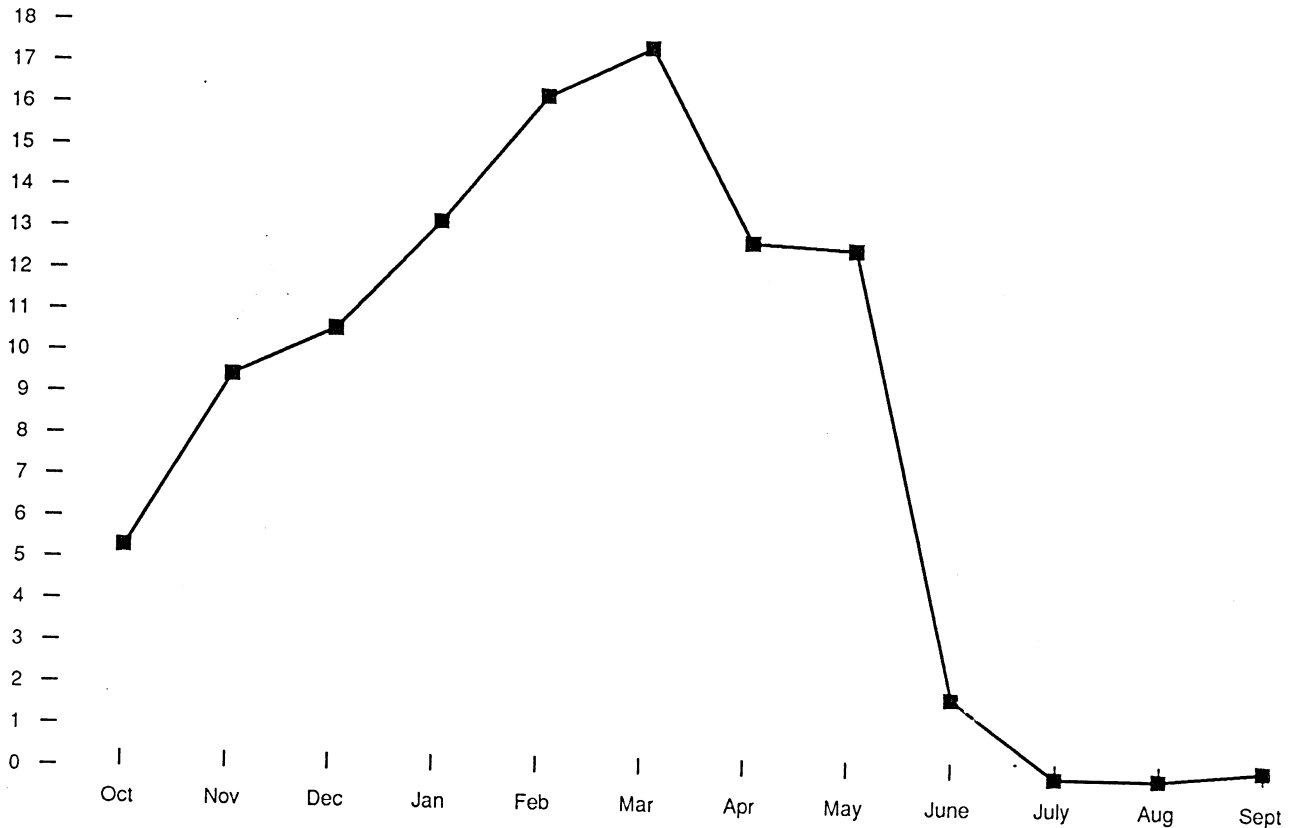


Table 15--Lambs born by month and region, 1986

Month	Pacific	Inter-mountain	Northern Plains	Southwest	Texas	Average
<i>Percent</i>						
Oct.	5.20	1.07	0	5.57	14.67	5.30
Nov.	11.80	2.80	0	19.23	13.50	9.47
Dec.	17.03	6.73	0.33	21.17	7.77	10.61
Jan.	24.03	11.33	4.47	14.10	12.23	13.23
Feb.	26.33	16.70	10.33	10.07	18.03	16.29
Mar.	11.90	20.07	21.93	9.51	23.97	17.48
Apr.	3.53	20.30	21.67	11.40	7.20	12.82
May	.07	18.13	35.47	8.50	1.23	12.68
June	.07	2.87	5.77	.48	.17	1.87
July	0	0	0	0	0	0
Aug.	0	0	0	0	0	0
Sept.	0	0	0	0	1.23	.25
Total	100	100	100	100	100	100

Source: 1986 Farm Costs and Returns Survey.

Table 16--Sheep shorn by month and region, 1986

Month	Pacific	Inter- mountain	Northern Plains	Southwest	Texas	Average
<i>Percent</i>						
Jan.	0	1.68	6.10	5.26	0	2.61
Feb.	5.86	13.48	17.74	10.53	3.66	10.25
Mar.	2.93	25.00	27.32	14.87	7.95	15.61
Apr.	16.41	19.84	24.11	22.63	58.66	28.33
May	45.81	22.54	14.15	35.00	17.72	27.04
June	15.36	6.12	4.64	3.82	0	5.99
July	7.88	6.65	1.57	2.63	.79	3.90
Aug.	.97	.47	.30	4.79	1.77	1.66
Sept.	2.93	0	0	0	7.09	2.00
Oct.	.88	.23	0	0	2.36	.69
Nov.	0	1.36	1.88	.47	0	0.74
Dec.	.97	2.63	2.20	0	0	1.16
Total	100	100	100	100	100	100

Source: 1986 Farm Costs and Returns Survey.

More than 80 percent of sheep are sheared in the Western States during February through May, peaking in April (fig. 5). March shearing is more prevalent in the Intermountain and Northern Plains regions, while April and May are important months for shearing in the Texas, Pacific, and Southwest areas.

### Fenced Versus Open Range

Both public and private grazing land is fenced, but fencing is more common on privately owned land. Fencing depends on the land tenure and State and regional laws and regulations related to the use of private and public land for livestock grazing. Over 80 percent of the ewes in Western States are grazed on fenced ranges in both summer and winter. In Texas all ewes are grazed on fenced ranges in both summer and winter (table 17). In the West (excluding Texas), 24 percent of ewes are grazed on open ranges in summer and only 15 percent are grazed on open ranges in winter. Fencing is mostly used in the Pacific, Intermountain, Northern Plains, and Southwest regions. The Intermountain region, with much public land, has more ewes grazed on open ranges in both summer and winter than any other region.

