TRENDS OF PREDATOR LOSSES OF SHEEP AND LAMBS FROM 1940 THROUGH 1985.

CLAIR E. TERRILL, Beltsville Agricultural Research Center-West, USDA-ARS, Beltsville, Maryland 20705.

ABSTRACT: Mortality of sheep and lambs from all causes and from predator losses from 1940 through 1985 for the United States is presented including economic aspects. Lamb losses from all causes were 9% of the lamb crop in 1940 and were generally higher thereafter and reached a peak in 1978 of 14%. Losses of sheep 1 year old and older from all causes were 7.5% in 1940 remained somewhat higher through the '60s and then declined to a low of 5.2% in 1985. Calculation of predator losses were based on an upward trend of lamb losses relative to sheep losses with increasing losses to predators. Estimates of predator losses were conservative and probably were underestimated. Predator losses were lowest in 1940 at 2.85%, increased during World War II, remained moderately high through the '50s and then increased to a peak of 6.07% of all sheep and lamb in 1977. Losses declined following the advent of the parvovirus in 1978 to a low of 5.24% in 1981 and then increased to 5.69% in 1985. Monetary losses from predators showed a steady increase from $13 million in 1940, to almost $90 million in 1979, and almost $69 million in 1985. Total losses from 1960 through 1985 were $1.2 billion. Predator losses as a percent of net income increased from 23% in 1940 to 26% in 1960, and to 78% in 1979. After reduction in predator losses due to the parvovirus they were still 60% of net income in 1985. Obviously, predator losses have been a dominant factor in the decline of the sheep industry.

INTRODUCTION

Sheep and lamb losses to predators have been a dominant factor in the sheep industry for almost half a century. Livestock, particularly sheep and lambs, have been lost to predators since the nation was founded. Farmers were able to control predators fairly well for about 3 centuries using all of the conventional methods including toxins. A public agency was given the responsibility for control in the early 1930s but toxins were used effectively up to World War II when they became unavailable from Europe. Then during World War II, the toxin 1080 or monofluoroacetate was developed to control rodents and was found to be extremely effective and selective against canines. As it came into use in predator control in the late 1940s, it was restricted in use and such restriction became extreme in the late 1960s. Then with the Executive Order banning the use of toxins in predator control by federal employees in 1972, losses of sheep and lambs to predators rapidly expanded until the parvovirus apparently reduced the coyote population drastically in 1978-79. Losses were only reduced slightly, however, but the peak in losses reached during the late 1970s has not returned. Even though the Executive Order banning toxins was rescinded, toxins are still generally unavailable for practical use.

The author realized in the early 1970s that the sheep industry was vulnerable to propaganda from activists without solid facts upon which to base their defense. Survey data, while worthwhile, were always questioned and often produced underestimates of real losses. Furthermore, it was expensive to conduct surveys frequently. He proceeded to develop and prove a method of estimating predator losses by states from mortality data reported annually by USDA. This was based on the obvious upward trend of lamb losses relative to sheep losses as predator losses increased (Terrill 1976, 1977, and 1981). Trends in predator losses from 1958 through 1979 were presented by Drummond et al. 1981, and Terrill 1981. The objective of this paper is to trace those losses back to 1940 and forward to the most recent year (1985) with available data.

METHODS AND PROCEDURE

Data used were taken primarily from USDA Statistical Reports on Meat Animals for 1985 and previous years (USDA 1986). Procedure for calculations was described in detail by Terrill (1981). Correction factors were used from Gee et al. (1977) to convert index losses to real losses and to prevent overestimates. Economic data were obtained from Economic Indicators for the Farm Sector from USDA, 1985, and previous years. However, net returns were calculated as 20% of gross returns. Data were calculated by states and then combined for the United States, including only those states taking significant losses from predators in each year. Alaska, Hawaii, and some southeastern states were excluded because of insufficient or no data. Some errors found in the data presented in 1981 were corrected in the tables presented here.

RESULTS AND DISCUSSION

Mortalities of sheep and lambs from all causes from 1940 through 1985 for the United States are presented in Table 1. Lamb losses were 9% in 1940 and were generally higher thereafter except for the mid-1950s. The peak of losses were in 1978 at 14%. These losses were from docking time (2 to 4 weeks) in the western states, and from birth in the eastern states, to weaning or marketing, generally at 4 to 6 months of age. In sheep, 1 year old and older, losses were 7.5% in 1940 and generally increased only slightly with obvious increases in losses to predators. In fact, total losses were lower for sheep from 1976 forward than in 1940. This indicates, as other USDA and Forest Service data show, that nonpredator losses definitely decreased during the period studied. Such decreases were likely due to improved management and feeding and disease and parasite control and would occur for lamb mortality also if they were not masked by predator losses. Therefore, the estimates of predator losses were very conservative if not actually an underestimate of real losses.

