2017 National Elk Refuge Supplemental Feed Season and Winter Mortality Summary

Technical Report · May 2017
DOI: 10.13140/RG.2.2.36097.86881

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2017 National Elk Refuge Supplemental Feed Season and Winter Mortality Summary

Eric Cole, National Elk Refuge biologist

22 May 2017

Summary

Feed Season Length

Supplemental feeding started on 7 January 2017, 20 days earlier than average due to dense, deep snow conditions at low elevations which limited elk access to forage. Supplemental feeding ended for the season on 23 March 2017, 10 days earlier than average. An early end date was the result of major melting events in mid-February and mid-March, which led to the south end of the Refuge and lower elevation areas on the Bridger Teton National Forest being completely snow free by 16 March 2017. The net effect was a total feed season length of 76 days, which was 10 days longer than average and the longest feed season since 2011. The decision of when to initiate and end supplemental feeding each season are made jointly by NER and Wyoming Game and Fish Department (WGFD).

Winter Elk Numbers

Elk numbers observed on the south end of NER increased from approximately 6,000 elk in mid-December to 7,000 elk in early January, and peaked at approximately 9,000 elk by early February. The average number of elk on feed (8,767) and the number of elk counted on NER feedgrounds during the annual classification count (8,879) were both the highest since 1997. Eighty-three percent of the total elk counted in the Jackson elk herd were on NER feedgrounds, and this was the highest percentage ever observed.

Winter Bison Numbers

The average number of bison on feed (400) and the number of bison classified on feed during the annual count (504) were the lowest since 2001. This reduction in bison numbers was the result of annual bison hunting seasons that began on NER in 2007, and the Jackson Bison Herd is now at the 500 population objective.

Amount Fed

Total tons of alfalfa pellets fed to elk and bison (3,113 tons), total tons fed to elk (2,809 tons), and the average amount fed per elk per day (8.4 lbs.) were all well above average and the highest since 2011.

Winter Mortality

Since 1982, NER staff has used consistent search methods to attempt to document all elk winter mortalities on the Refuge (non-hunt related mortality from November through April that occurs on the entire 24,000 acre refuge area). Despite an early start to the feed season and feeding a heavy ration, winter elk mortality documented on NER was well above average. We documented 312 total elk mortalities (3.5% of the classified total), which was the highest since 1984. We documented 210 elk calf mortalities (19.6% of the estimated number of calves on feed), which was the highest since comparable measurements began in 1982. Although these total and calf mortality winter mortality

rates are high compared to the past 35 years on NER, they are still very low compared to historic records from the early decades of NER, compared to other wintering elk populations in the Greater Yellowstone Ecosystem, and compared to mortality rates for other ungulate species in western Wyoming observed during the winter of 2017. For example, historic records suggest that as many as 991 total elk (10% total mortality) and 813 calves (percent of calves unknown because elk were not classified that year) died on NER in 1943. Research by Singer et al. (1997) suggested that winter elk calf mortality rates in Yellowstone National Park averaged 34% from 1969 to 1992, and were as high as 83% during the severe winter of 1989. Wyoming Game and Fish Department biologists estimated that mule deer fawn mortality was 86% in the Wyoming Range Deer Herd and 81% in the Sublette Mule Deer Herd during the winter of 2017. These were the highest winter fawn losses since the 1980s in these deer herds. Similarly, NER staff documented higher than typical winter mortality for other ungulates that wintered on the Refuge in 2017 (24% total mortality for pronghorn and 5% total mortality for bighorn sheep).

NER staff attempts to document factors associated with cause of death for each dead elk, but scavengers quickly consume most elk carcasses, and we were only able to identify factors in 25% of the elk that died in 2017. In general many bull elk mortalities had symptoms consistent with scabies (33 of 56 bulls), only 12 elk mortalities had confirmed wolf predation, and foot rot was relatively minor compared to previous years (33 cases in 2017). We attribute higher than typical mortality on NER in 2017 to severe winter conditions and a large number of elk arriving on NER 3 to 4 weeks after feeding initiation. Due to late elk arrival on NER, a higher than typical subset of elk likely arrived in poor condition and too late to benefit nutritionally from supplemental feeding. In addition, many elk that typically winter elsewhere came to the Refuge this year, and therefore these elk had no knowledge of NER feeding operations and subsequently took longer to find and utilize Refuge feedlines. This convergence of factors (winter severity, late elk arrival to NER, and delayed participation by some elk in the NER feed program) led to higher than average elk mortality rates this winter on NER.

Feed Season Details

Supplemental feeding operations for elk and bison began on 7 January 2017, two and a half weeks earlier than the 10-year average start date of 24 January. Although feeding was initiated much earlier than the average date, there is considerable annual variability in feeding start date (10-year range of feeding start dates January 5 to February 12). There are 4 factors that potentially influence the feeding start date: 1). The amount of forage produced in the previous growing season; 2). Snow conditions; 3). The number of elk and bison occupying the refuge during the fall and early winter; and 4). Elk and bison movements from NER to surrounding private lands. Although 2016 forage production declined from 2015 levels, refuge-wide herbaceous forage production in 2016 was still near the long-term average (Figure 1). Because 2016 forage production was near average levels, it had little influence on the supplemental feeding start date. An earlier than average feeding start date this year was associated with above average snow depth (Figure 2), dense snow conditions associated with a rain/freeze event in mid-December, higher than average elk numbers on NER during the late December to early January time period (Figure 3), and some small groups of elk leaving the Refuge for private land in Spring Gulch in late December and early January.