There is continuous pressure for new fencing. Fencing provides better management of rangeland, greater control of sheep, and lower cost of production. A comparison of the 1980 and 1986 surveys of sheep operators in the Western States confirms that use of fences increased by 22 percent in summer ranges and increased by 15 percent in winter ranges.

### Lamb and Stock Sheep Losses

Sheep and lamb losses in 1986 were 1,275,000 head, or 12.7 percent of January 1 sheep inventory (23). Based on the 1986 sheep survey, lamb losses before and after docking/marketing accounted for 67 percent of total lamb and stock sheep losses.

Diseases and miscellaneous causes, including weather, caused the most lamb losses before docking, amounting to 65 percent in 1986 (table 18). Predators, mainly coyotes, accounted for the rest.

Figure 5

Sheep shorn by month, 1986

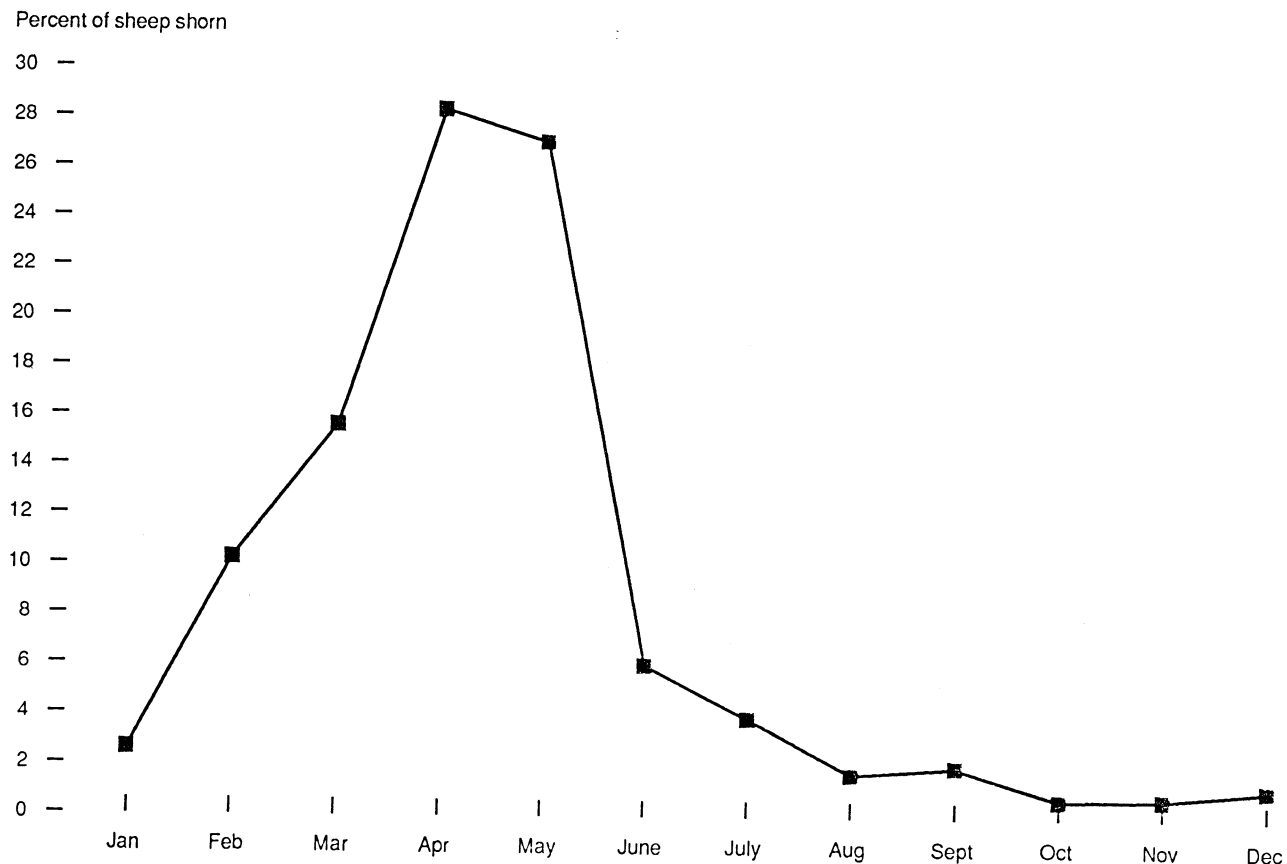


Table 17--Use of fenced and open range, by region, 1986

Region	Summer range		Winter range	
	Open	Fenced	Open	Fenced
	<i>Percent</i>			
Pacific	22	78	5	95
Intermountain	29	71	24	76
Northern Plains	21	79	18	82
Southwest	25	75	11	89
Texas	0	100	0	100
All regions	19	81	12	88

Source: 1986 Farm Costs and Returns Survey.

Weather conditions (usually winter and spring snowstorms) are always potential problems for western sheep producers, causing 26 percent of all lamb losses before docking. Diseases, internal parasites, and other known and unknown causes accounted for 39 percent of lamb losses before docking.