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Table 1. Percentage of losses of sheep and lambs from all causes from 1940 through 1984 for the United States.

Year	Lamb crop	Lamb losses	Sheep inventory	Sheep losses	Lamb losses minus sheep losses
	--1,000--	-- % --	--1,000--	-- % --	-- % --
1940	32,885	9.0	52,107	7.5	1.5
1941	32,854	9.7	53,920	7.8	1.9
1942	32,604	9.1	56,213	7.2	1.9
1943	31,310	10.7	55,150	7.9	2.8
1944	29,248	10.3	50,782	8.1	2.2
1945	27,042	9.2	46,520	7.4	1.8
1946	24,540	9.3	42,362	7.4	1.9
1947	22,082	9.5	37,498	7.6	1.9
1948	20,012	9.9	34,337	8.5	1.4
1949	18,811	9.9	30,943	9.4	0.5
1950	17,905	9.6	29,826	8.6	1.0
1951	17,978	9.6	30,633	8.1	1.5
1952	18,479	9.4	31,982	7.9	1.5
1953	19,497	9.1	31,900	7.8	1.3
1954	20,340	8.6	31,356	7.5	1.1
1955	20,214	8.9	31,582	7.8	1.1
1956	20,336	9.1	30,157	7.9	1.2
1957	19,810	9.4	30,654	8.1	1.3
1958	20,686	9.3	31,217	7.8	1.5
1959	21,120	9.5	32,606	7.8	1.7
1960	21,012	10.2	33,170	7.4	2.8
1961	20,782	9.9	32,725	7.4	2.5
1962	19,712	10.2	30,969	7.8	2.4
1963	18,516	10.2	29,176	7.8	2.4
1964	16,994	10.6	27,116	8.4	2.2
1965	16,312	10.5	25,127	8.7	1.8
1966	15,881	10.5	24,734	7.8	2.7
1967	15,015	11.0	23,933	8.3	2.7
1968	14,443	10.9	21,223	8.0	2.9
1969	13,723	11.3	21,350	8.6	2.7
1970	13,439	11.0	20,423	8.0	3.0
1971	12,930	11.2	19,686	7.7	3.5
1972	12,537	11.8	18,710	7.6	4.2
1973	11,500	12.5	17,724	8.3	4.2
1974	10,508	13.6	16,394	7.7	5.9
1975	9,857	13.8	14,512	7.8	6.0
1976	8,888	13.6	13,376	7.4	6.2
1977	8,605	13.7	12,766	7.1	6.6
1978	8,020	14.0	12,348	7.4	6.6
1979	7,974	13.7	12,220	7.3	6.4
1980	8,246	12.3	12,687	7.1	5.2
1981	8,825	11.8	12,936	6.4	6.6
1982	8,576	12.5	12,966	6.4	6.1
1983	8,209	11.4	12,026	5.6	5.1
1984	7,788	12.0	11,486	6.9	5.1
1985	7,381	11.4	10,443	5.2	6.2

Losses of sheep and lambs to predators, probably primarily from coyotes, from 1940 through 1985 are presented in Table 2. Losses were lowest in 1940 (2.85%) when toxins were used effectively. Considerably higher losses in the '80s of 5.38% were almost 90% greater than in 1940. This may indicate that losses cannot be reduced to the pre-World War II level without the availability of toxins for judicious use.

Losses increased drastically in 1941 over 1940 and remained quite high until about 1947. Then it appeared that the restricted use of 1080 tended to hold losses fairly steady through the mid-1950s. Then, restrictions on use of 1080 became more severe with an increase in square miles per bait station and losses started to rise until they exceeded 5% in 1972 when the Executive Order effectively banning the use of toxins was issued; losses then further steadily increased to a peak of 6.07% in 1977.

The parvovirus, which increased mortality of canines, struck in 1978 and appeared to kill as many as 40% of coyotes in captivity (Evermann et al. 1980). Predator losses fell immediately and reached a low point of 4.95% in 1980. Since then losses of lambs and sheep to predators have increased to 5.69% in 1985. The apparent lower loss in 1984 may have resulted from the exclusion of Wyoming that year because of severe storms which killed thousands of adult sheep. It is obvious that toxins need to be used to reduce these losses to a lower level, especially in this period of severe farm depression when rural

Table 2. Loss of sheep and lambs to predators for the United States.