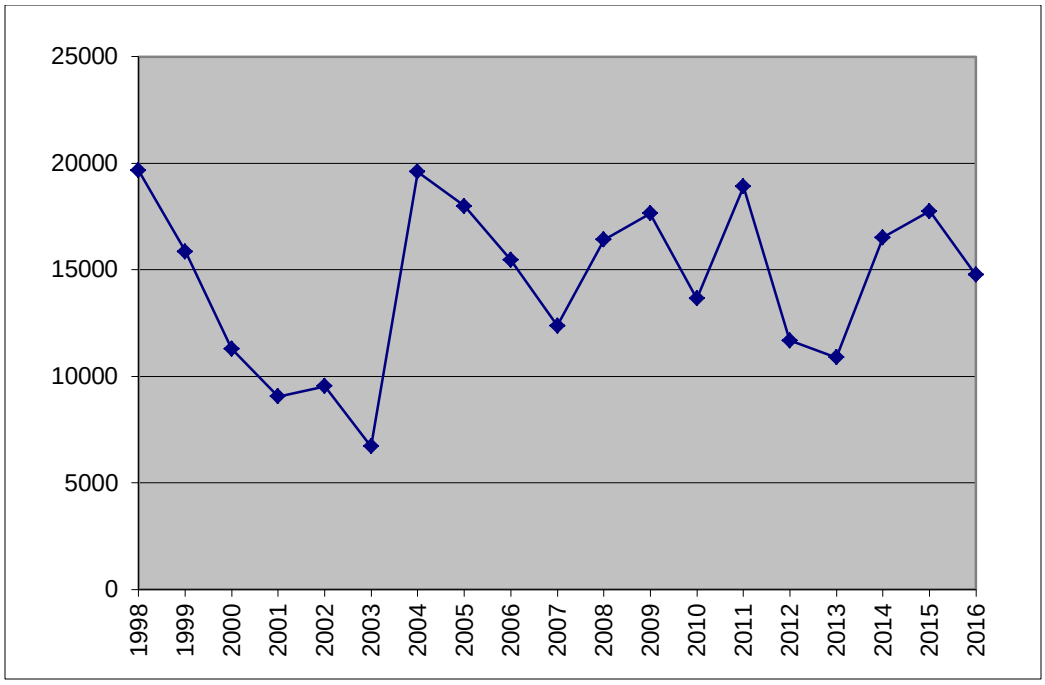

Figure 1. Total herbaceous forage production (tons) on the National Elk Refuge, 1998-2016.

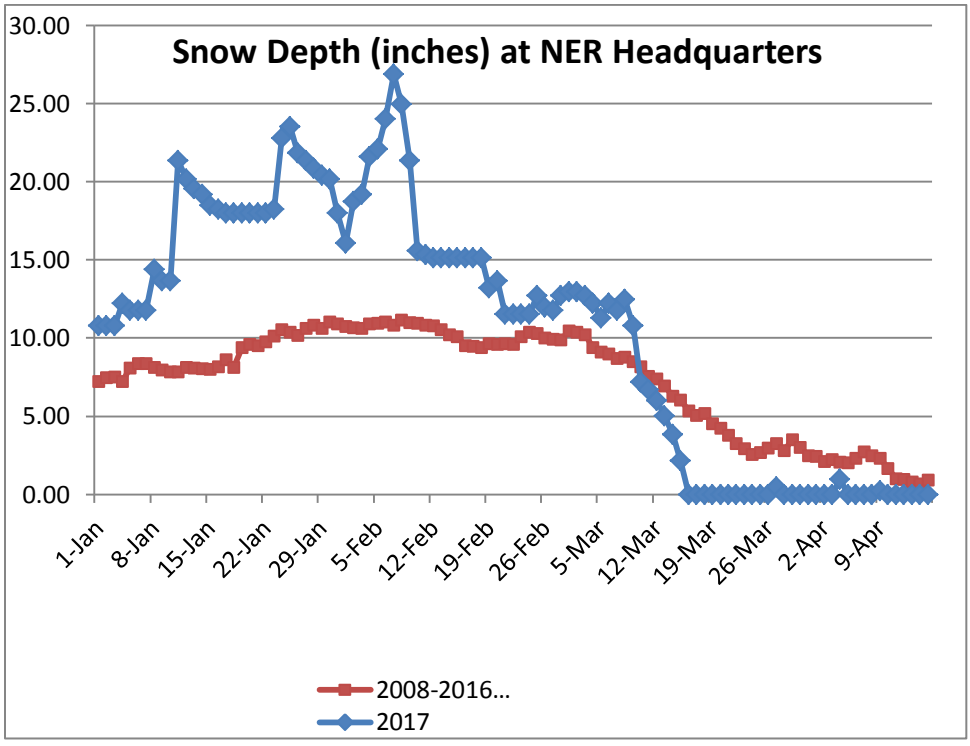

Figure 2. 2017 Daily snow pack depth (inches) in blue and 2008-2016 mean daily snow pack depth in red at the National Elk Refuge headquarters.

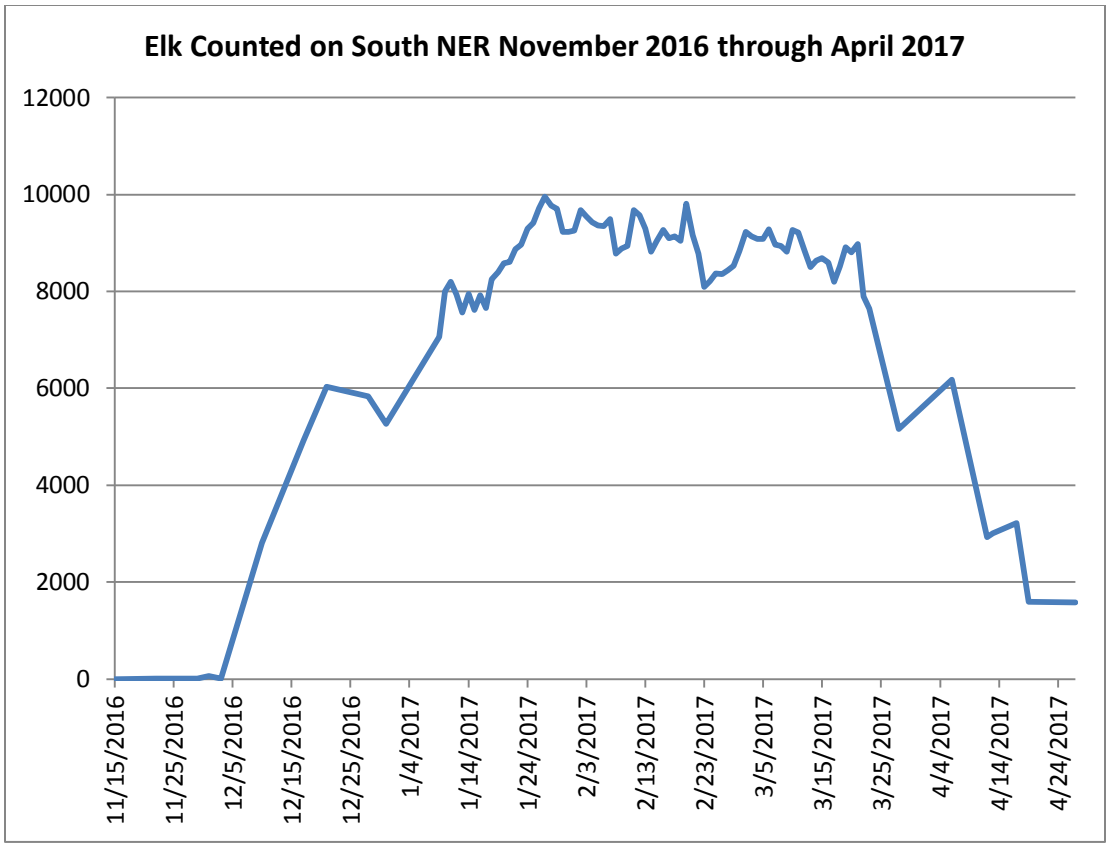

Figure 3. The number of elk counted on the south half of National Elk Refuge via weekly ground counts and a 3-day moving average of daily feedground estimates November 2016-April 2017.