Predators accounted for 60 percent of lamb losses after docking (table 19). Losses to predators are higher for lambs after docking, due to grazing and less protection. Coyotes killed about 39 percent of

Table 18--Lamb losses before docking/marketing, by type of predators, diseases, and region, 1986

Cause of loss	Pacific	Inter- mountain	Northern Plains	Southwest	Texas	Total
	<i>Percent</i>					
<b>Predators:</b>						
Eagles	3.67	2.39	2.81	6.40	27.71	6.63
Bobcats	10.21	1.99	0	9.36	10.62	4.98
Coyotes	18.71	10.69	13.27	33.81	19.72	16.34
Foxes	1.23	1.55	3.78	1.84	10.10	3.15
Dogs	5.69	1.31	1.09	6.97	0	2.44
Mountain lions	.45	.19	.10	0	0	.17
Bears	0	.25	0	0	0	.10
Other predators	4.56	1.51	0	1.53	.93	1.64
Total predators	44.52	19.89	21.05	59.91	69.08	35.45
<b>Diseases and miscellaneous:</b>						
All diseases	2.33	21.42	12.42	3.67	0	11.56
Internal parasites	1.12	.09	0	1.68	3.96	.95
External parasites	0	0	0	0	0	0
Weather	29.62	28.90	34.99	14.50	8.04	25.73
Poisonous plants	0	0	0	0	0	0
Old age	0	0	0	0	0	0
Other known causes	5.50	21.82	22.42	.84	3.47	14.36
Unknown causes	16.91	7.88	9.12	19.40	15.45	11.94
Total diseases	55.48	80.11	78.95	40.09	30.92	64.55
<b>Total losses</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: 1986 Farm Costs and Returns Survey.

all lambs lost after docking. According to sheep producers surveyed, 6 percent of the losses were from dogs and 15 percent were affected by other predators. Lambs are less vulnerable to diseases after docking. Diseases and miscellaneous causes accounted for 40 percent of lamb losses after docking.

Diseases and predators are also problems for adult sheep (table 20). Predators accounted for 31 percent of losses in adult sheep population, while diseases caused 69 percent of total stock sheep losses. Coyotes were the most common predators, accounting for 15 percent of the losses.

### Water Hauling

Much of the West is arid rangeland with limited rainfall and little surface water and streams. Natural features such as rivers, lakes, and streams provide water to livestock. When natural water source features do not exist and precipitation is sufficient, manmade structures such as pits and ponds can provide water at almost no cost to livestock producers. In the absence of the above, some areas have groundwater supplies that allow well drilling. Where no other source is available, water must be hauled by truck or water trailers. Hauling water for sheep is more widespread in the Southwest than in other regions. Forty-five percent of the southwestern sheep operations reported hauling water during the year, compared with 29 percent in the Pacific, 16 percent in the Intermountain, and 8 percent in both the Northern Plains and Texas regions (table 21). The average one-way hauling

Table 19--Lamb losses after docking/marking, by type of predators, diseases, and region, 1986

Cause of loss	Pacific	Inter- mountain	Northern Plains	Southwest	Texas	Total
	<i>Percent</i>					
<b>Predators:</b>						
Eagles	0.54	0.19	0.27	13.19	0.53	1.87
Bobcats	2.47	.30	.26	2.61	4.79	1.61
Coyotes	19.32	44.12	46.49	21.45	45.64	39.08
Foxes	.49	.68	2.22	.50	1.41	1.07
Dogs	12.17	8.06	3.12	8.62	.88	6.41
Mountain lions	5.90	.74	.02	6.01	8.32	3.17
Bears	0	1.10	.75	.03	0	.58
Other predators	23.92	.02	0	25.04	3.46	6.55
Total predators	64.82	55.21	53.12	77.44	65.04	60.34
<b>Diseases and miscellaneous:</b>						
All diseases	14.10	11.72	7.85	2.42	1.31	8.33
Internal parasites	3.98	.15	.29	4.05	7.15	2.32
External parasites	0	0	2.11	0	0	.42
Weather	6.69	5.10	7.63	6.79	0	5.13
Poisonous plants	0	2.54	1.47	.27	.32	1.36
Old age	0	0	0	0	0	0
Other known causes	.18	9.55	11.55	0	0	6.01
Unknown causes	10.23	15.74	15.98	9.02	26.18	16.10
Total diseases	35.18	44.79	46.88	22.56	34.96	39.66
<b>Total losses</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: 1986 Farm Costs and Returns Survey.

distance was 12 miles in the Southwest and 7.8 miles in the Pacific regions, with 373 and 436 yearly trips, respectively. In contrast, the Intermountain, Texas, and Northern Plains regions required fewer trips and shorter distances to haul water. Comparisons of the 1980 and 1986 surveys reveal that, on average, the number of farms hauling water in every region except Texas declined from 67 to 14 percent, which may be related to the use of more groundwater or construction of new water projects in the Western States.

### Feed Sources

Grazing accounts for about three-fourths of the feed needs of western sheep (table 22). Pastures and rangeland provide 74 percent of feed requirements. Nearly 80 percent of all pastures and ranges grazed by western sheep are private. The rest are Federal- and State-administered pastures. Most sheep enterprises use private, rented, or leased pastures. Nonirrigated private pastures and ranges account for 46 percent of total feed in the Western States. Private nonirrigated pastures and ranges are the most important source of feed in all regions.

Hay and supplemental feed (feed grains and commercial protein mixes) are used during lambing or when pasture and range forages are unavailable because of snow or dry weather. The feed supplements ranged from 22-31 percent of total feed in the Western States.

Table 20--Sheep losses, by type of predators, diseases, and region, 1986

Cause of loss	Pacific	Inter- mountain	Northern Plains	Southwest	Texas	Total
<i>Percent</i>						
<b>Predators:</b>						
Eagles	0	0	0	3.61	0	0.65
Bobcats	0	0	0	2.79	0	.50
Coyotes	10.46	18.99	15.00	14.80	12.80	15.17
Foxes	0	.08	.14	0	0	.05
Dogs	16.46	11.90	3.93	7.59	5.81	9.63
Mountain lions	5.28	2.54	.20	1.94	0	2.14
Bears	1.10	1.74	.57	.04	.38	.92
Other predators	4.72	.11	.20	4.60	.47	1.80
Total predators	38.01	35.35	20.04	35.36	19.45	30.86
<b>Diseases and miscellaneous:</b>						
All diseases	22.76	12.84	14.74	19.43	1.79	14.66
Internal parasites	5.18	.63	2.53	4.84	14.74	4.42
External parasites	1.38	.99	0	0	1.5	.76
Weather	1.04	4.24	7.98	1.67	0	3.35
Poisonous plants	0	6.35	5.01	5.68	8.99	5.21
Old age	16.59	10.86	11.75	18.81	10.66	13.44
Other known causes	4.57	15.19	19.17	3.26	4.01	10.43
Unknown causes	10.48	13.55	18.78	10.96	38.83	16.87
Total diseases	61.99	64.65	79.96	64.64	80.55	69.14
Total losses	100	100	100	100	100	100

Source: 1986 Farm Costs and Returns Survey.

