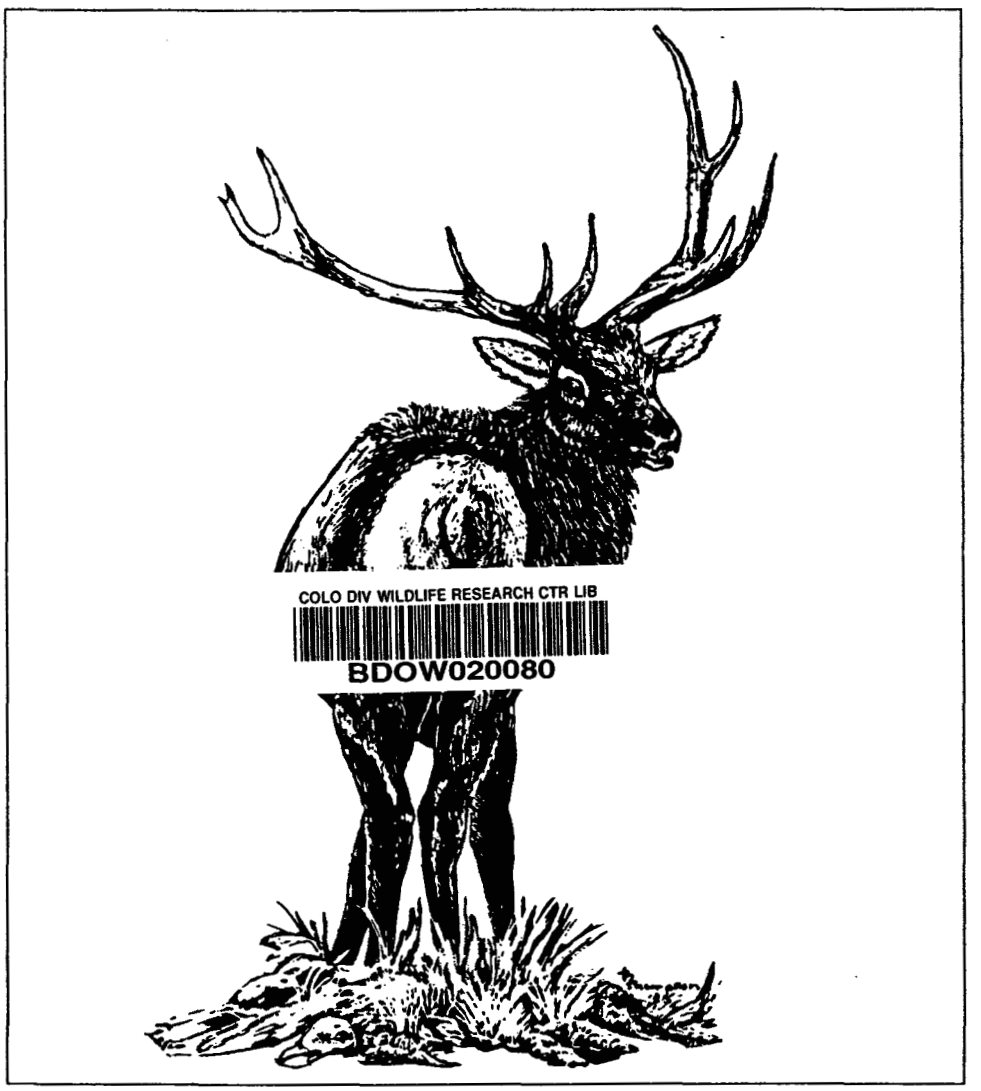
Washington Department of Wildlife
Wildlife Managment Division

Western States and Provinces

1988 ELK WORKSHOP PROCEEDINGS



July 13-15, 1988
Wenatchee, WA

PROCEEDINGS OF THE

1988 WESTERN STATES AND PROVINCES

ELK WORKSHOP

JULY 13 - 15, 1988

Wenatchee, Washington

Workshop Chairmen -	Jack Smith and Rolf Johnson
Program Chairman -	John Pierce
Registration -	Bob Perleberg
Field Trip	John Musser, Edd Bracken, and Ken Kilgore
Editors -	Max Zahn, John Pierce, and Rolf Johnson
Host -	Washington Department of Wildlife

The Rocky Mountain Elk Foundation
contributed to the printing costs of these proceedings.

Limited Copies Available From:
Washington Department of Wildlife
600 Capitol Way N.
Olympia, WA 98501-1091

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BE MERCIFULLY CLEAR

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Abstract

This talk is about words. To do anything useful for elk we must first do something with words. Without words we can neither learn nor teach about elk, cannot convince other people to give money for the conservation of elk. What we say and write determine, more than anything else, the future of elk.

Wildlife Report Writing

John Ruskin said, "The greatest thing a human soul ever does in this world is to see something and tell what it saw in a plain way." Processing what you see and presenting a clear picture of it to someone else is not only useful, but hard. Some people who know a great deal contribute little because they don't know how to tell what they saw in a plain way. Roughly 20 percent of all business and government correspondence is written to explain other correspondence.

Clarity seems such an elementary thing nobody practices it. Most of us here can run if need be. Some run often, to keep in shape. Few train hard enough to run well. Writing is much like running. The basics are easy to learn, but you will not write well unless you work hard at it, minding little things that make a lot of difference. To write clearly you must be precise, concise and competitive.

Being precise is more than being accurate; it's saying what will give someone else the right idea. Writing succeeds when the reader comes to think as you would have him think.

A lot of imprecise writing comes from where you would expect precision: universities and government. Perhaps in self-defense a welfare office published these notes from its clients:

"I am forwarding my marriage certificate and my three children, one of which is a mistake, as you can see.

Unless I get my husband's money pretty soon I will be forced to lead an immortal life.

In accordance with your instructions, I have given birth to twins in the enclosed envelope.

You have changed my little girl to a boy. Will this make any difference?

My husband got his project cut off two weeks ago and I haven't had any relief since".

Robert Louis Stephenson once said: "Don't write merely to be understood; write so you cannot possibly be misunderstood". You needn't tell all you know; clear pictures are simple ones. Saying what is important is less a virtue than not saying what isn't . To write precisely you must cull ruthlessly the words that don't matter, then order the rest. You must direct your reader through what isn't essential to what is. It is presumptuous to throw words out for him to sift. If you won't define the essence of your work, don't expect it of him.

Being precise not only makes things easy on your reader; it consolidates your authority. Cutting through a jungle of clutter you bring others to a place. You are a leader, with a mission. As a leader, you must set the pace. To keep it brisk, to

keep your destination clear, make your words count. Make them strong, lucid, purposeful -- and well-ordered. A lot of confusion comes from poor chronology. For

Example: "I cannot get sick pay. I have six children. Can you tell me why"?

We've been told to avoid cliches and euphemisms. They are still rampant. Cliche is from a French verb, meaning to stereotype or cast from a mold. Trite words project trite thoughts and a lazy writer. Some are easy to spot: "throw in the sponge", "draw the line", "bated breath". But how about "habitat destruction", "critical elk winter range", "environmental impact"? These are pretty descriptive, but so are all cliches. When a phrase seems so natural you don't think about it, likely your reader won't either. Keep him alert with words that say precisely what you want them to. If you can't find an original way to make your point, your point probably isn't original either.

"Euphemism" derives from a Greek root meaning "words of good repute". Euphemisms skirt what you must define. They are indirect ways to say what you haven't the courage or honesty to say directly. If you want to say "die", say "die", not "suffer mortality". Use "fat", not "rotund"; "sick", not "indisposed"' "finish", not "finalize". One of the most irritating euphemisms is the use of "harvest" for "kill". Shocks of grain and big pumpkins and the first Thanksgiving have nothing to do with shooting an animal. "Kill" is what hunters do. If that's wrong let's stop it; if it isn't there's no need to apologize with a euphemism. ("Harvest" <u>is</u> a legitimate way to describe a collective kill in the context of game management. That's different than harvesting an elk with your .338.)

Being precise is tearing away peripheral ideas to expose the core of what you want to say. Being concise is paring that core to a few words. Short is always best -- short words, short sentences, short paragraphs. Try to make at lease 75% of your words one-syllable. Keep sentences to two lines or less. Get at least three paragraphs on each page. Avoid redundancies: "Totally destroyed" is no more destroyed than "destroyed". Write as if each word on the page costs you a quarter.

Most of us think simple thoughts. But lots of writing in our profession is long and tiresome. The last paper I read -- an abstract for a proposal to do research to yield a report -- was longer than the Gettysburg Address! The proposal, at over 15,000 words, was 10 times as long as our Declaration of Independence! In Hamlet, Polonius said that brevity is the soul of wit. It is also the essence of good writing.

You don't often find something that's too brief. I did, in my letters from the welfare office:

"This is my eighth child. What are you going to do about it"? So brief it misleads, this nonetheless has a certain charm. It grabs your attention. Your interest hasn't a chance to wander. Before you know it, you have read the whole thing. Not so with the writing most of us read most of the time. It's more like this:

"The estimate of net willingness to pay is the end result of a series of mathematical and statistical operations on the aggregated data. One item of interest about estimated net willingness to pay is the sensitivity of this estimate to variation within the travel cost data. This variation is initially seen in the computed statistical confidence interval associated with the estimate of each coefficient of the visit-per-capita regression model."

This sort of thing would have dismayed Solomon, who wrote in Ecclesiastes: "The more the words, the less the meaning, and how does that profit anyone?"

But short isn't enough. You can be precise and concise and still be dull. Dull is deadly. People don't read dull things. If you have worked hard enough to write accurately and tightly you might as well go all the way and write vividly. Oliver Wendell Holmes said: "A word is the skin of a living thought." Active, moving words are what people want to read. They are the kind of competitive words you see in magazine ads.