2017 Feeding Initiation

WGFD biologist Aly Courtemanch and NER biologist, Eric Cole cooperatively monitor snow and forage conditions to determine when supplemental feeding is necessary. The recommendation to begin supplemental feeding is based on criteria that are mutually agreed upon between the Refuge and Wyoming Game and Fish Department. These criteria state that when average available forage declines to 300 lbs per acre at key index sites, supplemental feeding is typically warranted, but feeding start date can also be influenced by elk behavior or other factors. This season we monitored conditions on 24 and 28 December 2016, and 2 and 4 January 2017. Average available forage declined from 775 lbs. per acre on the first visit to 465 lbs per acre on January 4. Given the rate of decline in available forage and movements of some small groups of elk from the refuge to the Spring Gulch area, we recommended that supplemental feeding begin on 7 January 2017. NER and WGFD managers agreed with this recommendation.

Feeding Termination

Despite the early feeding initiation date and dense snow pack on NER that was well above the long term average depth from late December to mid-March, the overall length of the feed season was 76 days, which was only 10 days longer than average (Figure 4). As part of a strategy to minimize disease

transmission, NER and WGFD recommend ending feeding in the spring as soon as sufficient natural forage becomes available. Feeding ended for the season on 23 March 2017 (10 days earlier than average, Figure 5). The early end date was attributed to 2 major melting events in mid-February and mid-March, which resulted in most of the south end of NER and surrounding areas being snow-free by 16 March 2017 (Figures 6 and 7).

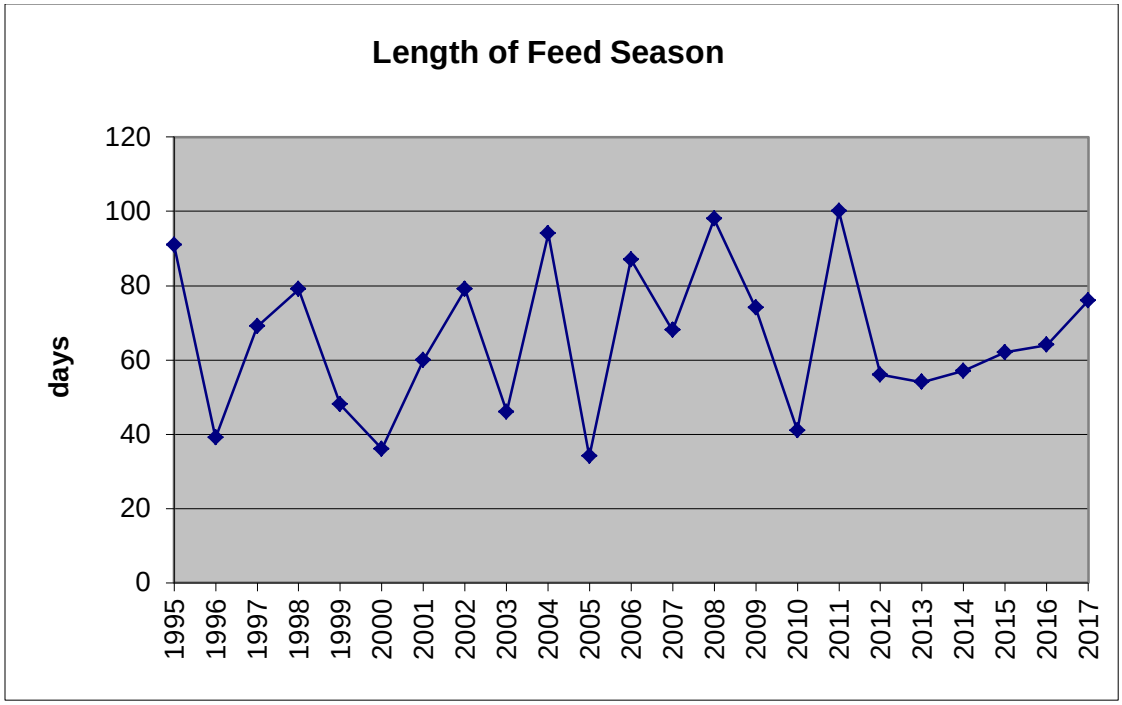

Figure 4. Feed season length (days) on the National Elk Refuge, 1995-2017.