Table 21--Operations that haul water to sheep, 1986

Region	Farms hauling water	Average trips	Average one-way distance
	<i>Percent</i>	<i>Number</i>	<i>Miles</i>
Pacific	29	436	7.8
Intermountain	16	41	2.5
Northern Plains	8	4	.1
Southwest	45	373	12.1
Texas	8	1	1.0
All regions	21	171	4.7

Source: 1986 Farm Costs and Returns Survey.

Feed sources varied widely in the Western States. In Texas, private pastures are more important than in other areas. Sheep producers in the Intermountain region rely more on Federal rangeland. Crop residues are more important in the Pacific and Southwest regions than in other regions. Northern Plains and the Southwest regions use more hay and concentrate than do other regions. The 1986 survey of sheep producers indicates fewer sheep are grazing on Federal- and State-administered pastures and ranges.



Table 22--Annual feed sources, by region, 1986

Region	Owned, rented, or leased pasture				Bureau of Land Management <sup>1</sup>	National Forest Service <sup>2</sup>	State and other	Total
	Hay and concentrates	Nonirrigated pasture	Irrigated pasture	Crop residue				
	<i>Percent</i>							
Pacific	24	38	6	16	3	10	2	100
Intermountain	24	38	9	4	11	7	7	100
Northern Plains	31	46	5	4	7	3	5	100
Southwest	27	39	6	11	5	7	5	100
Texas	22	78	0	1	0	0	0	100
All regions	26	46	5	5	5	6	4	100

<sup>1</sup>U.S. Department of the Interior.

<sup>2</sup>U.S. Department of Agriculture.

Source: 1986 Farm Costs and Returns Survey.

### Grazing Land Tenure

Analysis of grazing land tenure indicates that sheep production heavily relies on rented and leased pastures. Pastures and ranges leased from grazing associations and dry private pastures that are rented account for 71 percent of the total areas grazed by sheep (table 23). Owned dry pastures and rangelands account for 16 percent of the total. Total irrigated pastures grazed by sheep from owned, rented, and leased sources amount to less than 1 percent of total grazing areas. Other public lands, excluding those of the Bureau of Land Management (BLM) and the Forest Service (FS), furnish another 4 percent. Cropland area grazed by sheep amount to about 2.5 percent of total land.

### Cattle and Sheep Combinations

Sheep, livestock, and crop production are complementary enterprises in the Western States (2, 3, 13). Sixty-six percent of sheep producers interviewed also had cattle, 33 percent had some crops, and 19 percent raise other livestock (table 24). The combination of sheep and beef cattle is most prevalent in the Northern Plains and Texas areas where private pastures and rangelands allow needed flexibility for grazing mixed livestock. This flexibility is not available to most Federal rangeland users because

Table 23--Grazing tenure, by type of ownership and region, 1986

Region	Owned pasture		Rented and leased pasture						Cropland grazed		Total	
	Dry	Irrigated	Private		Public				Small grain	Crop residue		
			Dry	Irrigated	State	Indian	Railroad	Grazing association	Other			
	<i>Percent</i>											
Pacific	4.21	0.09	5.27	1.00	1.25	0	1.60	80.48	0.38	0.59	5.14	100
Intermountain	22.99	.91	26.99	.80	5.38	0.01	1.11	27.68	12.22	.52	1.38	100
Northern Plains	34.25	.62	31.63	.86	5.52	0	2.15	13.61	9.67	1.11	.56	100
Southwest	10.05	.19	7.24	.44	4.22	.21	.64	72.53	2.06	.32	2.10	100
Texas	9.58	0	89.84	.01	0	0	0	0	0	.51	.06	100
All regions	16.22	.36	32.19	.62	3.28	.04	1.10	38.86	4.87	.61	1.85	100

Source: 1986 Farm Costs and Returns Survey.

Table 24--Sheep farms by type of enterprise and region, 1986

Region	Sheep farms		
	Crops	Cattle	Other livestock
	<i>Number</i>		
Pacific	26	44	0
Intermountain	27	68	14
Northern Plains	39	77	22
Southwest	18	48	8
Texas	29	73	48
All regions	33	66	19

Source: 1986 Farm Costs and Returns Survey.

land use policies usually limit mixed grazing. Mixed grazing provides greater potential to increase livestock production in the Western States.

In the past, sheep were the prime income source for western operations. However, this is no longer true. In 1986, farm businesses with sheep obtained only 27 percent of their agricultural income from sheep (table 25). Only in the Northern Plains does lamb and wool income provide more than 40 percent of gross income. Losses to predators and diseases persuaded many sheep producers to shift their agricultural effort more to beef cattle than to sheep (8). Cattle sales were the principal enterprise in every region except the Northern Plains where sheep and cattle were equally important (table 25). A comparison of 1986 with 1980 shows that gross income from the sale of sheep in the Western States declined from 65 percent to 27 percent, while gross income from sale of cattle increased from 24 percent to 58 percent. Gross income from sale of crops and other livestock remained almost unchanged.

### Labor

Sheep production requires the use of more labor than other livestock. In addition to operator and family labor, contract and hired labor is used extensively in sheep production in Western States (8, 9, 10, 14). Labor is used for feeding and taking care of ewes and newborns in the lambing season. Shepherders are also hired to help on ranges and open pastures.

More than half of the labor needed for the sheep operation is provided by operators and their families. The remainder is provided by contract and hired labor. In the Western States, hired and contract labor use ranged from 1.93 hours per ewe in Texas to 1.38 hours per ewe in the Pacific area (table 26). Operator and family labor was highest in the Pacific region and lowest in Texas, and ranged from 3.44 to 1.57 hours per ewe. Sheep producers in the 11 Western States used 3.98 total hours of operator, family, contract, and paid labor per ewe.

Sheep production competes with beef cattle for productive sources of labor and land. Expenditure for labor in sheep production is ranked second to feed costs. Expenses for contract and hired labor as a share of total variable costs is highest for sheep (21.2 percent) and lowest for fed cattle (1.1 percent) (table 27). Therefore, it seems likely that the current stagnation or steady decline in sheep numbers will continue unless methods can be developed to improve the level of returns from sheep production relative to labor and management. Sheep production requires higher returns for labor and management than do alternative farm enterprises.