Advertising is a good study in competitive writing because it is the most competitive there is. Ad writing hooks you right away, quickly delivers a message, leaves you with a strong image. An ad is short but powerful, plain but compelling. We remember it, if only to look for the next ad in the series.

One reason scientific writing and government reports are dull is that the people who write them want to be safe. They couch statements in qualifiers -- "generally", "usually", "as a rule" -- and use timid words instead of bold ones: "suggest", "implies", "tends to confirm". It's as if we have to remind the reader on every line that nothing is for sure. Pretty soon he tires of reading about things that might be and reads elsewhere about things that are.

Another contributor to dull writing is the buzzword. Sometimes you must use uncommon words or words specific to a subject. It's hard to talk about antler development without "pedicel", or ruminant digestion without "abomasum". But for most complex words there are simple words or phrases that mean the same thing and sharpen the image. Words like "interface" and "verbalize" and "biofeedback" are pompous words that blunt your writing.

A sure way to make your work dull is to stay in the passive voice. That is, instead of saying "I shot a bull on the Colockum" you would say "A bull was shot by me on the Colockum." To drain all the life from that, you could say "An elk was harvested by me on the Colockum unit." We don't talk in passive voice; there's no reason for us to write that way -- at least, most of the time.

But we do write that way, almost all the time. It sounds objective to say in a proposal "the elk will be visually monitored". It sounds subjective and unscientific to say "I'll watch the elk." But if all you are going to do is watch the elk you needn't apologize. And if you are indeed going to watch the elk, someone will be glad to know that you know you are supposed to watch the elk!

Passive voice can be useful. Saying "elk were transplanted in the Siskiyous" is a pretty good way to say they were -- unless you want to tell who was involved. But passive things in general put people to sleep. We don't like to watch passive movies or listen to passive speeches. We can hardly expect others to read our passive writing.

I was surprised to find in my welfare notes one written in passive voice:

"Mrs. Jones had not had any clothes for a year and has been visited regularly by the clergyman."

Perhaps the writer was trying to add dignity.

I hear that scientific writing and government reports have little in common with popular writing. I hear it from the same people who use the word "professional" a lot. It's as if to be professional you must be obscure. To be understood is to admit mortality. Some of these writers are bright people with a good grasp of grammar. Their writing is correct, but as sterile as a boiled beaker. It has too many words, too little focus, no life.

Scientific writing has a great deal in common with popular writing: If nothing else,

it begs a reader. It also demands revision. First drafts are merely your notes in sentences. To produce good writing you must throw away a lot -- a lot of words, a lot of time, a lot of paper. But all that is not really lost. It's like wax in a casting process, sacrificed for the finished part. Someone said it this way: "If *there's not enough fire in your writing*, there's probably not enough of your writing in the fire." Better that you throw a draft in the fire than a reader toss your final work.

Everything you write competes for your reader's time with a lot of other writing. There's far too much to read. I get lots of mail and I don't read it all. Some of what I discard has ideas that would benefit me. I throw it because it doesn't instantly compel me to read it. A fish is a fish, be it dead in the belly of a boat or tailwalking on a tight line. We ignore one, raptly watch the other.

In South Africa last year I climbed to a cave where Bushmen had painted. It was a lot of trouble for a Bushman to paint, and there aren't very many good paintings left. The one I examined had been carefully done. It was a clear picture.

I came back from South Africa and found more advanced work: "The effectiveness and efficiency of each measure's performance was determined on the bases of the kinds and magnitude of outputs each measure offered." I didn't like that picture, so I found another: "The final iteration of plan formation was to select from among the various combinations of compatible measures, the plan that was effective and efficient over the broadest range of planning objectives." Perhaps you get better mail.

Clear writing takes a lot of time, and most wildlife people would rather do their work than write about it. The catch is that writing about what you do is part of what you do. It's not something you tack on when you find time. Saying you have no time to write, well is like saying you have not time to eat well.

Being mercifully clear is more than just being kind to your reader or cleverly packaging your message. It is doing yourself a favor. You are what you write; at least, readers think so. To meet someone you have read and be disappointed credits that writer. Most would be delighted to hear they fall short of their work. What you write will likely be remembered longer by more people than anything else about you. What you write is your public self, the image of your work. Make it precise, lively enough to compete with letters to a welfare agency. Tell what you saw in a plain way. Be mercifully clear.

SIMULATIONS EVALUATING THE EFFECTS OF VARIOUS HARVEST METHODS ON YIELD AND ANTLER SIZE OF ELK

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Abstract

Computer models have been employed to determine the effects various hunting plans have on the yield and composition of elk populations. These models have provided the professional wildlife manager a valuable tool, but have not considered what might be happening to the gene pool of the population. Such genetic considerations are important in that some proposals may provide favorable yields, but may cause progressive deterioration of antler size over the years. To evaluate both these components (yield and antler size), a series of programs have been developed. Results of running these programs indicate that while some harvest methods can be expected to cause a reduction in antler size, others can actually lead to an improvement in the gene pool and at the same time provide favorable yields. The development of the computer models and the results from using these models under various harvest methods will be discussed.

Introduction

Computer programs have been employed to determine the effects various harvest plans have on yield and composition of elk populations. These programs have provided the professional wildlife manager a valuable tool, but have not considered the effects of the harvest options on the gene pool contributing to antler size. Such genetic considerations are important in that some harvest options may provide favorable yields, but may cause serious deterioration of antler size over the years. For this reason a program has been developed which considers both total harvest yield and the effects of the yield on the genes influencing antler size within elk populations.

Description of the Program

At the onset of the program, a population of approximately 1000 elk is created. Each animal in this population is characterized by values relating to the animal's age, sex, and genotype. In addition, bulls are characterized by values representing an environmental effect, an antler potentiality score, and the number of points per antler. Relative to these characteristics, the population is generated in such a way that its composition is similar to that expected for a natural non-hunted population.

The genotypes are produced by randomly assigning twenty plus or minus characters to each animal in the population. The twenty characters symbolize ten pairs of genes and represent the total genetic contribution to the size of an animal's antlers.

The ten pairs of genes can act under any one of three optional types of genetic control. The first assumes a lack of dominance at all ten loci. The second is more complex than the first as it includes some loci exhibiting complete dominance and some exhibiting partial dominance. The third option is the most complex, since it includes loci exhibiting lack of dominance, partial dominance, complete dominance, and overdominance.

Values associated with the lack of dominance option (and assuming no environmental influence) are shown in figure 1. When applied to an animal's ten pairs of genes, these values determine that animal's genotypic score. Notice from the figure that with this type of genetic control, the values associated with heterozygosity at any locus are always intermediate between homozygosity for the favorable allele (represented by a pair of pluses) and homozygosity for the unfavorable allele (represented by a pair of minuses).

Figure #1. Values of genotypes for each of 10 pairs of genes when all loci exhibit a lack of dominance and no environmental influence exists.

	Genotypic Values (H=1 or H=0)		
Gene Pair	++	+-	--
1	64	45	26
2	62	39	16
3	58	39	20
4	56	39	22
5	54	33	12
6	50	30	10
7	40	24	8
8	36	21	6
9	34	18	2
10	24	12	0

Figure 2 shows the genotypes which might be generated for two bulls within a particular population. The genotype on the left characterizes a bull with a favorable genotype and the genotype on the right that of one with a less favorable genotype. The scores associated with each pair of alleles occur when all loci exhibit a lack of dominance (and there is no environmental influence), hence they are derived from the values shown in figure 1.

Figure #2. Genotypes and scores of two typical bulls. Values assume the lack of dominance and no environmental influence options have been selected.

Bull with Favorable Genotype	Bull with Unfavorable Genotype
-- (26)	+- (45)
+- (39)	-- (16)
+- (39)	+- (39)
++ (56)	++ (56)
-+ (33)	+- (33)
++ (50)	-- (10)
+- (24)	-- (8)
++ (36)	-+ (21)
-+ (18)	-- (2)
++ (24)	+- (12)
Genotypic Score = 345	Genotypic Score = 242

A percentage of the score generated by the 10 pairs of genes and a percentage of a score representing the environmental influence are combined for each bull to generate the animal's antler potentiality score.

Any of five levels of environmental influence can be used. They are levels in which the environment provides either 0%, 25%, 50%, 75%, or 100% of the variation in potentiality scores. When the 25% option is used, for example, the potentiality score of an animal is determined by taking 75% of its genotypic score and adding it to 25% of another value which has been randomly generated from a distribution with properties like those characterizing the genotypic scores.

The potentiality score and the age of the bull determine the number of points per antler for each bull. The relationship between these values and antler size used to generate the results presented in the next section of this paper is shown in table 1. Yearling bulls (those listed as one year old), for example, had a single point if their score was less than .8 standard deviations (based on the expected standard deviation for calves in the initial population) above 300 (which is the expected mean of calves in the initial population). Those with a higher score, but one that was less than 1.2 standard deviations above the mean, have two points. Those with still higher scores had 3 or more points depending on how high their score was.

Table #1. Relationship between number of points and age of bull. Values in the table represent the antler potentiality scores in terms of standard deviations from a mean of 300. The number of points listed in any column is appropriate only when the nearest column to the left does not apply.