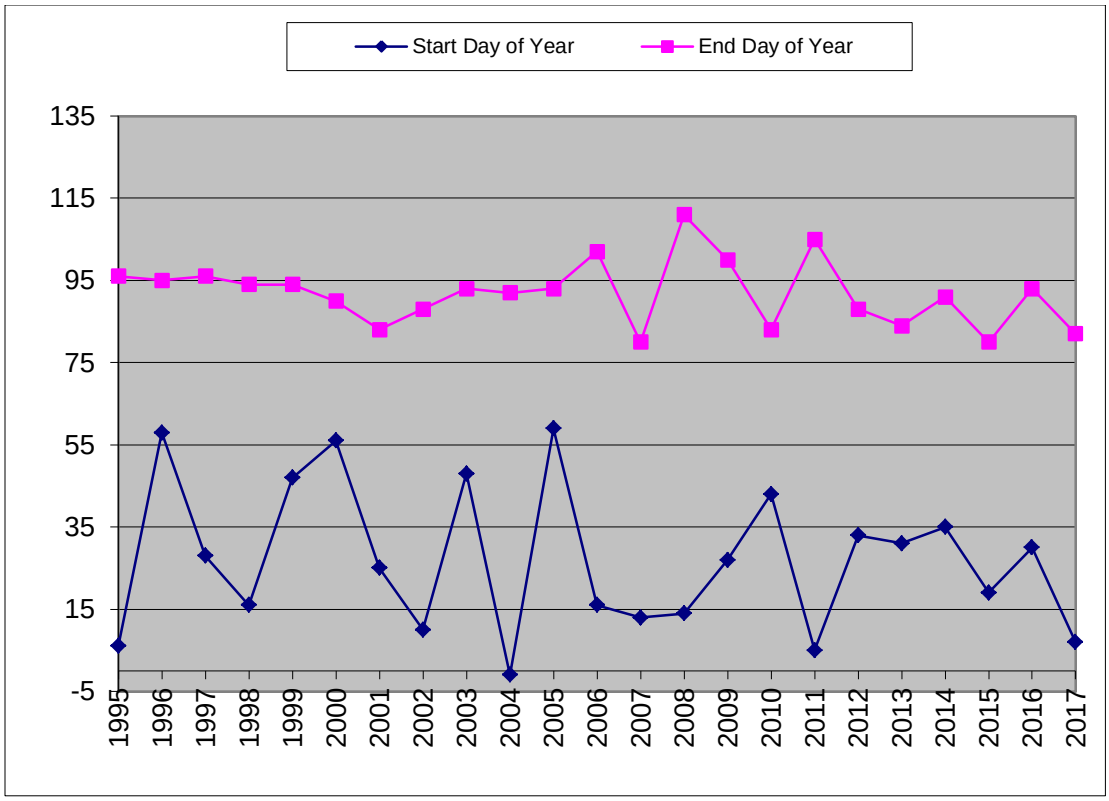

Figure 5 Start day and end day of the National Elk Refuge feed season expressed as day of the year relative to New Year's day, 1995-2017.

Figure 6. Sleeping Indian webcam image from East Gros Vente Butte showing Forest Service slopes east of NER and Poverty Flats portion of NER, 26 March 2017.

Figure 7. Spring Creek Ranch Webcam image showing Spring Gulch and lower Gros Vente River bottom, 26 March 2017.

Elk and Bison Numbers and Amount Fed

In cooperation with the WGFD we count and classify elk on NER in February each year. Elk classification count results for the entire Jackson elk herd including NER-specific data are presented in Figure 8. We counted 8,879 elk on NER feedgrounds, representing 83% of the elk counted in the entire Jackson elk herd. This was the highest percentage of the Jackson elk herd on NER feedgrounds ever documented, a trend that has been increasing since 2000 (Figure 9).

Hunt Area	Cow	Calf	Mbull	Spike	Unclass	Total			
70	0	0	0	1	0	1			
75	5	2	2	1	0	10			
77 on feed	5199	974	1517	369	820	8879			
77 on native range	16	15	13	6	0	50			
78	1	0	1	1	25	28			
79	2	1	27	1	0	31			
80	46	23	114	29	0	212			
81 - BV emergency feed	176	64	10	7	0	257			
81- Spread Creek native winter	1	0	4	0	0	5			
81 - Gros Ventre native winter	34	16	66	5	0	121			
82	97	23	3	5	0	128			
83	0	0	23	1	0	24			
GV on feed	749	137	38	46	0	970			
GTNP outside hunt areas	33	2	11	4	0	50	Calf:Cow	Mbull:Cow	Spike:Cow
Herd Unit Total	**6359**	**1257**	**1829**	**476**	**845**	**10766**	**19.8**	**28.8**	**7.5**
Management Area	**Cow**	**Calf**	**Mbull**	**Spike**	**Unclass**	**Total**	**Calf:Cow**	**Mbull:Cow**	**Spike:Cow**
NER on feed	5199	974	1517	369	820	8879	18.7	29.2	7.1
NER native range	16	15	13	6	0	50	93.8	81.3	37.5
80	46	23	114	29	0	212	50.0	247.8	63.0
Buffalo Valley/Spread Creek	179	65	42	9	0	295	36.3	23.5	5.0
Upper Gros Ventre	821	161	115	54	0	1151	19.6	14.0	6.6
Lower Gros Ventre	59	15	15	3	0	92	25.4	25.4	5.1
78	1	0	1	1	25	28			
75 and southern GTNP	38	4	12	5	0	59	10.5	31.6	13.2
Herd Unit Total	**6359**	**1257**	**1829**	**476**	**845**	**10766**	**19.8**	**28.8**	**7.5**
On Feed	6124	1175	1565	422	820	10106	**% off feed**		
On Native Range	235	82	264	54	25	660	6.1		
Total	6359	1257	1829	476	845	10766			
Management Area	**Cow**	**Calf**	**Mbull**	**Spike**	**Unclass**	**Total**			
NER on Feed	5199	974	1517	369	70	8129			
Gros Ventre	880	176	130	57	0	1243			
Other Winter Ranges	280	107	182	50	775	1394			
	6359	**1257**	**1829**	**476**	**845**	**10766**			
Area	**Cow**	**Calf**	**Mbull**	**Spike**	**Unclass**	**Total**	**Calf:Cow**	**Mbull:Cow**	**Spike:Cow**
NER on feed	5199	974	1517	369	820	8879	18.7	29.2	7.1
Gros Ventre on feed	749	137	38	46	0	970	18.3	5.1	6.1
NWR - Gros Ventre	131	39	92	11	0	273	29.8	70.2	8.4
NWR - NER vicinity	62	40	126	35	0	263	64.5	203.2	56.5
Buffalo Valley/Spread Creek	179	65	42	9	0	295	36.3	23.5	5.0
NWR - Other	39	2	14	6	25	86	5.1	35.9	15.4
	6359	**1257**	**1829**	**476**	**845**	**10766**	**19.8**	**28.8**	**7.5**

Figure 8. Elk classification count data for the Jackson elk herd, February 2017.

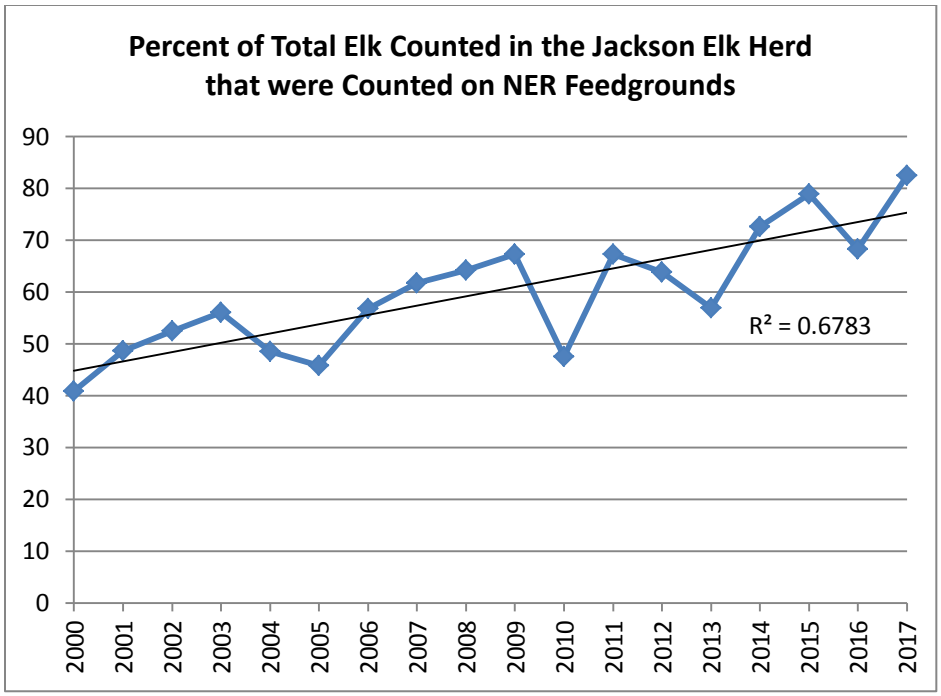

Figure 9. The percent of the total elk counted in the Jackson elk herd that were counted on NER feedgrounds during annual classification counts, with associated trend line, 2000-2017.