Table 25--Sources of agricultural income for farms and ranches with sheep, by region, 1986

Region	Income source				Total
	Crops	Cattle	Sheep livestock	Other	
<i>Percent</i>					
Pacific	7	75	18	0	100
Intermountain	10	55	31	4	100
Northern Plains	12	41	41	7	100
Southwest	4	78	18	0	100
Texas	7	43	26	24	100
All regions	8	58	27	7	100

Source: 1986 Farm Costs and Returns Survey.

Table 26--Hired and contract labor per ewe, by region, 1986

Region	Hired and contract labor	Operator labor	Unpaid family labor	Total
<i>Hours per ewe</i>				
Pacific	1.38	2.37	1.07	4.82
Intermountain	1.54	1.92	.82	4.28
Northern Plains	1.61	1.31	.47	3.39
Southwest	1.69	2.01	.60	4.30
Texas	1.93	1.17	.40	3.50
Average	1.60	1.78	.60	3.98

Source: 1986 Farm Costs and Returns Survey.

Table 27--Labor use by type of operation, 1989

Type of operation	Unit	Hired and contract labor	Operator and family labor	Labor expense as share of variable expenses
<i>Hours</i>				
Fed cattle	Cwt	0.73	0.18	1.1
Farmer feedlots	Cwt	.11	1.02	1.0
Commercial feedlots	Cwt	.85	0	1.7
Cow-calf	Cwt	3.20	27.58	8.7
Farrow-to-finish hogs	Cwt	.30	.90	5.2
Sheep	Ewe	1.56	3.49	21.2

Source: (19).

## Production and Marketing

Several new sheep production technologies have been developed such as out-of-season and accelerated lambing, artificial insemination, pregnancy testing, early weaning of lambs, and confinement of ewes. But, only a few of these practices have found their way into commercial sheep operation (13). Most of these innovations are labor intensive and more suitable for farm flocks. They are also too expensive to be implemented on range sheep operations.

Marketing of sheep creates more problems for sheep producers. Declines in the number of lamb packing plants may reduce competition for available lambs (17). Development of large sheep feedlots increased the market for feeder lambs. This marketing practice provides a continuous supply of lambs to packing plants.

### Lamb Production and Disposition

Only 81 percent of lambs produced are available for sale. Losses after docking account for 6 percent of the total lamb crop, while herd replacements account for 13 percent (table 28). Replacement rates ranged from 9 to 17 percent of the breeding ewes.

Feeder lambs and slaughter lambs together accounted for 68 percent of the Western States' lamb crop in 1986. Sale of weaned lambs as feeders is more common in the Western States. The largest proportion (49 percent) of the 1986 Western States' lamb crop was sold as feeders to commercial feedlots for fattening.

Sales of weaned lambs for immediate slaughter accounted for 19 percent of the total 1986 lamb crop. Where good quality forages are available, lambs gain fast enough to sell as "fats" by the time they are weaned. Lush pastures along the Pacific coast and in the Southwest produce lambs of this quality. Pastures and rangelands in Texas and the Northern Plains are drier and less productive than in other regions in the West and produce few fat lambs at weaning.

Table 28--Lamb disposition, by region, 1986

Lamb crop disposition	Pacific	Intermountain	Northern Plains	Southwest	Texas	All regions
	<i>Percent</i>					
Lost or died after docking	4.45	7.13	6.44	5.41	5.60	5.81
Kept for replacement	8.53	14.80	16.64	11.34	14.87	13.23
Sold as herd replacements	1.84	2.18	2.54	3.72	1.18	2.29
Sold as feeders	28.23	53.33	60.20	34.40	67.91	48.81
Sold for slaughter when weaned from ewes	44.60	11.58	2.54	32.29	3.91	18.98
Sold for slaughter after being fattened on supplement feed	4.16	5.10	9.45	2.70	3.08	4.90
Sold for slaughter after being fattened on pasture	6.53	4.93	.94	6.19	2.65	4.25
Sold for all other uses	1.67	.96	1.25	3.95	.79	1.72
Total	100	100	100	100	100	100

Source: 1986 Farm Costs and Returns Survey.

About 9 percent of the lamb crop is sold for slaughter after being fattened on supplemental feed or in pastures. Sheep producers either fatten the feeders in drylot facilities or graze on crop residue such as beet tops or alfalfa stubble. These materials provide a nutritious fattening ration.

### Wool Production

Wool production is an important segment of sheep production. Sales of wool and wool payments ranged from 27 to 30 percent of total cash receipts. Income received from sales of wool plays an important role in the success or failure of commercial sheep producers. The average fleece weight declined from 8.43 pounds in 1970 to 7.82 pounds in 1986, which is related to the lack of producers' attention to wool production and a switching away from wool breeds (21).

Wool production per ewe in 1986 ranged from 8 pounds in Texas to 10.9 pounds in the Northern Plains. The average fleece weight for the Western States was 9.8 pounds.

### Lamb and Wool Marketing Season

Lamb marketing is associated with seasonal lambing with a 5- to 6-month lag (fig. 6). Production cycles and forage availabilities of pastures and ranges contribute to this marketing cluster. Principal lamb marketing months by area are: Pacific, 84 percent during May-July; Intermountain, 86 percent during June-October; Northern Plains, 71 percent during September-November; Southwest, 55 percent during April-June and 20 percent in October; and Texas, 65 percent during February-June and the rest during remaining months (table 29). No major changes in the marketing of lambs are