		Number of Points (per antler)							
		1	2	3	4	5	6	7	8
	9+	<-3.6	<-2.8	<-2.0	<-1.2	<-0.4	<+0.4	<+1.2	1.2+
	8	<-4.0	<-3.2	<-2.4	<-1.6	<-0.8	< 0.0	<+0.8	0.8+
	7	<-4.0	<-3.2	<-2.4	<-1.6	<-0.8	< 0.0	<+0.8	0.8+
Age	6	<-4.0	<-3.2	<-2.4	<-1.6	<-0.8	< 0.0	<+0.8	0.8+
of	5	<-3.6	<-2.8	<-2.0	<-1.2	<-0.4	<+0.4	<+1.2	1.2+
Bull	4	<-2.8	<-2.0	<-1.2	<-0.4	<+0.4	<+1.2	<+2.0	2.0+
	3	<-2.0	<-1.2	<-0.4	<+0.4	<+1.2	<+2.0	<+2.8+	2.8+
	2	<-1.2	<-0.4	<+0.4	<+1.2	<+2.0	<+2.8	2.8+	-
	1	<+0.8	<+1.2	<+1.6	<+2.0	<+2.8	2.8+	-	-

The potentiality score represents a value indicative of how large a bull's antlers will be when the bull is of optimal age. While the score actually represents only a relative value, the scores can be extrapolated to those used in Pope and Young or Boone and Crocket scoring. All elk populations, regardless of options selected, are initially generated to have an average potentiality score slightly below 300. The mean of calves and yearling bulls is expected to be 300, but because of score dependent mortality, older bulls tend to have somewhat lower scores and a standard deviation of approximately 40.

After the initial population is generated, a variety of bull harvest methods are available. They include existing practices of annually harvesting any antlered bull, annually harvesting 3 point or better bulls, annually harvesting 5 point or better bulls, and annually harvesting only non-branch antlered bulls (spike bulls). Other methods of harvest, which have been developed for use with this program, are also available. They are the cyclic plans in which non-branch antlered bulls are harvested every year, and all other antlered bulls are harvested every second, third, fourth, or sixth year. The option of not harvesting any bulls is also available.

The harvest of bulls is based on a selected percentage. The harvest can be either uniform (the same percentage for legal bulls of all ages), or age dependent. Age dependent harvest options include a decreasing likelihood of 10%, 25%, or 50% for each year of age, with the minimum likelihood of harvest being 10% or 25% of the maximum. For example, if the percentage of harvest selected for the youngest legal bulls is 80%, and if a 50% decrease in likelihood for each year of age is selected along with a minimal harvest that is 25% of that of the maximum; then a one year old legal bull would have an 80% chance, a two year old legal bull a 40% chance, and all legal bulls three years or older a 20% chance of being harvested.

The option of including cows and calves in the harvest is also provided. The number of these animals harvested each year will fluctuate since the percentages are based on the numbers of calves and cows that are available each year.

Statistics are collected before and after each selective harvest. Included are average antler potentiality scores, the numbers and types of animals existing before and after selective harvest, and the numbers and types of animals harvested. Bulls are assumed to contribute to the gene pool of the calf crop prior to any selective harvest. While all adult bulls have some chance of siring offspring, the likelihood is both age and score dependent. The optimal age of bulls is from 5 to 10. Bulls of 4 or 10 to 12 years of age are 20% less likely, those 3 or 13 or more years of age are 40% less likely, those 2 years of age are 60% less likely, and those 1 year of age are 85% less likely to sire a particular calf than are bulls of optimal age.

A bull is also 0.5% less likely to sire a calf for each point that its score deviates from the optimum of 330. A 3 year old bull with a score of 270, for example, will be 42% [(1-.40) x (1-(.005 x (330-270)))] as likely to sire a particular calf as a bull of optimal age and score. Only cows surviving the selective harvest and normal yearly mortality produce calves.

The probability that a surviving cow will produce a calf is determined largely by age dependent fertility rates. The rates used to generate the results given in the next section of this report were 60%, 87%, 93%, 93%, 93%, 93%, 93%, 91%, 89%, 86%, 84%, 81%, 78%, 74%, 70%, and 0% for cows 1 through 16 years of age, respectively.

Fertility and survival rates are also density dependent. When the size of the existing population is below carrying capacity, survival and fertility rates increase (because mortality and infertility decrease); whereas when the size is above carrying capacity, survival and fertility rates decrease.

Carrying capacity can be specified as 1000 or 2000 animals. When the size of the population (PSIZE) is below carrying capacity (CCAP), mortality rates decrease by the amount DEC determined by the first equation listed below, and infertility rates decrease by twice this amount. When the size of the population is above carrying capacity, mortality rates increase by the amount INC determined by the second equation, and infertility rates increase by twice this amount. DEC = 0.5 times the Square Root of ((CCAP-PSIZE)/CCAP) INC = 0.5 times the Square Root of ((PSIZE-CCAP)/CCAP)

Normal male survival (which excludes density dependent and selective harvest effects) is dependent upon age and the potentiality score (and therefore on antler size since greater size increases energy expenditure during and after the rut). The columns in tables 2A and 2B give the yearly survival rates used for calves through bulls 16 years of age. As can be seen from the tables, survival of a bull of a particular age depends on its potentiality score (in terms of standard deviations from a mean of 300). A bull four years of age with a score of 340 (one standard deviation above the mean), for example, had a 72% chance of surviving an additional year.

Table 2A. Yearly survival rates for bulls. The columns give survival rates for bulls of various ages, the rows give rates for bulls in terms of how far their antler potentiality scores deviate (in standard deviations) from the mean.

	Calf	1	2	3	4	5	6	7	8
> 3.6	.700	.664	.663	.657	.612	.567	.540	.540	.510
> 3.2	.700	.680	.680	.675	.630	.585	.558	.558	.527
> 2.8	.700	.696	.697	.693	.648	.603	.576	.576	.544
> 2.4	.700	.712	.714	.711	.666	.621	.594	.594	.561
> 2.0	.700	.728	.731	.729	.684	.639	.612	.612	.578
> 1.6	.700	.744	.748	.747	.702	.657	.630	.630	.595
> 1.2	.700	.760	.765	.765	.720	.675	.648	.648	.612
> 0.8	.700	.776	.782	.783	.738	.693	.666	.666	.629
> 0.4	.700	.792	.799	.801	.756	.711	.684	.684	.646
> 0.0	.700	.800	.833	.819	.774	.729	.702	.702	.663
>-0.4	.700	.800	.850	.837	.792	.747	.720	.720	.680
>-0.8	.700	.800	.850	.855	.810	.765	.738	.738	.697
>-1.2	.700	.800	.850	.873	.828	.783	.756	.756	.714
>-1.6	.700	.800	.850	.900	.846	.801	.774	.774	.731
>-2.0	.700	.800	.850	.900	.864	.819	.792	.792	.748
>-2.4	.700	.800	.850	.900	.900	.837	.810	.810	.765
>-2.8	.700	.800	.850	.900	.900	.855	.828	.828	.782
>-3.2	.700	.800	.850	.900	.900	.900	.846	.846	.799
>-3.6	.700	.800	.850	.900	.900	.900	.900	.900	.850
<-3.6	.700	.800	.850	.900	.900	.900	.900	.900	.850

Table 2B. A continuation of table 2A. Again the columns give survival rates for bulls of various ages, the rows give rates for bulls in terms of how far their antler potentiality scores deviate (in standard deviations) from the mean.

	9	10	11	12	13	14	15	16
> 3.6	.504	.472	.441	.409	.347	.252	.126	.000
> 3.2	.520	.487	.455	.422	.357	.260	.130	.000
> 2.8	.536	.502	.469	.435	.369	.268	.134	.000
> 2.4	.552	.517	.483	.448	.380	.276	.138	.000
> 2.0	.568	.532	.497	.461	.391	.284	.142	.000
> 1.6	.584	.548	.511	.475	.402	.292	.146	.000
> 1.2	.600	.563	.525	.487	.413	.300	.150	.000
> 0.8	.616	.577	.539	.500	.424	.308	.154	.000
> 0.4	.632	.593	.553	.513	.435	.316	.158	.000
> 0.0	.648	.608	.567	.526	.446	.324	.162	.000
>-0.4	.664	.623	.581	.539	.456	.332	.166	.000
>-0.8	.680	.638	.595	.553	.468	.340	.170	.000
>-1.2	.696	.653	.609	.565	.479	.348	.174	.000
>-1.6	.712	.668	.623	.578	.490	.356	.178	.000
>-2.0	.728	.683	.637	.591	.501	.364	.182	.000
>-2.4	.744	.697	.651	.604	.512	.372	.186	.000
>-2.8	.760	.712	.665	.617	.522	.380	.190	.000
>-3.2	.776	.728	.679	.631	.534	.388	.194	.000
>-3.6	.800	.750	.700	.650	.550	.400	.200	.000
<-3.6	.800	.750	.700	.650	.550	.400	.200	.000

Normal female survival (excluding density dependent effects) is dependent upon age. The survival rates used to produce the results given later were 70%, 80%, 85%, 90%, 90%, 90%, 90%, 90%, 85%, 80%, 75%, 70%, 65%, 55%, 40%, 20%, and 0% for calves through sixteen-year-olds, respectively.

The number of calves produced each fall depends on cow survival rates, cow fertility rates, and on the rate of survival of the new individual from conception to 6 to 9 months of age. It is assumed that there are equal numbers of males and females conceived, but that survival to 6-9 months of age is 60% for males and 65% for females. These survival rates, however, are subject to the same degree of density dependent modification as the other survival rates. In producing offspring, gametes from cows and bulls are randomly combined. While each of the cows can produce no more than one calf per year, individual bulls can have many offspring.

After each crop of calves is produced (and the survivors have aged a year), the antler size of each bull is again determined and statistics on the composition of the herd are again compiled. This process of selective harvest, of mating and generating a new calf crop, and of determining normal yearly survival can be continued for as many as 100 years.

An automated version of the program is available which allows options to be selected and then runs each of as many as twenty populations for up to fifty years. This version collects the statistics from the individual populations and compiles averages based on all of them.

Comparison of Harvest Plans

Simulations should not be expected to exactly duplicate behavior of natural populations. There are too many variables which cannot be determined with certainty that influence populations. The point of computer simulation, therefore, is seldom to mimic the exact behavior of a particular population, but instead is to gain insights as to how certain factors influence natural populations and to get some idea as to the magnitude of effects.