Consistent with classification count results, the average number of elk on feed each day (8,767) was the highest since 1997 (Figure 10). In contrast, the average number of bison on feed each day was only 400, the lowest number since 2001 (Figure 11). However, high numbers of elk and the longer than average feed season led to 3,110 total tons of alfalfa pellets being fed, the highest amount since 2011 (Figure 12).

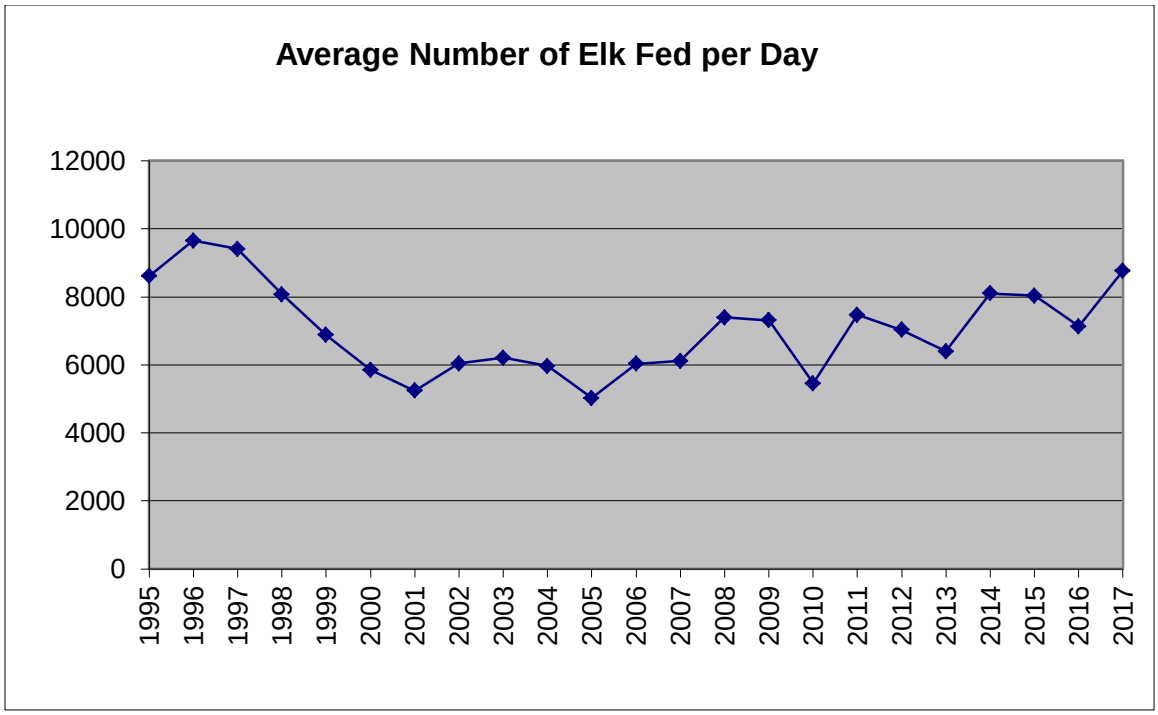

Figure 10. Average number of elk fed per day derived from daily feedground estimates on the National Elk Refuge, 1995-2017.

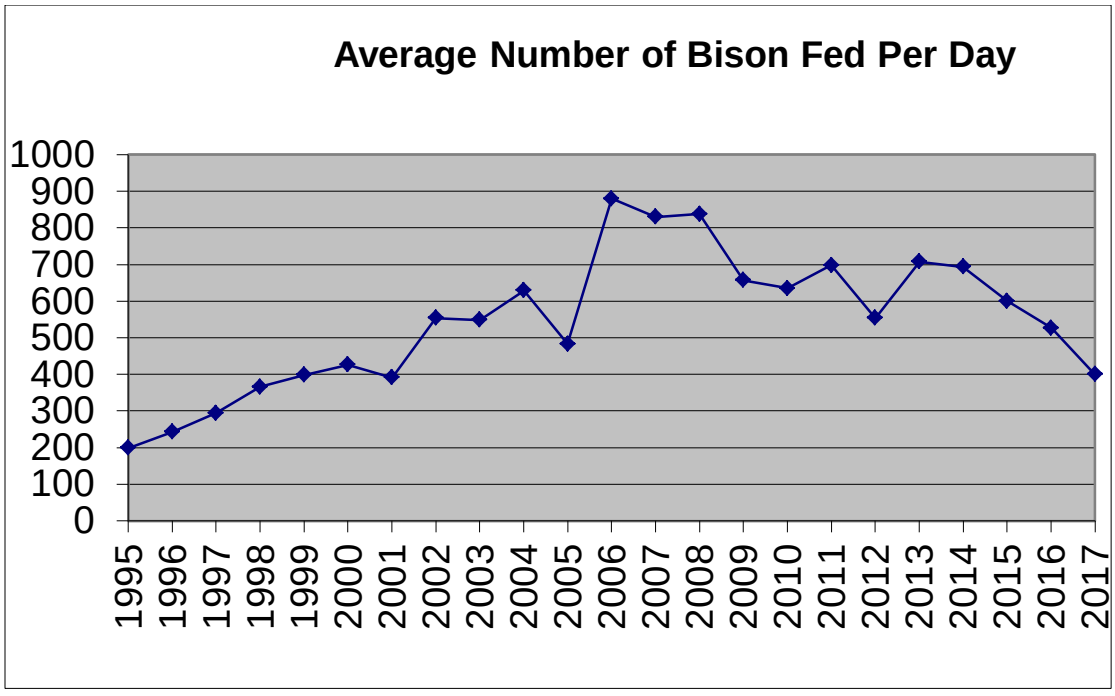

Figure 11. Average number of bison fed per day derived from daily feedground estimates on the National Elk Refuge, 1995-2017.