Figure 6

#### Monthly lamb marketing, 1986

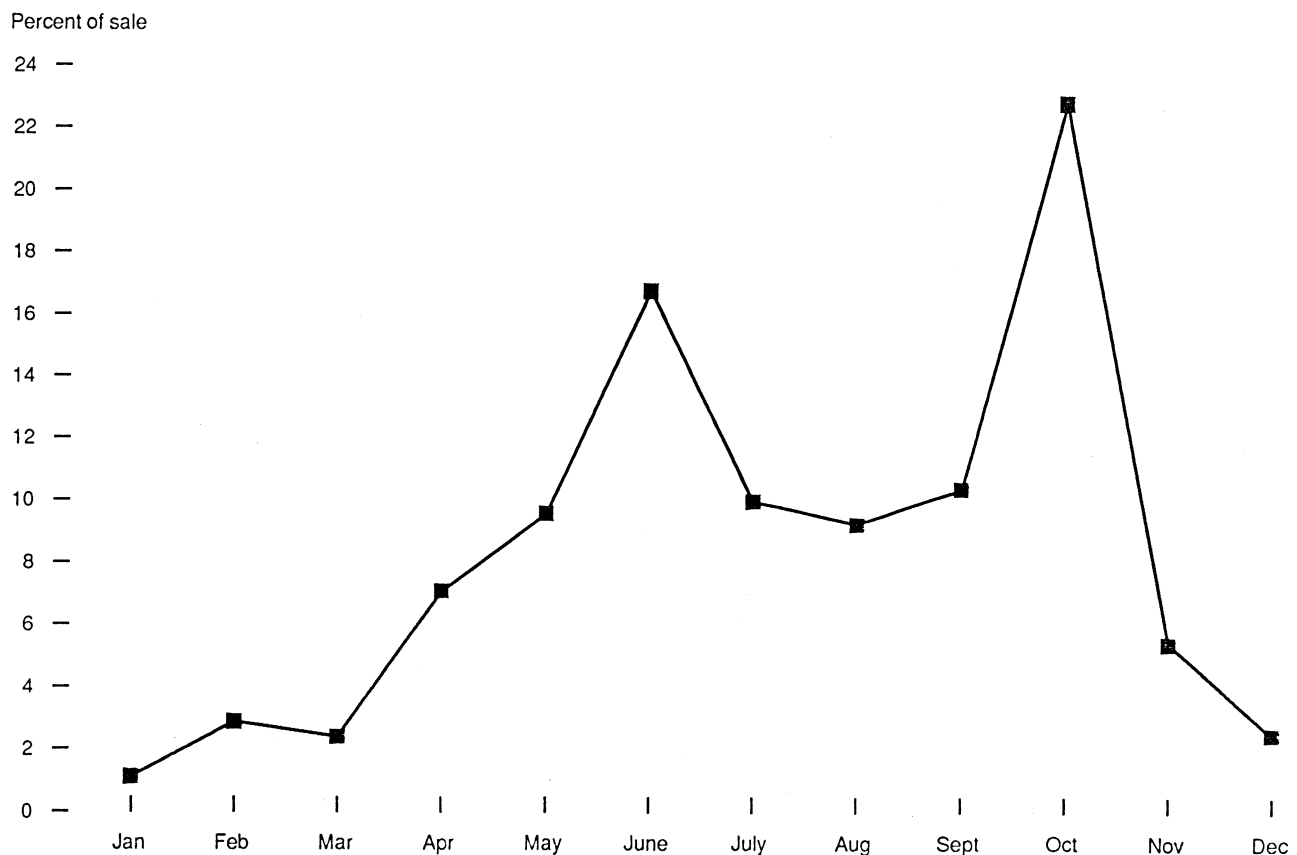


Table 29--Lamb sales by month, by region, 1986

Month	Pacific	Inter- mountain	Northern Plains	Southwest	Texas	Average
<i>Percent</i>						
Jan.	0.13	1.27	1.60	0.30	2.27	1.11
Feb.	.13	.30	.47	.30	13.13	2.87
Mar.	.17	0	0	1.90	9.87	2.39
Apr.	5.13	1.63	2.50	11.10	15.00	7.07
May	16.27	1.10	1.90	21.80	6.80	9.57
June	29.57	8.60	3.80	21.80	20.03	16.76
July	18.20	10.07	9.17	8.37	4.03	9.97
Aug.	19.47	9.63	4.60	3.97	8.47	9.23
Sept.	5.27	17.03	14.17	6.73	8.70	10.38
Oct.	5.00	41.10	44.27	20.17	3.50	22.81
Nov.	.67	6.60	12.40	3.57	3.60	5.37
Dec.	0	2.67	5.13	0	4.60	2.48
Total	100	100	100	100	100	100

Source: 1986 Farm Costs and Returns Survey.

expected in the near future, because of rigidity of environmental and biological factors that dictate current production practices.

Wool marketing is highly seasonal (fig. 7). Seventy-six percent of all wool is marketed during the first 4 months of the year (table 30). Wool is a storable product, but rarely held for a full year. The exception is when prices are extremely low. Months of heaviest wool marketing vary somewhat from year to year, depending on wool prices.

### Sheep Enterprise Costs and Returns

Before 1984, the primary survey of costs of producing sheep and other livestock was the Cost of Production Survey (COPS) conducted by USDA. The sample for the sheep COPS drew from a nonrandom list of sheep producers who had responded to other surveys, based on probability proportional to size. The cost of production of sheep, published annually in the *Economic Indicators of the Farm Sector, Costs of Production--Livestock and Dairy* (19), is based on the 1980 sheep COPS.

The enterprise budget presented here to describe costs and returns for Western States' sheep production is based on the 1986 Farm Costs and Returns Survey (FCRS). The FCRS, begun in 1984, is conducted jointly by ERS and NASS and consists of personal interviews of farm and ranch operators to obtain information on income, expenses, and production practices.

The FCRS, however, is a full-probability, multiframe survey that incorporates cost-of-production data with whole farm financial data. The FCRS captures a more diverse and random sample of sheep producers and is more representative of all sheep producers.