Simulations do offer distinct advantages over field studies of natural populations when evaluating factors influencing populations. Besides cost and time considerations, an important advantage is that simulations can be repeated many times, and under conditions in which only the factor being considered is varied. This allows an evaluative approach similar to that used in laboratory studies, where experimental conditions are held as constant as possible over time.

To evaluate the effects of various harvest methods, the automated version of the program described earlier was run repeatedly under conditions in which only the harvest method and the extent of the harvest varied. Because of run to run variation, each simulation was repeated ten times. Averages of the ten runs for each harvest method are presented in tables 3-6. The average numbers of animals harvested in each of these plans are based only on the last forty-five of the fifty years represented in each simulation. The conditions under which these results were obtained include: (1) genetic control assuming a lack of dominance, (2) no environmental influence, (3) no harvest of cows or calves, and (4) carrying capacity set at 1000 animals.

Table 3 shows the effects of running the program for each of the harvest plans while assuming each legal bull has a 50% chance of being selectively harvested each year. The results show that the non-branched only plan and the 3, 4, and 6 year cycle plans result in the greatest genetic improvement, increasing antler potentiality scores by 30 or more points (approximately three-fourth of a standard deviation). Within this group, the 3 year cycle plan is particularly impressive as it provides a high total harvest (averaging 56.3 animals per year) and a high trophy bull yield (averaging 7.7 animals, for each year including those years when only non-branched bulls are taken). The 2 year cycle plan is also very good in terms of harvest, though it is less favorable genetically than the other cycle plans.

Table 3. Average change over fifty years in potentiality scores and in frequencies of favorable genes, along with the numbers of animals harvested each year for eight harvest plans run under the condition that each legal bull had a 50% chance of being harvested each year.

Harvest Plan	Change in Score	Change in Frequency of Favorable Genes	Total Harvest	5 Point Harvest	6-8 Point Harvest
Any Antlered Bull	+15	+0.035	79.7	7.4	4.1
3 Point or Better	-25	-0.061	52.7	7.6	3.7
5 Point or Better	-26	-0.065	30.6	21.3	9.3
Non-Branched Only	+32	+0.074	27.4	0.0	0.0
2 Year Cycle Plan	+25	+0.061	66.5	7.1	7.4
3 Year Cycle Plan	+31	+0.073	56.3	6.1	7.7
4 year Cycle Plan	+33	+0.079	50.3	4.8	7.2
6 year Cycle Plan	+30	+0.074	45.6	3.4	6.3

The 3 point or better and the 5 point or better plans both result in substantial genetic deterioration. In addition, neither the total harvest nor the trophy harvest is very good with the 3 point or better plan. The total harvest is even worse with the 5 point or better plan, but this plan does yield impressive numbers of 5 point and trophy (6-8 point) bulls.

Although not shown in the table, the plan of not harvesting any bulls results in essentially no change in antler potentiality scores. This is a result of the program design. Antler size under natural non-hunting conditions is quite stable, as it is most likely operating under conditions of stabilizing selection. Bulls with the greatest fitness have neither the largest nor smallest antlers. Bulls with extremely large antlers must spend more energy carrying their rack than those with smaller antlers. Hence they are more likely to enter the winter range in a weakened condition and therefore to die. Bulls with small antlers are less likely to build and maintain a harem, and therefore are less likely to be as prolific as those with larger antlers.

It is interesting to note that utilization of the most commonly used plan, that allowing the harvest of any antlered bull, increases the percentage of favorable genes in the population. While this may at first seem unexpected, it is because more of the mating in a non- hunted population is done by old bulls. As bulls age, those with largest antlers have the highest yearly mortality. Because of this, potentiality scores of older bulls are on the average lower than younger bulls. The effect of hunting is to reduce the relative numbers of older bulls, and therefore to increase the percentage of calves that are produced by matings involving young bulls. Calves with higher average scores therefore occur when more are produced by these higher averaging young bulls.

Table 4 shows the effects of running the program for each of the harvest plans while assuming each legal bull has a 80% chance of being selectively harvested each year (a 60% increase over that used to produce the results in table 3). By comparing the results in this table with those in table 3, it becomes evident that increasing the harvest greatly accelerates the rate of genetic change regardless of which harvest plan is implemented.

Table 4. Average change over fifty years in potentiality scores and in frequencies of favorable genes, along with the numbers of animals harvested each year for eight harvest plans run under the condition that each legal bull had a 80% chance of being harvested each year.

Harvest Plan	Change in Score	Change in Frequency of Favorable Genes	Total Harvest	5 Point Harvest	6-8 Point Harvest
Any Antlered Bull	+20	+0.051	96.0	5.1	1.3
3 Point or Better	-38	-0.098	59.8	2.8	0.5
5 Point or Better	-33	-0.084	35.3	31.1	4.2
Non-Branched Only	+59	+0.142	33.2	0.0	0.0
2 Year Cycle Plan	+40	+0.097	88.1	9.8	5.3
3 Year Cycle Plan	+52	+0.126	74.3	10.0	9.2
4 year Cycle Plan	+51	+0.125	68.3	7.3	10.4
6 year Cycle Plan	+55	+0.137	61.7	5.2	11.2

Table 4 shows that the 3, 4 and 6 year cycle plans are again impressive both in terms of genetic improvement (though less favorable than the non- branched only plan), and in terms of the quality of harvest. The 3 point or better and 5 point or better plans are again the only plans causing genetic deterioration. Notice that the trophy bull harvest with the 5 point or better plan is not nearly what it was when harvest rates were lower. Notice how poorly the 3 point or better plan does. Compare the genetic effects and the harvest in all categories in this plan, for example, with the plan allowing harvest of any antlered bull.

Table 5 shows the results obtained when the probability of harvest is influenced by the age of the bull and when the maximal probability of harvest is 50%. The conditions in which the data were obtained assume that for each year of age, a bull's chance of being harvested decreases by 25%, and that the minimum probability of harvest is 12.5%. Thus legal yearling bulls have a 50% chance of being harvested, 2 year bulls a 37.5% chance, 3 year bulls a 28.2% chance, 4 year bulls a 21.2% chance, 5 year bulls a 15.9% chance, and 6 year and older bulls a 12.5% chance of being harvested in any year.

Table 5. Average change over fifty years in potentiality scores and in frequencies of favorable genes, along with the numbers of animals harvested each year for eight harvest plans run under conditions in which experience reduces probability of harvest by 25% per year. Depending on the age of the bull, probabilities of harvest each year range from 50% for yearling bulls to 12.5% for six year and older bulls.

Harvest Plan	Change in Score	Change in Frequency of Favorable Genes	Total Harvest	5 Point Harvest	6-8 Point Harvest
Any Antlered Bull	+ 5	+0.014	63.3	3.9	3.6
3 Point or Better	-15	-0.038	27.3	5.1	4.9
5 Point or Better	-10	-0.025	14.0	7.0	7.0
Non-Branched Only	+31	+0.074	27.6	0.0	0.0
2 Year Cycle Plan	+17	+0.037	49.2	2.8	3.0
3 Year Cycle Plan	+25	+0.057	42.1	2.4	2.6
4 year Cycle Plan	+25	+0.064	37.9	1.9	2.0
6 year Cycle Plan	+26	+0.063	35.1	1.3	1.6

Incorporating the effects of bull experience into the simulations results in reducing overall yield and particularly trophy bull yield. Comparing table 5 with table 3 shows that it also has the effect of reducing genetic change. Table 5 also shows that incorporating the effects of experience into the model causes the cyclic plans to compare genetically somewhat less favorably than the non-branched only plan.

Table 6 shows the results obtained when the probability of harvest is again influenced by age (as in table 5), but under conditions in which the probability of harvest increases by an additional 60%, so that harvest probabilities range from 80% to 20%. The results in table 6 show that under these higher rates of harvest, marked increases in the frequency of favorable genes occur. The improvement is similar to that found when high rates of harvest were uniformly applied to bulls of all ages (see table 4).

Table 6. Average change over fifty years in potentiality scores and in frequencies of favorable genes, along with the numbers of animals harvested each year for eight harvest plans run under conditions in which experience reduces probability of harvest by 25% per year. Depending on the age of the bull, probabilities of harvest each year range from 80% to 20%.

Harvest Plan	Change in Score	Change in Frequency of Favorable Genes	Total Harvest	5 Point Harvest	6-8 Point Harvest
Any Antlered Bull	+14	+0.032	92.2	3.4	1.5
3 Point or Better	-33	-0.083	41.0	5.8	3.3
5 Point or Better	-18	-0.043	20.7	12.2	8.5
Non-Branched Only	+59	+0.144	33.5	0.0	0.0
2 Year Cycle Plan	+40	+0.096	77.3	6.6	3.9
3 Year Cycle Plan	+50	+0.119	63.3	5.6	4.3
4 year Cycle Plan	+50	+0.124	56.0	4.3	4.1
6 year Cycle Plan	+54	+0.134	49.4	3.2	3.5

Table 6 again shows that the 3 point or better plan produced poorer genetic results than the 5 point or better plan and very much poorer results in terms of trophy bull harvest. Notice also that the overall yield from the cycle plans are much better than the 3 point or 5 point or better plans, and that they yield much greater numbers of trophy bulls than the any antlered bull plan.

Summary

The results of these simulations indicate that the 3 point and 5 point or better plans are the only plans resulting in genetic deterioration. The difference between these two plans and the plan in most common usage, that allowing the harvest of any antlered bull, is substantial, as differences in potentiality scores range from 15 to 58 points (or from 3.9% to 19.3% in the amount of change in the frequency of favorable genes). Since many states are using these plans in more and more areas, it will be worthwhile to closely monitor the results. It is especially critical to do this for an extended period of time, since these plans may initially produce good yields, but taper off quickly.