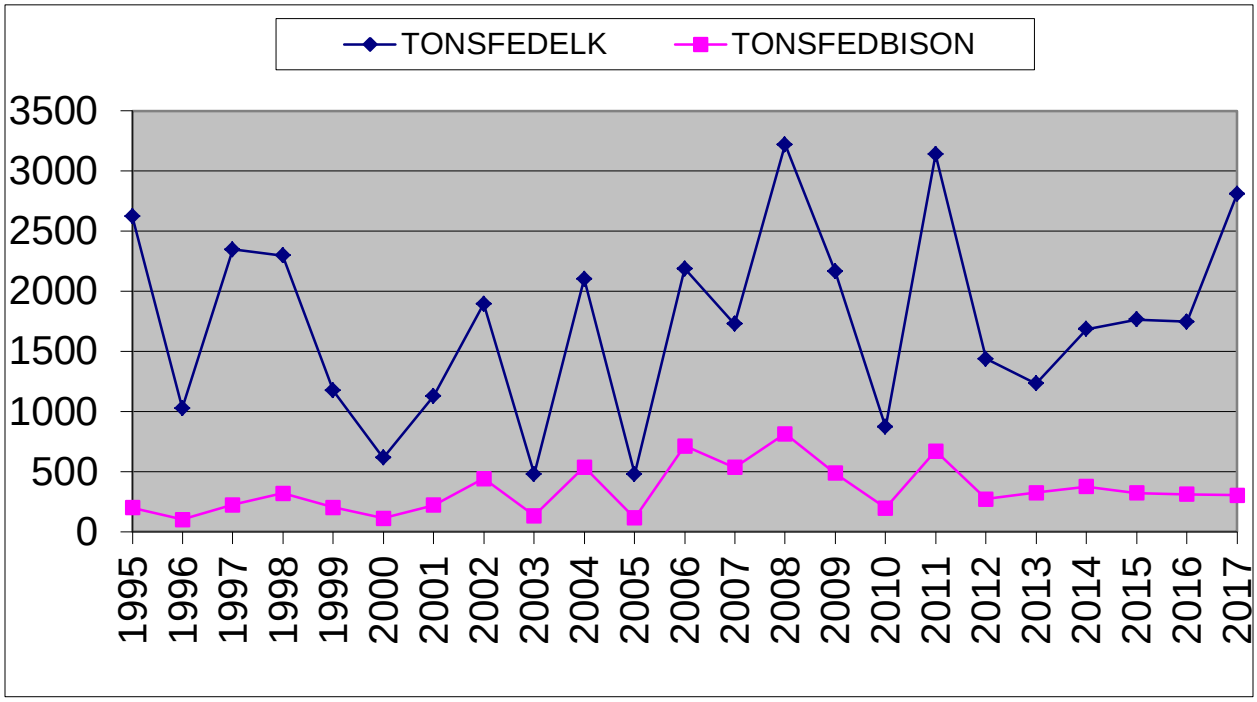

Figure 12. Total tons of alfalfa pellets fed to elk (blue) and bison (pink) on the National Elk Refuge, 1995-2017.

Typical daily alfalfa pellet rations are 8 lbs. per elk per day, but to ensure that elk calves are not precluded from feed by older, more dominant elk, the daily rate is often higher than 8 lbs. per elk per day in the middle of the feed season. To enable rumen acclimation between natural forage and alfalfa pellets, the feed rate is gradually increased over a period of about a week at the start of the feed season and gradually reduced at the end of the season. During these transition periods at the beginning and end of the feed season, the daily ration is less than 8 lbs. per elk per day, and therefore the average daily ration for a given year is strongly correlated with feed season length. The average amount fed per elk per day tends to be higher in longer feed seasons such as 2017. The average amount fed per elk per day in 2017 was 8.4 lbs., the highest average rate since 2008 (Figure 13).

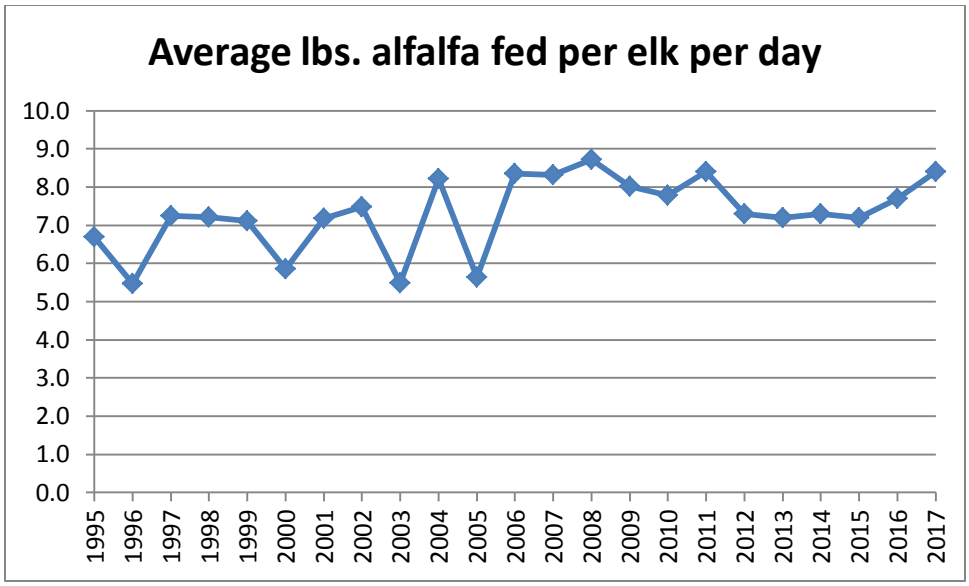

Figure 13. Average amount of alfalfa pellets fed to elk (lbs. per day) on the National Elk Refuge, 1995-2017.

Feedground Use and Associated Elk Density

There are 4 feedgrounds on NER: Headquarters, Nowlin, Poverty Flats, and McBride (Figure 14). Elk are fed at each feedground, and most bison are fed at McBride. Each day elk are fed on as large an area as possible, but in an area which still allows elk to effectively find the feed and consume it (typically 100-150 acres per day across all feedgrounds). We attempt to feed elk and bison on clean ground whenever possible, which entails moving the area where elk and bison are fed on each feedground each day. There is a general spatial progression over time where the lowest elevation areas of each feedground are fed at the beginning of the feed season, and the highest elevation areas are fed at the end of the season. Potential feedground area is approximately 5,000 acres, but the full 5,000 acres are seldom used except in the longest feeding seasons. GPS track-log data are used to map where feeding occurs each day. In 2017 total feedground area was 3,040 acres (Figure 14). The north end of Poverty Flats feedground and western portions of the McBride feedground were not used in 2017 because feeding ended earlier than expected.