It is important to recognize that some of the differences between the sheep budget presented in this report and the one estimated from the previous survey data are mostly due to survey procedure and not necessarily to technological change. For example, the smaller volume of the primary products

Figure 7

Monthly wool marketing, 1986

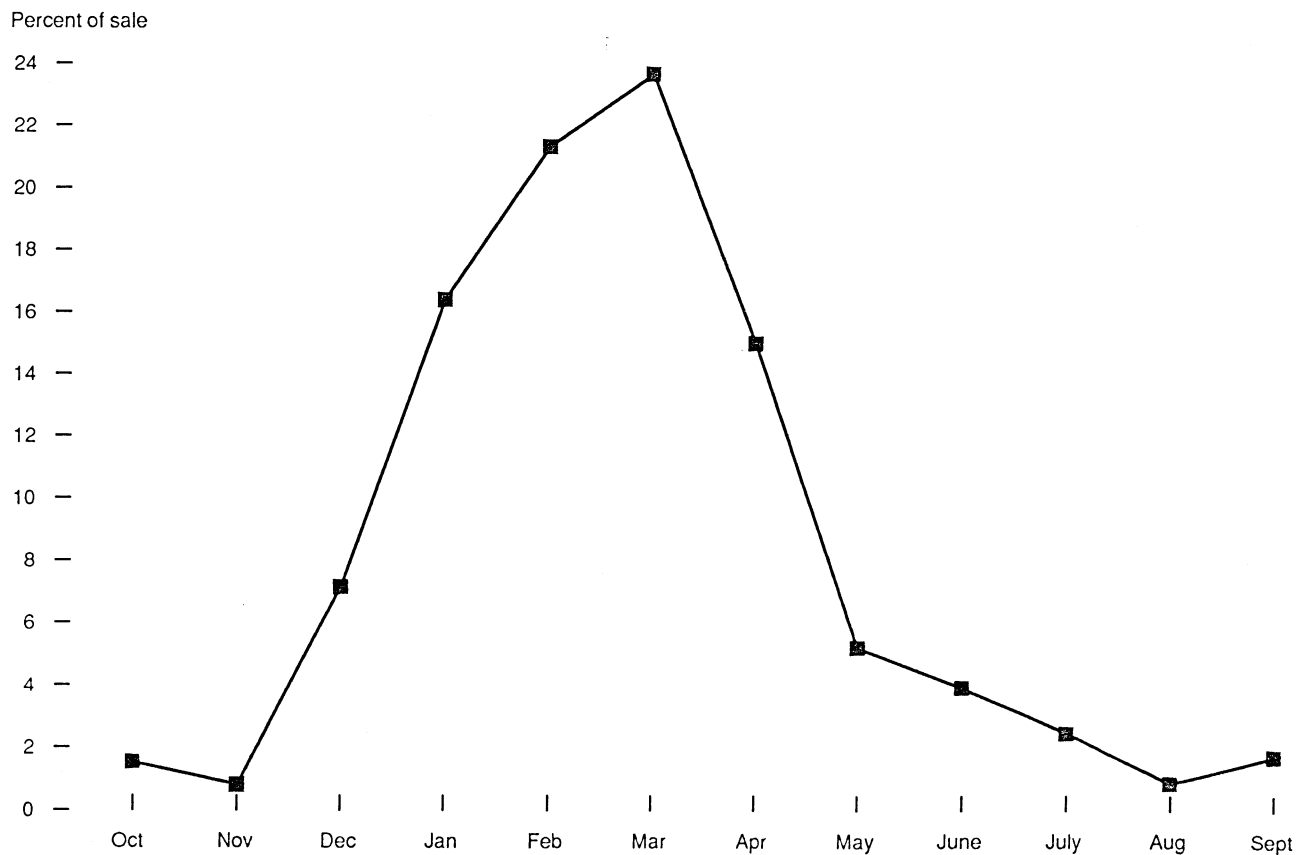


Table 30--Wool marketing by month, by region, 1986

Month	Pacific	Inter-mountain	Northern Plains	Southwest	Texas	Average
<i>Percent</i>						
Oct.	2.00	0	5.67	0	0	1.53
Nov.	0	2.33	1.00	0.67	0	.80
Dec.	0	12.00	16.67	2.33	4.67	7.13
Jan.	7.33	20.33	23.00	22.67	8.67	16.40
Feb.	19.67	14.67	18.33	23.00	31.00	21.33
Mar.	19.67	20.00	16.67	30.33	31.67	23.67
Apr.	23.67	17.33	11.00	11.00	12.00	15.00
May	13.00	4.33	0	7.33	1.33	5.20
June	8.00	5.67	1.67	0	4.33	3.93
July	3.00	.33	3.00	2.33	3.67	2.47
Aug.	1.33	1.00	.67	0	1.33	.87
Sept.	2.67	2.00	2.33	.33	1.33	1.73
Total	100	100	100	100	100	100

Source: 1986 Farm Costs and Returns Survey.

per ewe (slaughter and feeder lambs, cull ewes, and wool) does not indicate that productivity per ewe is declining.

The area covered and the number of completed questionnaires in the 1986 survey also is different from the last survey. The 1986 survey provided information for only 11 Western States, while the 1980 COPS produced data for sheep producers in 17 Western States. The number of completed questionnaires in the 1980 sheep COPS was significantly larger than in the 1986 FCRS survey (800 versus 339).

The technical data used as the basis for the sheep budget were obtained through the 1986 FCRS. Structural data such as flock size, type and quantities of feed and forages, and expenses for handling and hauling of feed and other products, labor, shearing, tagging, and other inputs used in production of sheep are obtained from sheep producers. However, the 1986 sheep production costs failed to collect information on use of machinery and housing in sheep production. To overcome this problem, the machinery and equipment expenses reported in the 1980 sheep COPS were used as a proxy in the 1986 survey. By combining these two surveys, it was assumed that methods of raising sheep and type of machinery and housing used in production of sheep in the Western States did not change between the two surveys or that the changes were not significant.

### **Secondary Data**

The technical data used as a basis for the sheep budget are supplemented with price and quantity data available from other surveys conducted by ERS and NASS. The additional data include slaughter and feeder lamb prices, wool prices, land values, wage rates, and price and quantity data for feed and other agricultural inputs. The additional data are used to update the sheep costs and returns budgets during 1987-89.

To estimate the machinery costs employed in sheep production, engineering relationships developed by the American Society of Agricultural Engineers are programmed into a computerized budget generator. These equations estimate expenses for fuel, lubrication, electricity, repairs, taxes, insurance, and machinery replacement costs according to the number, type, and hours of use described in the survey data for the equipment and machinery.

The sheep budget is estimated on a per ewe basis. The sheep enterprise contains costs and returns measures separated into three major categories: cash receipts, cash expenses, and economic costs.