While the plan allowing harvest of only non- branch antler bulls is consistently the best or among the best in terms of genetic improvement, it is worthless for trophy harvest and would be hard to enforce. This plan might be considered on a restricted basis, however, to develop a genetically superior population for use in stocking virgin areas or replenishing the gene pool of genetically inferior populations.

The cyclic plans might also be hard to enforce. However, hunters might be more likely to accept a plan which allows them access to only non-branch antlered bulls, when they realize that one or several years later they will have a chance for those trophy bulls they might encounter. For example, the three year plan might be used in a region with three separate sections. While one of the sections is open for all bulls, the other two would allow the harvest of only non-branch antlered bulls. By rotating each year which of the sections is open for harvesting any type of bull, managers might be able to get compliance and also high levels of hunter satisfaction. In addition, they would be increasing the frequency of favorable genes within the populations, which would mean even larger bulls in the years to come.

While the simulations presented here indicate that some plans are preferable to others, it is important to consider the results as preliminary. Simulations which vary other options, particularly those involving genetic control and the amount of environmental influence need to be assessed. These simulations are being done and the results will be reported as they become available.

Panel Discussion

"Artificial Feeding: History, Current Program and Biological Consequences."

Moderator: John Andrews

Speakers: Mark Boyce
Roger McKeel
Bruce Smith
Lon Kuck
Ken Emerson

ELK WINTER FEEDING DAMPENS POPULATION FLUCTUATIONS AT THE NATIONAL ELK REFUGE

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Abstract

Numbers of elk at the National Elk Refuge have increased slightly over the last 75 years, while the amplitude of fluctuations has dampened substantially. Likewise, feeding rations on the Refuge have increased significantly through time, and the variance in hay fed has decreased. A 20-year moving standard deviation of hay fed is corrrelated with the 20-year moving standard deviation in the number of elk using the Refuge during winter. Although constant elk populations may be easier to manage, elk population fluctuations may occasionally release aspen from browsing allowing some stands to regenerate.

Introduction

Winter feeding at the National Elk Refuge is necessary to sustain the Jackson elk (Cervus elaphus) herd because cattle ranching and residential development have usurped critical elk winter range (Robbins et al. 1982). Several management dilemmas emerge with the winter feeding program including (1) risk of brucellosis transmission to livestock (Thorne et al. 1979), (2) necessity of culling to control elk numbers in Grand Teton National Park, and (3) extraordinary expense to feed the animals. Public benevolence towards elk has encouraged higher rations than are necessary to sustain the elk (see Boyce 1989). Despite these problems, the Refuge feeding program is successful at reducing winter mortality to an average of only 1.2% annually.

Another postulated consequence of winter feeding is reduced population fluctuations because of reduced winter mortality (DeByle 1979), and enhanced survival of calves (Thorne et al. 1976). Such an effect may have significant ramifications to aspen (Populus tremuloides) management (Boyce and Hayden-Wing 1979). In this paper, I present evidence which suggests that feeding on the National Elk Refuge reduces population fluctuations in the Jackson elk herd.

Discussion with John Hart stimulated this analysis. I thank the National Elk Refuge, Bridger-Teton National Forest, Grand Teton National Park, and the Wyoming Game and Fish Department for funding. Evie Merrill, Bill Barmore, and Bruce Smith provided valuable comments.

Methods

Elk on the National Elk Refuge are censused and classified as mature bulls, spikes (yearlings), cows and calves by observers on hay sleds, usually in February each year. Since 1975 elk have been fed alfalfa pellets during winter but were fed baled hay in earlier years. Feeding and census records were obtained from files of the National Elk Refuge and the Wyoming Game and Fish Department. Data up to 1986 are reported by Boyce (1989).

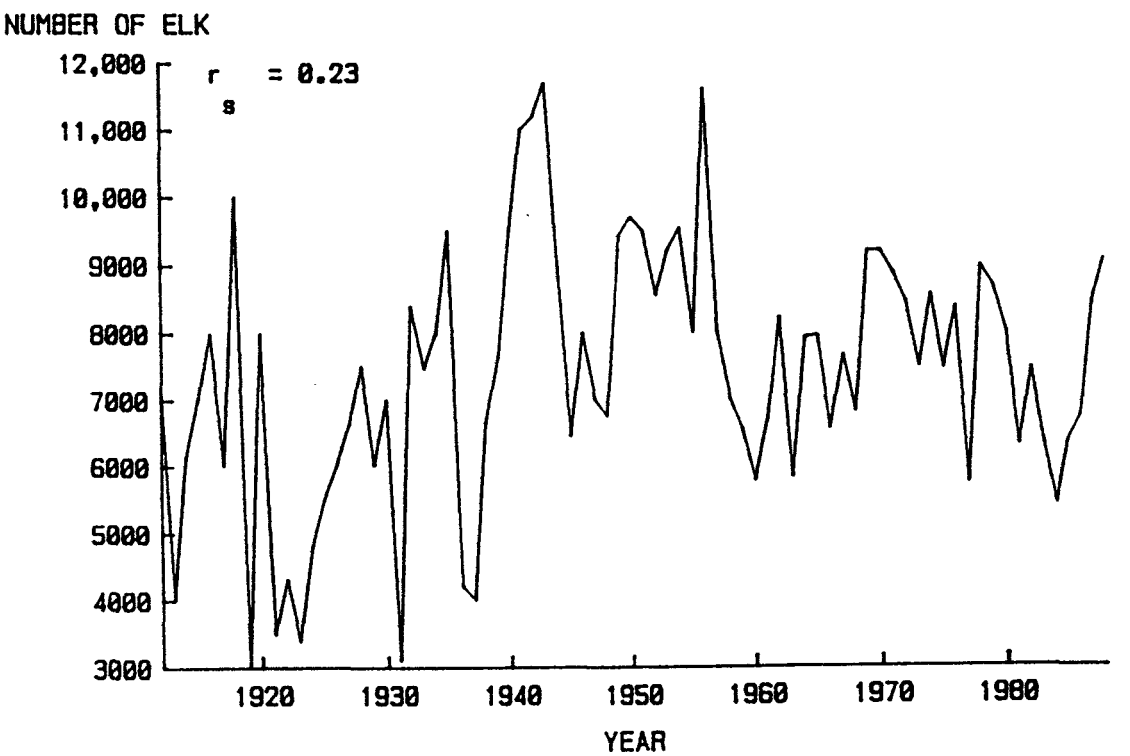
Weather data from Moose, Wyoming was used for years 1936-88 because winter precipitation at this weather station was most highly correlated with elk attendance on the Refuge (Sauer and Boyce 1979; 1983); weather data from Moran, Wyoming was used for 1914-1935 because the Moose weather station was not established until 1935.

Statistical analyses were performed using SYSTAT. Time series trends were evaluated using Spearman rank correlations.

Results

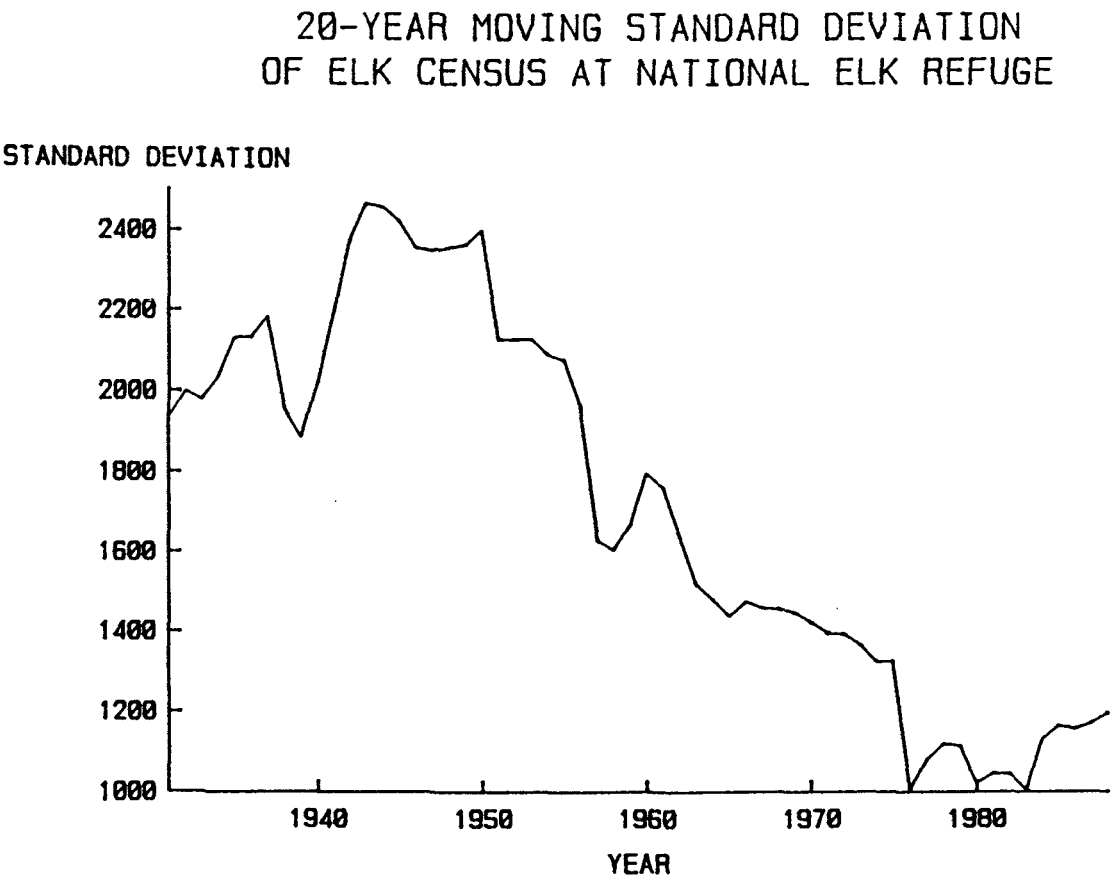
Population size on the National Elk Refuge has increased slightly during the past 75 years, and the trend is statistically significant (r_s = 0.233, n = 73, P = 0.05). Inspection of Figure 1 suggests that variance in the elk census in early years was higher than in more recent years.