Year	Sheep and lambs Killed by Predator	Predator losses as % of inventory plus lamb crop	Value of Predator losses
	-- 1,000 --	-- % --	-- $1,000 --
1940	1,944	2.85	13,470
1941	2,842	3.98	24,220
1942	2,489	3.51	30,760
1943	2,720	3.64	23,113
1944	2,250	3.23	15,559
1945	2,165	3.36	20,403
1946	1,988	3.61	23,748
1947	1,892	3.82	28,035
1948	1,619	3.63	27,113
1949	1,387	3.38	24,437
1950	1,358	3.44	35,821
1951	1,355	3.38	36,291
1952	1,409	3.41	20,849
1953	1,425	3.42	19,020
1954	1,465	3.50	21,540
1955	1,392	3.32	19,633
1956	1,416	3.44	20,774
1957	1,378	3.44	26,613
1958	1,408	3.65	30,613
1959	1,542	3.69	26,091
1960	1,790	4.19	25,835
1961	1,791	4.07	22,242
1962	1,653	4.11	23,969
1963	1,569	4.10	22,974
1964	1,461	4.09	24,255
1965	1,283	3.79	26,914
1966	1,474	4.44	31,306
1967	1,482	4.64	27,142
1968	1,368	4.32	35,705
1969	1,269	4.17	32,411
1970	1,266	3.91	31,911
1971	1,361	4.41	32,255
1972	1,426	5.08	37,647
1973	1,367	4.85	45,648
1974	1,309	4.97	41,922
1975	1,373	5.83	52,346
1976	1,211	5.65	49,565
1977	1,247	6.07	64,367
1978	1,137	5.75	82,688
1979	1,139	5.70	89,865
1980	1,019	4.95	71,934
1981	1,126	5.24	64,970
1982	1,184	5.53	62,051
1983	1,096	5.48	57,952
1984	932	5.37	57,685
1985	1,006	5.69	68,588

income seems to be at a relative all-time low point. Experience before 1940 indicates that toxins can be used against predators without any serious damage to wildlife.

Monetary losses from predators also presented in Table 2 show a steady increase in total loss from $13 million in 1940 to almost $90 million in 1979 and almost $69 million in 1985. The judicious but effective use of 1080 since 1960 could have prevented much of this loss.

An even greater loss to the country was the loss of over 100,000 sheep producers and their families to rural America. Some of the land they used is probably now idle. If this land were grazed by sheep with range and pasture improvements, soil erosion could be reduced. The addition of higher quality food and fiber, now lost to predators, would provide employment and possibly also lower prices to consumers. I have estimated that it may require as long as 50 years for sheep numbers to reach the levels they could have reached if effective predator control had been maintained from 1960 on.

The western states and some of the other states with a total of 22, have taken losses long before 1940. The movement of the coyote population eastward was evident from the years in which significant losses were first noted. These were Illinois and New York in 1968, Louisiana in 1969, Arkansas, South Dakota, and West Virginia in 1970, Kentucky in 1972, Oklahoma in 1973, Indiana in 1974, New Jersey in 1975, Tennessee in 1977, Pennsylvania in 1981, and Maine in 1982. Alaska and Hawaii were not included in the study because of their small numbers of sheep. Predator losses have not been significant in the other 13 states.

In 1985 monetary losses to predators were highest in California with a loss of $10.6 million. Other states taking extremely heavy losses of over $1 million were: Texas, Wyoming, Utah, Colorado, New Mexico, Oregon, Montana, Nevada, Iowa, Arizona, Ohio, Idaho, Missouri, Pennsylvania and South Dakota. States taking heavy losses of over $500,000 were: Illinois, Wisconsin, Virginia, Michigan, North Dakota, Minnesota, and Kansas in order of loss.

The meaning of the losses to the average sheep producer is shown in Table 3 where losses are shown in relation to gross and net income and on a per-ewe basis. Losses as a percent of gross income varied from 3.4 to 6.9 from 1940 to 1964, and in 1965 the losses began to steadily increase from 5.8% in 1965 to 15.6% in 1979. Then with the advent of the parvovirus losses fell back to 10.5% in 1984 and then increased to 12% in 1985.

Estimated net income to sheep producers in some recent years has been about 20% of gross income. Thus, in column 6 of Table 3 the estimated net income per ewe inventoried is given and the predator losses per ewe is given in column 7. In 1940 predator loss per ewe was 23% of net income. In 1950 it was 35% of net income, and in 1960 it was 26%. However, the early result of predator losses was in large operators going out of sheep, resulting in increasing numbers going to market. Thus, in the early years of the decline of sheep numbers gross income declined from $5.00 per ewe in 1958 to $4.23 per ewe in 1961. Then predator losses as a percent of gross income increased from 4.7% in 1961 to 15.6% in 1979. Predator losses as a percent of estimated income increased from 26% in 1960 to 33% in 1970, 52% in 1975, and 78% in 1979, thus, offsetting the increase in gross returns which had stimulated an increase in sheep numbers in 1977 and 1978. Losses from predators per ewe were still 60% of net returns in 1985 which seemed sufficient to bring a further decline in sheep numbers in 1985 to their lowest level, January 1, 1986, since records have been kept.