### **Cash Receipts**

Cash receipts include the value of slaughter and feeder lambs, cull ewes, wool, and wool incentive payments. Total cash receipts increased to \$78.94 in 1987 and declined to \$71 per ewe in 1989 (table 31). Variation in cash receipts is directly related to market prices of slaughter and feeder lambs. Cash receipts from sale of wool and wool incentive payments remained fairly stable, ranging from \$19.76 to \$21.56 per ewe during 1986-89.

### **Cash Expenses and Capital Replacement**

The cash expenses and capital replacement charge per ewe in the United States fell slightly in 1988 and remained unchanged in 1989. Feed costs accounted for 33 percent of total cash costs plus capital replacement expenses in 1989, whereas feed expenses were 29 and 27 percent in 1986 and 1987, respectively. Feed costs increased substantially in 1988 but fell slightly (by 52 cents per ewe) in 1989. Hay and concentrates were the two feed items showing the largest increase from 1986 to 1989.



Table 31--U.S. Sheep production cash costs and returns, all sizes of operation, 1986-89

Item	1986	1987	1988	1989
<i>Dollars per ewe</i>				
<b>Cash receipts:</b>				
Slaughter lambs (9.1 lbs)	6.26	6.59	6.13	5.92
Feeder lambs (57.1 lbs)	39.84	47.83	44.56	41.23
Cull ewes (15.6 lbs)	3.38	3.65	3.81	3.79
Wool (9.5 lbs)	7.00	9.43	14.51	12.85
Wool payment	11.66	9.18	4.21	5.78
Unshorn lamb payment	2.90	2.26	1.04	1.43
Total	71.04	78.94	74.26	71.00
=====				
<b>Cash expenses:</b>				
Feed--				
Grain (0.6 bu)	1.46	1.27	1.83	1.97
Protein supplements (0.28 cwt)	2.54	2.62	2.99	3.16
Salt and minerals (7.0 lbs)	.40	.40	.40	.42
Hay (0.29 ton)	8.04	7.61	11.03	9.93
Pasture	1.69	1.43	1.60	1.75
Public grazing	.63	.61	.70	.80
Crop residue	.16	.13	.16	.16
Total feed costs	14.92	14.07	18.71	18.19
Other--				
Veterinary and medicine	1.01	1.02	1.06	1.14
Livestock hauling	.99	.94	1.00	1.08
Marketing	.41	.42	.44	.47
Ram death loss	.30	.33	.30	.28
Shearing and tagging	2.27	2.11	2.24	2.31
Fuel, lubrication, and electricity	1.12	1.17	1.19	1.38
Machinery and building repairs	2.30	2.35	2.44	2.54
Hired labor (2.1 hr)	7.25	6.73	7.14	7.37
Miscellaneous	.06	.07	.07	.07
Total, variable cash expenses	30.63	29.21	34.59	34.83
General farm overhead	3.51	4.70	3.69	3.70
Taxes and insurance	2.62	2.75	2.82	2.87
Interest	7.72	7.05	6.65	6.18
Total, fixed cash expenses	13.85	14.50	13.16	12.75
Total, cash expenses	44.48	43.71	47.75	47.58
Cash receipts less cash expenses	26.56	35.23	26.51	23.42
Capital replacement	7.53	7.83	7.96	8.14
Total, cash expenses and replacement	52.01	51.54	55.71	55.72
Net cash receipts	19.03	27.40	18.55	15.28

Source: (19).

Feed composition and total feed expenditures changed drastically between the 1980 and 1986 surveys. Total feed expenditures between the two surveys increased 182 percent due to substitution of hay for pasture, grain, and concentrates. The feed ration based on the 1986 survey included less grains, concentrates, and pasture and more hay than in 1980. Changes in the feed ration resulted mainly from a shift of slaughter lamb production to feeder lamb production.

Other variable expenses such as veterinary medicine, livestock hauling, marketing, labor, fuel, and repairs accounted for 30 percent of total cash and capital replacement expenses. These expenditures increased slightly, by 76 cents per ewe, in 1989. Hired labor and shearing and tagging accounted for about 60 percent of other variable expenses.

Fixed cash expenses per ewe decreased 41 cents per ewe, while capital replacement charges per ewe increased slightly in 1989. These two items made up 37 percent of total cash and replacement costs. Cash receipts from sheep production were large enough to cover total cash expenses and capital replacement, leaving a positive net return.

Net cash receipts for sheep producers continued to decline but remained positive in contrast with other livestock production, except dairy. The combined effects of higher feed costs and lower cash receipts resulted in a decline in net cash receipts of \$12.12 per ewe from 1987 to 1989. Net cash receipts for sheep producers fell from a peak of \$27.40 per ewe in 1987 to \$15.28 per ewe in 1989.

### Economic Costs

Table 32 shows the economic costs for sheep producers under the assumption that all assets are owned. Sheep producers' total economic costs of production declined slightly in 1987 but increased substantially in 1988, mainly due to higher feed prices (table 32). Total economic costs increased 3 percent in 1989. Receipts of sheep producers have not been large enough to cover all economic expenses since 1988. Residual returns to management and risk became negative, declining from \$11.29 per ewe in 1987 to -\$5.98 per ewe in 1989.

Table 32--U.S. sheep production economic costs and returns, all sizes of operation, 1986-89

Item	1986	1987	1988	1989
	<i>Dollars per ewe</i>			
Total, cash receipts	71.04	78.94	74.26	71.00
=====				
Economic (full ownership) costs:				
Variable cash expenses	30.63	29.21	34.59	34.83
General farm overhead	3.51	4.70	3.69	3.70
Taxes and insurance	2.62	2.75	2.82	2.87
Capital replacement	7.53	7.83	7.96	8.14
Returns to operating capital	.84	.89	1.22	1.43
Returns to other nonland capital	2.72	3.24	3.77	4.16
Land	5.90	6.31	7.21	7.73
Unpaid labor (2.9 hr)	14.20	12.72	13.72	14.12
Total, economic costs	67.95	67.65	74.98	76.98
Residual returns to management and risk	3.09	11.29	-.72	-5.98

Source: (19).

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