Figure 1. Maximum winter counts of elk on the National Elk Refuge, 1912-1988. A slight but statistically significant increasing trend exists in this time series (r_s = 0.277, n = 73, P = 0.05).



I evaluated this using a 20-year moving standard deviation of the previous 20 years of censuses over the entire period 1912-88. There has been a highly significant decrease in standard deviation through time (r_s = -0.865, n = 58, P < 0.001; Figure 2).

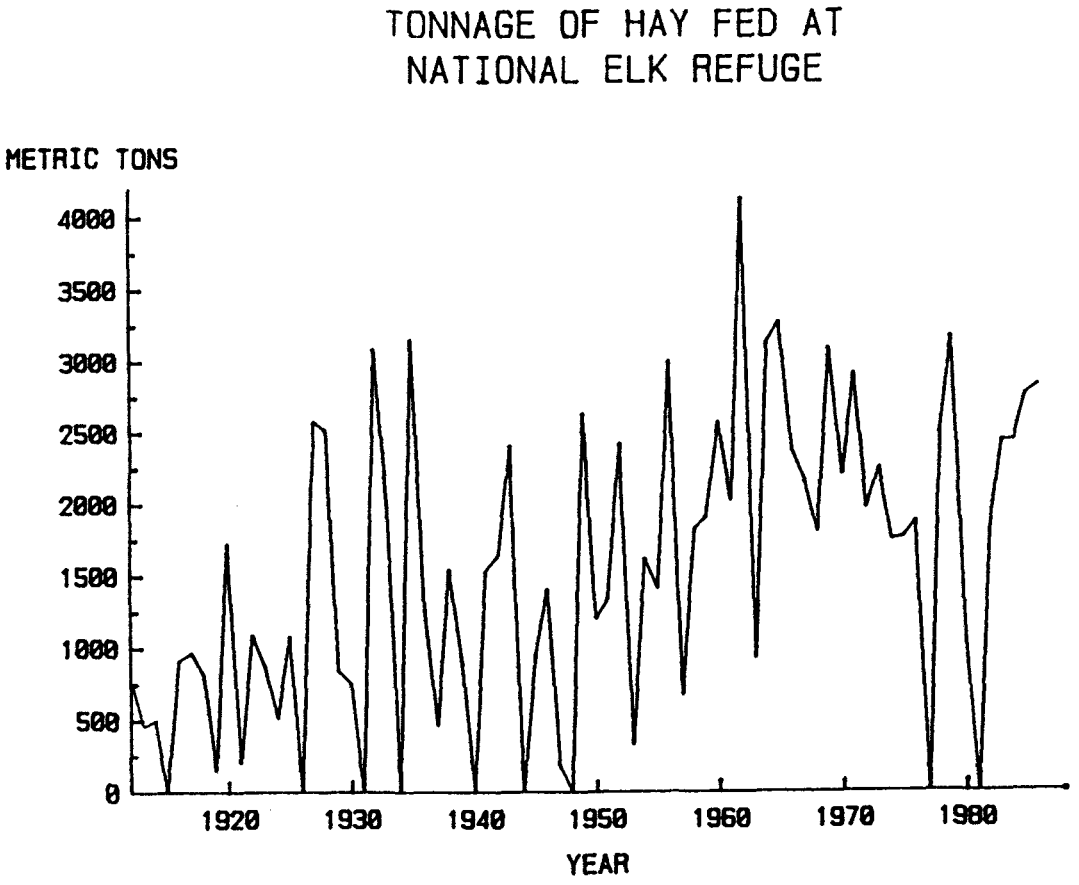
Figure 2. Standard deviation in maximum census of elk for the previous 20-years moving over the period from 1931 to 1988, i.e., data begin 1912 as in Figure 1. This trend is highly significant (r_s = -0.865, n = 58, P < 0.001).



Winter counts on the National Elk Refuge are correlated with January precipitation (Sauer and Boyce 1979; Boyce 1989) because in tougher winters a higher proportion of the elk population is driven onto the feed ground. However, there is no tendency for a declining trend in a 20-year moving standard deviation of January precipitation (r_s = 0.049, n = 58, P >0.5). Furthermore, I found no correlation between the 20-year standard deviation in January precipitation and the same measure for variation in total population size (r = 0.174, n = 58, P > 0.1).

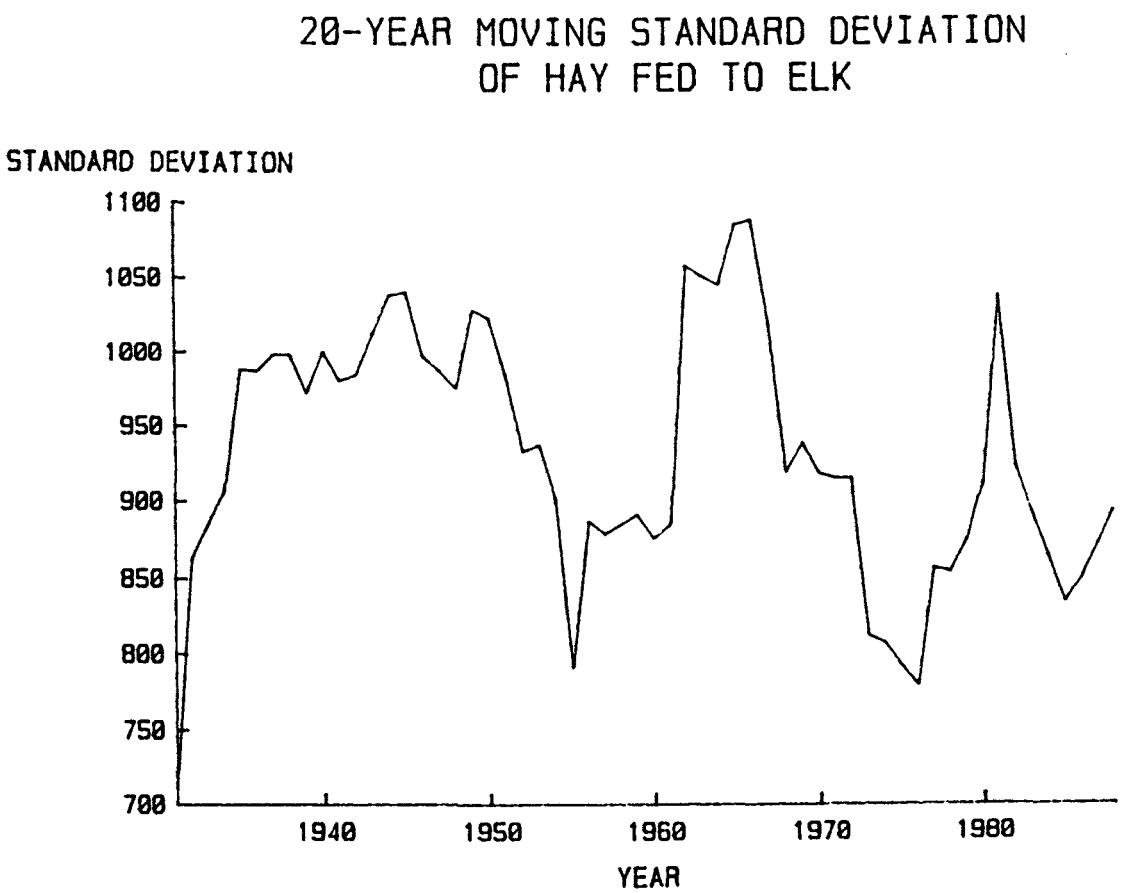
Feeding on the National Elk Refuge has a pattern similar to that for elk numbers; i.e., there has been a significant increase in tonnage of hay fed during the past 75 years (r_s = 0.293, n = 52, P < 0.05), but the amplitude of fluctuations in winter feeding has dampened (Figure 3).

Figure 3. Total metric tons of hay fed to elk on the National Elk Refuge. Because alfalfa pellets fed in recent years are more nutiritios than baled hay, pellets were converted by assuming that 800 tons of pellets were equivalent to 1,000 tons of baled hay (Thorne and Butler 1976).



As was true for the total number of elk counted on the Refuge, a 20-year moving standard deviation of feeding rations exhibits an declining trend (r_s = -0.322, n = 56, P < 0.02), but the pattern is weak (Figure 4).

Figure 4. Moving standard deviation of the hay fed to elk for the previous 20 years over the period 1931 to 1988, i.e., data begin in 1912 as in Figure 3. There exists a weak, but statistically significant, declining trend (r_s = -0.322, n = 56, P < 0.02).



The 20 year-moving standard deviation of the number of elk on the Refuge (STD) is correlated with the 20 year moving standard deviation in feeding rations (STD = 2.14 [SD feed] 264; r = 0.39, n = 66, P = 0.003). Despite the lack of correlation between the standard deviation in elk census and the standard deviation in January precipitation, there was a weak correlation (r = 0.278, n = 56, P < 0.05) between the standard deviation of January precipitation and the standard deviation of hay fed, revealing only that if precipitation varied substantially, the feeding program was also likely to vary.