Table 3. Some economic aspects of predator losses of sheep and lambs.

Year	Gross income from sale of sheep, lambs, and wool	Value of loss from sheep & lambs killed by predators	Predator loss as a % of gross income from sale of sheep, lambs and wool	Gross income per ewe 1 yr. old and older	Estimated net income per ewe 1 yr. old and older	Predator loss per ewe 1 yr. old and older
	-- $1,000 --	--$1,000 --	-- % --	-- $ --	-- $ --	-- $ --
1940	297,113	13,470	4.5	8.32	1.66	0.38
1941	368,003	24,220	6.6	10.10	2.02	0.67
1942	467,438	30,760	6.6	12.51	2.50	0.82
1943	505,345	23,113	4.6	13.55	2.71	.062
1944	453,837	15,559	3.4	13.35	2.67	0.46
1945	451,644	20,403	4.5	14.02	2.80	0.63
1946	485,127	23,748	4.9	17.53	3.51	0.86
1947	514,394	28,035	5.5	20.30	4.06	1.11
1948	532,759	27,113	5.1	23.15	4.63	1.18
1949	466,331	24,437	5.2	22.23	4.45	1.16
1950	518,113	35,821	6.9	25.83	5.17	1.79
1951	690,311	36,291	5.3	33.74	6.75	1.77
1952	520,716	20,849	4.0	24.81	4.96	0.99
1953	446,774	19,020	4.3	20.55	4.11	0.87
1954	453,879	21,540	4.7	21.18	4.24	1.01
1955	479,517	19,633	4.1	22.49	4.50	0.92
1956	490,806	20,774	4.2	23.02	4.60	0.97
1957	474,927	26,613	5.6	22.64	4.53	1.27
1958	534,850	30,613	5.7	25.22	5.04	1.44
1959	504,502	26,091	5.2	23.11	4.62	1.20
1960	499,646	25,835	5.1	22.30	4.46	1.15
1961	469,481	22,242	4.7	21.15	4.23	1.00
1962	480,242	23,969	5.0	22.60	4.52	1.13
1963	458,256	22,874	5.0	22.88	4.58	1.14
1964	459,574	24,255	5.3	24.55	4.91	1.30
1965	461,673	26,914	5.8	26.38	5.28	1.54
1966	465,653	31,306	6.7	27.64	5.53	1.86
1967	438,735	27,142	6.2	27.03	5.41	1.67
1968	446,006	35,705	8.0	30.88	6.18	2.34
1969	469,172	32,411	6.9	34.19	6.84	2.20
1970	461,119	31,911	6.9	34.31	6.86	2.29
1971	458,634	32,255	7.0	35.47	7.09	2.37
1972	480,915	37,647	7.8	38.36	7.67	2.92
1973	515,973	45,648	8.8	44.87	8.97	3.79
1974	467,208	41,922	9.0	44.46	8.89	3.77
1975	487,988	52,346	10.7	49.51	9.90	5.19
1976	480,864	49,565	10.3	54.10	10.82	5.58
1977	505,055	64,367	12.7	58.69	11.74	7.24
1978	583,877	82,688	14.2	72.81	14.56	9.68
1979	576,417	89,865	15.6	68.90	13.78	10.74
1980	572,530	71,934	12.6	67.16	13.43	8.43
1981	531,754	64,970	12.2	60.62	12.12	7.41
1982	532,829	52,051	11.6	60.63	12.13	7.06
1983	499,934	57,952	11.6	60.47	12.09	7.01
1984	550,438	57,685	10.5	69.91	13.98	7.33
1985	571,265	68,588	12.0	72.55	14.51	8.71

The increase in lambs and ewes marketed in the early 1960s tended to keep prices down for the entire country. Then as numbers declined plants slaughtering lambs decreased, thus reducing the competition for purchasing lambs, and again prices declined for the entire country and not just in the areas where predator losses were heavy. This explains why predator losses affected the entire sheep industry, and not just the areas where predator losses were highest.

Like all farm prices, lamb prices were depressed by the embargo on grain to the USSR beginning about 1980 as shown by reductions in gross income per ewe from 1981 to 1983, even though inflation was still substantial and even though retail lamb prices were increasing. Now with some recovery of prices in 1984 and 1985, the average sheep producer is still having his salary or net returns for family labor and management reduced by almost 40% from predator losses.

Obviously, predator losses have been a dominant factor in the decline of the sheep industry. Now that expansion of the sheep industry, without replacing any other crop, without creating or increasing any surplus of food, and with minor federal support, is more likely than for any other farm enterprise, it is hoped that predator losses can be reduced and prevented to help bring much needed funds into rural America.

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