Based on total feedground area and 8,766 average elk on feed, the associated elk density was 1,558 per square mile. This density is approximately 5 times higher than reported by Monello et al. (2014) in Rocky Mountain National Park where CWD prevalence was 13%. Maintaining such high elk densities on NER is a concern; because most research suggests that higher CWD prevalence is associated with dense cervid aggregations, and modeling suggests significant negative effects on elk population growth rate over time should CWD become established in the Jackson elk herd (Galloway et al. 2017). Furthermore, research on the spatial spread of another disease, brucellosis, suggests that the elk feedgrounds of western Wyoming have the potential to amplify the prevalence and spread ungulate diseases via elk migration throughout the Greater Yellowstone Ecosystem (Kamath et al. 2016).

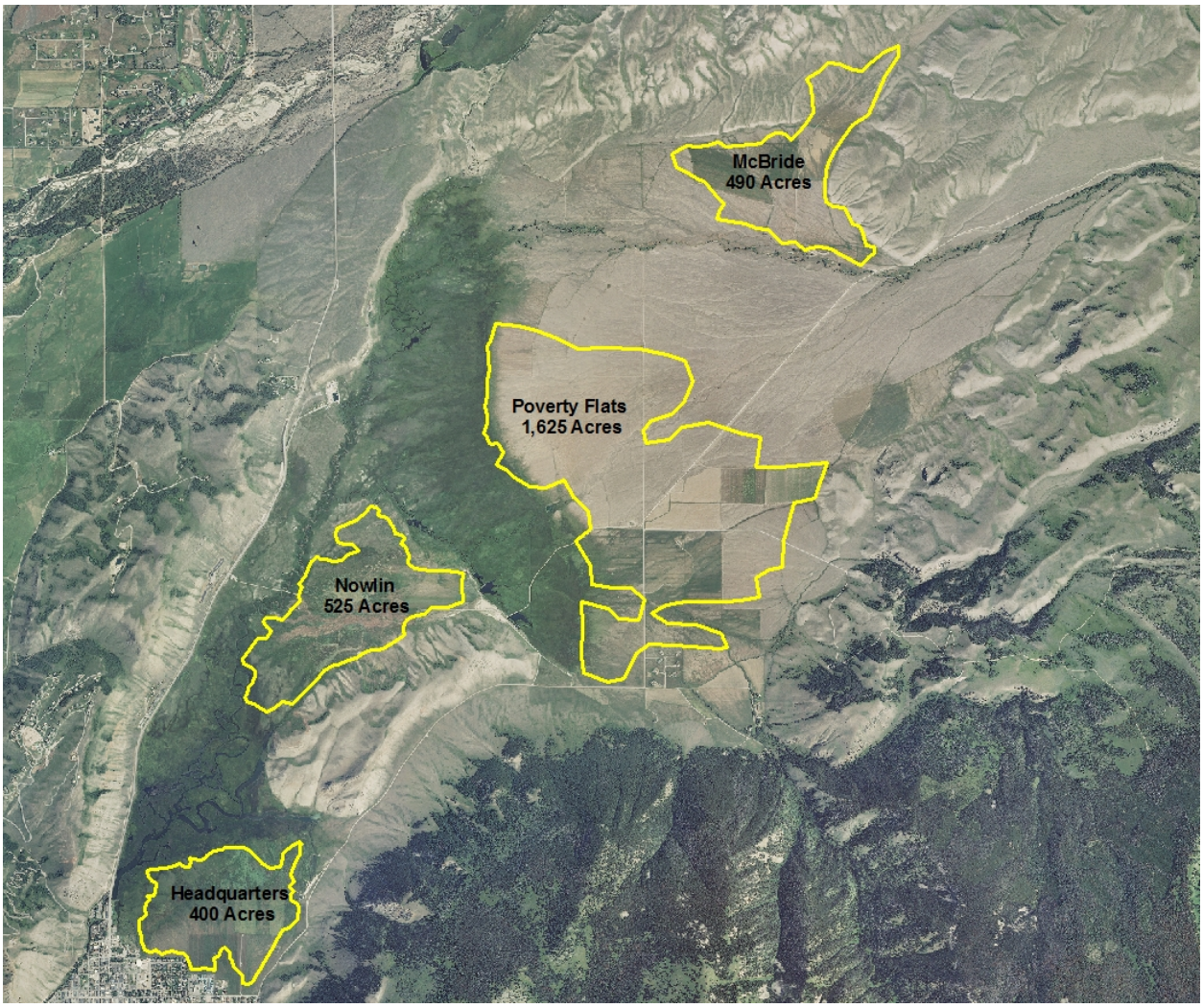

Figure 14. Feedgrounds on the National Elk Refuge. The area where elk were fed in 2017 based on GPS track-log data is shown in yellow.

Ungulate Winter Mortality

Since 1982, NER has used consistent survey methods to census winter elk mortality (non-hunt related mortality from November through April that occurs on the entire 24,000 acre refuge area). In recent years, the Refuge has increased survey effort by assigning a full time technician to document elk winter mortality as well as mortality in all other ungulate species that winter on NER. The severity of the 2016-2017 winter appears to have led to higher than typical mortality rates among most ungulate species on NER (Table 1).

Table 1. Estimated ungulate winter mortality from non-hunt related causes documented on the National Elk Refuge from November, 2016 through April, 2017.			
Species/Class Description	Number Documented	Percent Mortality	Comments
Elk (Total)	312	3.5%	Based on 8,879 elk counted on feed 2/28/2017
Elk (Mature Bull)	56	3.4%	Based on 1,671 estimated[a] on feed
Elk (Spike Bull)	5	1.2%	Based on 407 estimated[a] on feed
Elk (Calves)	210	19.6%	Based on 1,073 estimated[a] on feed
Elk (Cows)	41	0.7%	Based on 5,728 estimated[a] on feed
Pronghorn (Total)	7	24.1%	Based on 29 pronghorn counted on NER on 12/31/2016
Bighorn Sheep (Total)	4	4.9%	Based on 81 bighorn counted on NER on 12/3/2016
Bison(Total)	2	0.4%	Based on 504 counted on feed
[a]Elk class numbers estimated by applying class percentages derived from the 21 February 2017 NER classification count to 820 unclassified elk, then adding these to the elk classified on 2/21/2017.			