Some of the effect of variation in feeding levels on population fluctuations may occur through recruitment (Thorne et al. 1976), particularly in early years when feeding was more variable. For the 7 years prior to 1960 for which complete data exist, there is a significant positive correlation between tonnage of hay fed during a winter and the proportion of cow elk with calves at heel the

following year (r_s = 0.893, n = 7, P < 0.01). Since 1960, hay rations have been kept at higher levels, except during mild winters, such that no correlation exists between feeding and calf recruitment (P > 0.1; Boyce 1989).

After removing effects attributable to variations in winter feeding, there remains a strong temporal pattern among the residuals of elk population fluctuations (r_s = -0.793, n = 56, P < 0.001).

Discussion

Despite a general sentiment among wildlife biologist that supplemental feeding is bad, winter feeding of elk at the National Elk Refuge is well justified and highly successful. Even though approximately 20-30% of the cow elk have brucellosis, the Jackson herd is productive and viable (Boyce 1989). The animals are generally in excellent condition as evidenced by the fact that more Boone and Crocket trophy bull elk have come from the Jackson herd over the years than from any other population. Without winter feeding, the Jackson elk herd would be much smaller than it is now, simply because much of the winter range is now inaccessible to elk.

Results presented here suggest that elk population fluctuations on the National Elk Refuge may be partly due to variation in the winter feeding program. We know that feeding rations can influence calf weights and subsequent survival of calves (Thorne et al. 1976). Even though winter mortality is virtually eliminated on the National Elk Refuge, there is still significant density dependence in recruitment and calf survival (Sauer and Boyce 1983). Winter feeding would appear to contribute to this density dependence because per capita hay rations provided are never as large when numbers of elk are high (Boyce 1989). However, I have shown elsewhere (Boyce 1989) that multiple regression of male calf survival as a function of both the number of elk on feed and total per capita hay rations reveals that rations do not contribute significantly to the model (t = 1.64, P = 0.12). Yet, the number of elk on feed maintains a stong influence on calf survival, even when hay ration is included in the model (t = 3.23, P = 0.005).

Even though feeding has a significant influence on the magnitude of population fluctuations, there still remains substantial residual variation. Some of this may be due to hunter harvests, but reliable information on hunter kill for the Jackson elk herd is only available since 1950. For recent years, at least, hunter kill is a major variable driving population size (Boyce 1989).

For the manager, large population fluctuations in elk herds are a nuisance. Hunters object to wide fluctuations in populations of elk, accusing management agencies of incompetence if numbers and quotas change markedly through time. Also, when populations are greater than the winter range will support, elk are more likely to come into conflict with ranchers and residential landowners. From this perspective, constant population size enhanced by winter feeding may be desirable. However, elk population fluctuations that occur due to annual variation in winter range conditions may be important in sustaining some components of winter range, particularly aspen.

When elk are concentrated on feed grounds, they can have substantial effects on habitats. Most serious appear to be effects on aspen less than 4 m tall (DeByle and Winokur 1985). Heavy browse lines develop with concomitant effects on avian faunas (Flack 1976) and hiding cover for elk. Areas immediately surrounding elk feed grounds must be considered sacrifice areas because it is unlikely that aspen stands will have a chance to recover. However, for aspen stands further from feed grounds, elk population fluctuations may offer occasional opportunities for aspen regeneration when elk numbers are low and some stands are relieved from browsing (DeByle 1979). Fire also plays an important role in aspen regeneration, and it will be interesting to see if the extensive fires of 1988 are adequate to allow aspen shoots to escape ungulate browsing in the greater Yellowstone area.

There is no easy resolution to conflicts created by winter feeding. Feeding to replace lost winter range would be more "natural" if a constant amount of feed was provided each winter rather than adjusting rations to number of elk and weather conditions. However, this would result in heavy mortality during tough winters, which would be unacceptable to the public.

Literature Cited

Boyce, M. S. 1989. The Jackson elk herd: Intensive wildlife management in North America. Cambridge Univ. Press, Cambridge, U.K. 307 pp.

Boyce, M. S., and L. D. Hayden-Wing. 1979. North American elk: Ecology, behavior and management. Univ. Wyoming, Laramie. 294 pp.

DeByle, N. V. 1979. Potential effects of stable versus fluctuating elk populations in the aspen ecosystem. Pages 13-19 in M. S. Boyce and L. D. Hayden-Wing eds., North American elk: Ecology, behavior and management. Univ. Wyoming, Laramie. 294 pp.

DeByle, N. V., and R. P. Winokur. 1985. Aspen: Ecology and management in the western United States. U S Dept. Agr., Forest Serv., Gen. Tech. Rep. RM-119. Rocky Mtn For. Range Exp. Sta., Fort Collins, CO. 283 pp.

Flack, J. A. D. 1976. Bird populations of aspen forests in western North America. Ornithol. Monogr. 19:1-97.

Robbins, R. L., D. E. Redfearn, and C. P. Stone. 1982. Refuges and elk management. Pages 479-507 in J. W. Thomas and D. E. Toweill, eds. Elk of North America: Ecology and management. Stackpole Books, Harrisburg, PA. 698 pp.

Sauer, J. R., and M. S. Boyce. 1979. Time series analysis of the National Elk Refuge census. Pages 9-12 in M. S. Boyce and L. D. Hayden-Wing eds., North American elk: Ecology, behavior and management. Univ. Wyoming, Laramie. 294 pp.

Sauer, J. R., and M. S. Boyce. 1983. Density dependence and survival of elk in northwestern Wyoming. J. Wildl. Manage. 47:31-37.

Thorne, E. T., and G. Butler. 1976. Comparison of pelleted, cubed, and baled alfalfa hay as winter feed for elk. Wildl. Tech. Rep. No. 6. Wyoming Game and Fish Dep., Cheyenne, WY.

Thorne, E. T., R. E. Dean, and W. G. Hepworth. 1976. Nutrition during gestation in relation to successful reproduction in elk. J. Wildl. Manage. 40:330-335.

Thorne, E. T., J. K. Morton, and W. C. Ray. 1979. Brucellosis, its effect and impact on elk in western Wyoming. Pages 212-220 in M. S. Boyce and L. D. Hayden-Wing, eds. North American elk: Ecology, behavior and management. Univ. Wyoming, Laramie. 294 pp.

Status of Elk Winter Feeding In Yakima and Kittitas Counties Washington

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ABSTRACT

Introduction of 92 elk from Yellowstone Park between 1913 and 1916 formed the present Yakima and Colockum elk herds. Population expansion increased damage problems to agriculture and range land. Purchase of winter range provided a home and temporary control. Extensive fencing programs eventually provided permanent control. Expansion of the Yakima herd required feeding to maintain animals behind fencing. Feeding starts in mid December and extends through mid March. Amounts fed have varied between 15 and 1,900 tons per year. Over 5,000 animals have been fed during recent years.

INTRODUCTION

Should we feed big game animals? What is the ecological significance? Are we affecting the biological outcome? Could we have more? Should we have less? Are we changing habits? All these questions are legitimate ones surrounding artificial feeding. I doubt we will answer all these questions during the short time we have to discuss this subject. We will probably end up generating more questions; However, we can look at the elements leading up to our present elk feeding program here in Central Washington and consider some of these concerns.

HISTORY

Native Elk: Controversy still exists on whether elk were native to the east slopes of the Cascades. More recent publications recognize the controversy and believe some elk were probably resident to the area, but were eliminated prior to the 1900's on the east slope of the Cascades. Recent archeological evidence does support this claim. Whether or not elk were resident, what species and how many are purely academic and I will leave that subject to those with more expertise.

Introductions: Elk were introduced to Yakima County or re-introduced as the case may be during early winter in 1913. Local sportsmen and county game officials purchased 50 elk from Yellowstone Park. These animals were released on the Stevens Ranch along the Naches River and an additional seven elk from a Spokane Park were liberated in the same area in 1916.

The present day Colockum herd originated from a release of 42 animals near Boylston south of the town of Kittitas and driven north into the Wenatchee Mountains around 1916. From these original Kittitas and Yakima County

introductions we presently estimate some 12,000 and 5,500 animals inhabit the Yakima and Colockum elk herds respectively.

The elk herd in the Wenatchee Mountains and the Colockum Wildlife Area has adequate winter range and has never required supplementary feeding. Although we do have minor damage problems at times, the extensive fencing and feeding program present in the Yakima area has not been needed in the Colockum. At this point I will direct most of my comments toward the Yakima herd where most of our elk feeding occurs.

YAKIMA ELK HERD

Damage Problems: Several years elapsed between the introduction of elk into Yakima County and any recollection of damage problems. As these populations began expanding into available ranges the incidence of encounters with haystacks, fences, and orchards increased. By 1927, damage reports were common and the game commission was encouraged to open a season. Continuing on through the 1930's and 40's, damage problems, antagonism and frustrations became intensive. Game reserves originally established to protect these animals were abandoned, hunting seasons became more liberal and public criticism increased.

Elk competition with domestic cattle on and off of private lands increased during winter periods, which further increased the need to find a means of controlling these animals.

Solutions: The introduction of elk and the subsequent building of this population occurred after most of the region was inhabited. Attitudes toward elk, management and the department may have taken a different course here than areas where ranching, farming, and development evolved with elk present. Even though attitudes may be different, I believe all elk managers have a common need to control animals on private lands. Within the Yakima area landowner conflicts became acute and resulted in heated meetings between sportsmen, landowners, department officials, and state legislators. Legislation was eventually passed which limited the number of elk the department could manage in specific geographical areas. In an attempt to meet these laws and satisfy landowner requests most managers of the time realized the need for permanent solutions. Liberalized seasons, herding of animals back into the foothills and establishing temporary feeding stations generated varying results, but not the permanent solution needed.