Total winter elk mortality in 2017 (312 total elk, 3.5% of the total number of elk on feed) was the highest since 1984. Winter elk calf mortality (210 calves, 19.6% of estimated calves on feed) was the highest since comparable measurement began in 1982 (Figure 15). Although these total and calf mortality winter mortality rates are high compared to the past 35 years on NER, they are still very low compared to historic records from the early decades of NER, when compared to other wintering elk populations in the GYE, and when compared to mortality rates for other ungulates in western Wyoming observed during the winter of 2017. For example historic records suggest that as many as 991 total elk (10% total elk mortality) and 813 calves (percent of calves unknown because calves were not classified) died on NER in 1943. Research by Singer et al. (1997) suggested that winter elk calf mortality rates in Yellowstone National Park averaged 34% from 1969 to 1992, and were as high as 83% during the severe winter of 1989. Wyoming Game and Fish Department biologists estimated that mule deer fawn mortality was 86% in the Wyoming Range Deer Herd and 81% in the Sublette Mule Deer Herd during the winter of 2017. These are the highest winter fawn losses since at least the mid-1980s in these herds. Similarly, NER staff documented higher than typical winter mortality for other ungulates that wintered on the Refuge in 2017 (24% total mortality for pronghorn and 5% total mortality for bighorn sheep).

Like all ungulates experiencing their first winter, elk calves are more vulnerable to winter starvation than other segments of the population because they have lower fat reserves. Additionally, participation in the supplemental feeding program is a learned behavior, and elk calves have no knowledge of supplemental feeding operations. For example Smith (1994) found that the likelihood of radio marked elk participating in the NER feed program increased as an elk increased in age. Although feeding operations began on 7 January 2017 (2.5 weeks earlier than average), peak elk numbers on NER did not occur until early February (Figure 3). This late arrival of approximately 1,500 elk possibly resulted in a

higher than typical number of elk calves arriving in poor condition, participating in the feed program late, and succumbing to starvation despite receiving higher than average daily rations. The unprecedented high percentage of the total Jackson elk herd wintering on NER (83%) likely exacerbated the potential for elk with no knowledge of NER feeding operations to succumb to starvation despite their eventual proximity to supplemental feeding operations on the Refuge.

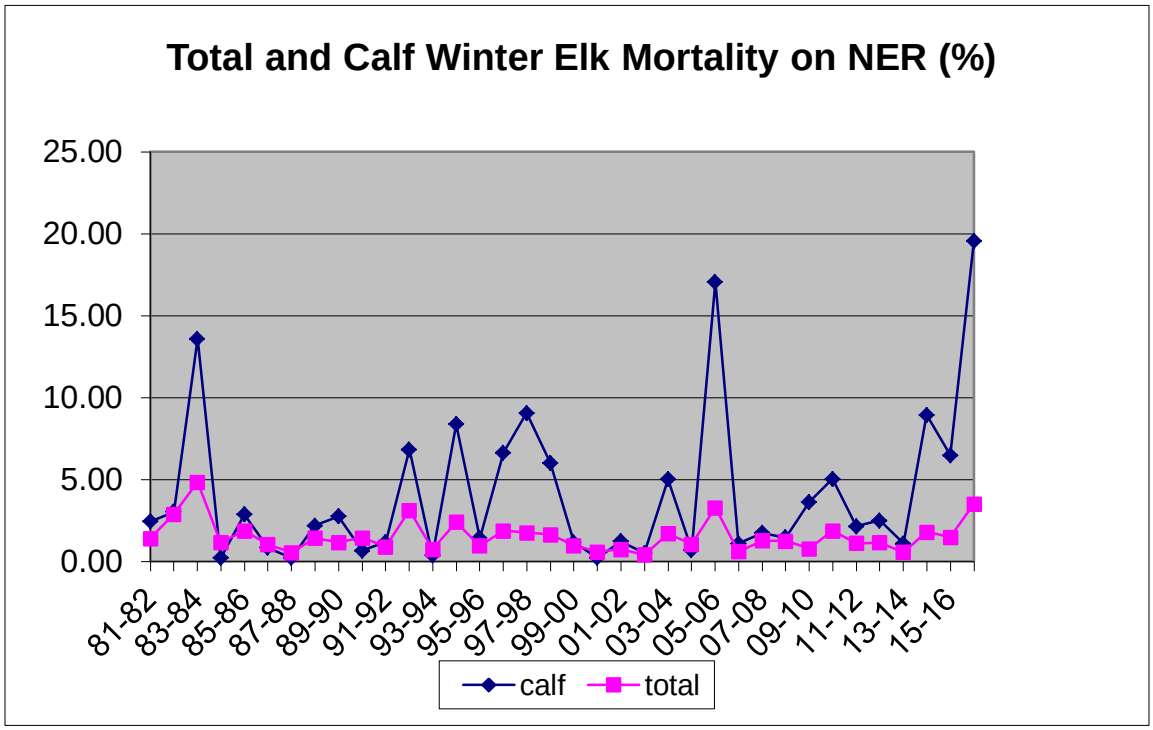

Figure 15. Total winter elk mortality (% of total elk classified on feed) and elk calf winter mortality (% of calves classified on feed) by year on the National Elk Refuge, 1982-2017.

Factors Associated with Winter Elk Mortality

We attempt to document factors associated with cause of death for each dead elk, but scavengers quickly consume most elk carcasses, and we were only able to identify factors in 25% of the elk that died in 2017 (Table 2). In general many bull elk mortalities had symptoms consistent with scabies (33 of 56 bulls), only 12 elk mortalities had confirmed wolf predation, and foot rot was relatively minor (33 cases) compared to previous years. We attribute higher than typical mortality on NER in 2017 to severe winter conditions and large numbers of elk arriving on NER 3 to 4 weeks after feeding initiation. Due to their late arrival on NER, a higher than typical subset of elk arrived in poor condition and too late to benefit nutritionally from the feed program. In addition, many elk that typically winter elsewhere came to the Refuge this year, and therefore these elk had no knowledge of NER feeding operations and subsequently took longer to find and utilize Refuge feedlines. This convergence of factors likely led to higher than average elk mortality rates this winter on NER.

Table 2. The number of winter elk mortalities on NER associated with different factors, November 2016, through April 2017.							
	Wolf-Related Only	Foot rot Only	Both Wolf-Related and Foot rot	Scabies Only	Both Wolf-related and Scabies	Joint Problem (not including Foot rot)	No Cause Determined
Number elk	10	32	1	32	1	2	234
Percent of total winter elk mortalities	3.2%	10.3%	0.3%	10.3%	0.3%	0.6	75%
Percent of the total number of elk on feed	0.11%	0.36%	0.01%	0.36%	0.01%	0.02%	2.63%

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