Early Findings: Early investigation that started the process of land purchase indicated severely depleted winter range was occurring and estimates of various winter populations were made. Conclusions drawn were:

1. The elk herd should be held approximately at the present number.

2. The Oak Creek-lower Bethel Ridge area should be purchased for winter elk use, eliminating domestic cattle from the range.

3. Elk-proof fences should be constructed if elk continued to move down into the orchards after the purchase of the Oak Creek Game Range.

Implementation: Most managers of the time realized department land purchase was needed. The first segment of the Oak Creek Game Range was purchased in 1939. Additional land was added to this inventory along with the need to erect eight foot high elk fences to prevent encroachment on the private lands. Present land holding amount to some 309,000 acres "enhanced" by 70 miles of fence in Yakima and Kittitas Counties.

Even with extensive land purchases, managers found the need to erect fences to control wandering elk. With fencing came the need to use artificial feed, if animal numbers were going to be maintained or increased.

The grim winters of the late 1940's and early 1950's removed all doubt that range capacity, specifically winter range capacity, was being exceeded. Extensive emergency feeding, herding, and fencing was employed to save these elk. They were subsequently harvested by hunters during some of the most liberal seasons ever established in Washington. These were successful in reducing herds to fit the capacity of their winter range - temporarily. Artificial feeding was once considered a temporary means to save elk from starving, marauding, or being shot by irate farmers. This program, however evolved quickly into a long term management program.

Purpose: Originally, feeding programs were initiated to hold animals off of private land, and later managers recognized a need to provide forage lost on range land outside of the fenced areas.

Location: We presently maintain 11 permanent feeding stations located on two major state managed wildlife areas, Oak Creek and L.T. Murray. The area served by these sites lies south of Interstate 90, north of the Yakima Indian Reservation and west of the Yakima River to the Cascade Crest.

Dates of Feeding: We find the critical period of activity usually amounts to about 2.5 months. The start of feeding is quite variable with most of the year's activity starting during the latter half of December and extending into late February. We have started feeding as early as November 21 and finished as late as April 1st. The only pattern we see with starting dates for feeding is that of weather. Early and lingering snowfall initiates interest, while snow melt and green up ends the interest in alfalfa. The winter of 1974 feeding activities did not start until the first week of January.

Amount of Feed: Over the last 23 years the amount of alfalfa fed has ranged from 15 tons to 1,900 tons for the winters of 1976-77 and 1985-86 respectively. While there doesn't seem to be any distinct trends, I can give you some perspective. Between 1964 and 1973 we fed an average of 832 tons. Between 1974 and 1983, 690 tons and the last four years from 1984-87 that average increased to 1,256 tons.

Numbers of Elk Fed: Many of the individual years feeding records were missing information on estimated numbers of animals fed, however some information was reported for hard winters. Reports indicated some 1,200 tons of hay were fed to 3,711 elk during the winter of 1955-56. Estimated cost of this operation was $150,000. A severe winter hit in 1968-69 causing an extensive effort toward emergency feeding, over 1,455 tons of

hay were fed along with grain and 12.5 tons of enriched alfalfa cubes. Estimates of the number of elk fed was near 5,000 animals and expenditures reported on a statewide effort amounted to some $160,000. A more recent winter, 1985-86, taxed our on hand resources and we spent some $200,000 above normal levels on emergency winter feeding.

Numbers of elk fed has ranged from 545 to over 5,100 during the last eight years. While animal numbers are increasing at our feed station this increase can not be attributed to greater dependency or a change of habits. Weather condition during hunting seasons and resultant low harvest has contributed considerably to the increasing elk herd in the Yakima area.

CONCLUSIONS

Department acquisition, fence building and feeding programs have met the initial objectives identified. Creating a home and providing control of animals on private land has lessened the problems, but still have not eliminated them entirely in all areas. In the case of elk it appears we have a successful program and some of the positive aspects are:

(1) Herd size can be maintained at a higher level.

(2) Supplemental feeding maintains a more stable population.

(3) Solved many landowner conflicts in agricultural areas.

(4) Provides for many non-consumptive uses.

(5) Requires an active harvest management program.

I do not want to imply that these are all of the positive points, nor do I want to leave out some of the negative ones. We do find some people end up with some wrong impressions. First of all, we find an attitude among some that all we have to do is close the season and buy more hay. In addition, we find the feeding desire rubs off on other management programs, especially deer. Some people believe feeding programs lessen the strength for promoting better management of habitat. Feeding programs do allow individuals to survive that may have been eliminated by natural causes. One of the more significant problems suggested is one of concentration and spread of disease. On the other hand if a disease problem does start, established feeding sites could be beneficial in treating large numbers of animals.

We still have a long way to go to answer all of the questions leveled at artificial feeding. I will leave you with one additional question. How many of our consumptive wildlife programs are 100% natural?

SUPPLEMENTAL WINTER FEEDING OF ELK ON THE NATIONAL ELK REFUGE, WYOMING

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ABSTRACT: The National Elk Refuge near Jackson, Wyoming, was established by act of Congress in 1912. Loss of elk winter range to agricultural use and residential development resulted in heavy mortality some winters and the need for winter feeding of the elk. An average 7,100 elk have been fed 67 out of 76 winters for an average 66.5 ±32.8 days. The 24,700 acre National Elk Refuge is managed as a big game winter range. Forage production is maximized by irrigation, prescribed burning, and range renovation practices. Herbaceous forage production has averaged 14,484 tons from 1973 - 1987, more than twice the intake requirements for the herd during the 5.5 months they utilize the Refuge. However, as snow accumulates and/or crusts, forage availability and elk distribution become restricted and supplemental feeding begins. Over the past 20 years, an average 7,319 elk were fed on the Refuge and the average starting date of feeding has been January 21 with an average ending date of April 10. The daily ration/elk has averaged 7.6 ±1.34 pounds. After the Refuge converted from baled hay to pelleted alfalfa hay in 1975, mechanized equipment was used to distribute feed. Techniques used to feed elk and the cost of supplemental feeding are discussed.

Intoduction

Jackson Hole, Wyoming, was historically a wintering area for elk. Cole (1969) wrote that, "The 1887 to 1911 estimates of 15,000 to 25,000 elk in the Jackson Hole herd, with highest numbers reported during severe winters, should establish the fact that the area was a historical wintering (ground)." In 1884, the first settlers arrived in Jackson Hole and homesteaded lands where elk had wintered. By 1909, homesteaders and ranchers had settled large areas of the elk's winter range. Conversion of the land for livestock use, "tusk" hunting, and several severe winters resulted in heavy elk losses during the winters of 1889, 1890, 1891, 1909, 1910, and 1911. These losses and depredation by elk on ranchers' haystacks resulted in appeals from residents of Jackson Hole that brought national attention to the elk situation. During the winter of 1910, the Wyoming State Legislature appropriated $5,000 to purchase hay to feed the elk. But the amount was inadequate and hundreds of elk died that winter (Wilbrecht and Robbins, 1979). During the severe winter of 1911, elk losses were conservatively estimated at 2,500 and 75% of the calves died before spring arrived (Brown, 1947). That same year, the U.S. Congress

appropriated $20,000 for the purchase of hay and conducting of studies to determine what should be done to alleviate the situation (Anderson, 1958).

As a result of the studies, Congress appropriated $50,000 in 1912 and 1913 to purchase land for the production of feed for elk. From its initial size of 1,760 acres in 1912, the National Elk Refuge has increased -- through federal acquisition of homesteads, withdrawals from the public domain, and a 1,760 acre donation by the Izaak Walton League -- to its present 24,700 acres (Wilbrecht and Robbins, 1979). Still this represents only 25% of the historic winter range of the elk herd. The NER is one of 440 national wildlife refuges administered by the U.S. Fish and Wildlife Service.

Supplemental feeding of elk has been necessary 67 out of the 76 years of the Refuge's existence. Although the Refuge produces about 14,000 tons of herbaceous forage anually; deep, crusted snow generally limits the availability of forage by February and necessitates supplemental feeding. The 5,000 to 9,000 elk which winter on the Refuge were fed hay either in loose (up to 1938) or baled form (1938-1974). In 1975, a change was made to pelleted alfalfa hay (Wilbrecht and Robbins, 1979). Feeding trial studies, conducted from 1971 through 1973, showed that the elk readily accepted the pelleted feed and weight changes were similar to those in control groups of elk fed long hay (Smith and Robbins, 1984). Additional studies were conducted from 1972-74, to observe the acceptance and behavior of free-ranging elk fed alfalfa pellets and from 1976-82 to investigate weight dynamics and reproductive success of elk provided experimental rations of pelleted alfalfa (Oldemeyer et al., this proceeding).

This paper discusses current management programs on the National Elk Refuge. Included are techniques, costs, and agency responsibilities of the supplemental feeding program, and relationships of winter feeding to range management and carrying capacity of the Refuge.

Elk Numbers From 1912 - 1988

An average 7,100 $\pm$1,562 (n = 42) elk have been fed on the National Elk Refuge since 1941. Although the elk herd was fed 67 out of the past 76 winters, during most years prior to 1941, the number of elk being fed was not recorded separately from the total number of elk in the Refuge and adjacent Bridger-Teton National Forest (BTNF) winter range (Fig. 1). Those National Forest lands immediately adjacent to the east side of the Refuge were excluded from grazing by domestic livestock in 1919 and classified as big game winter range. Since 1941, those elk not attending Refuge supplemental feeding areas were recorded separately from the number of elk being fed.

Over the 20 year period, 1968 - 1987, elk were fed all but two winters (1976-77 and 1980-81). For those 18 years, an average 7,319.44 $\pm$1,074.30 elk were fed and an average 7,773.83 $\pm$1,135.66 elk were either being fed or wintered on Refuge and adjacent National Forest winter range. In 1974, the U.S. Fish and Wildlife Service and Wyoming Game and Fish Department entered into a Cooperative Agreement which

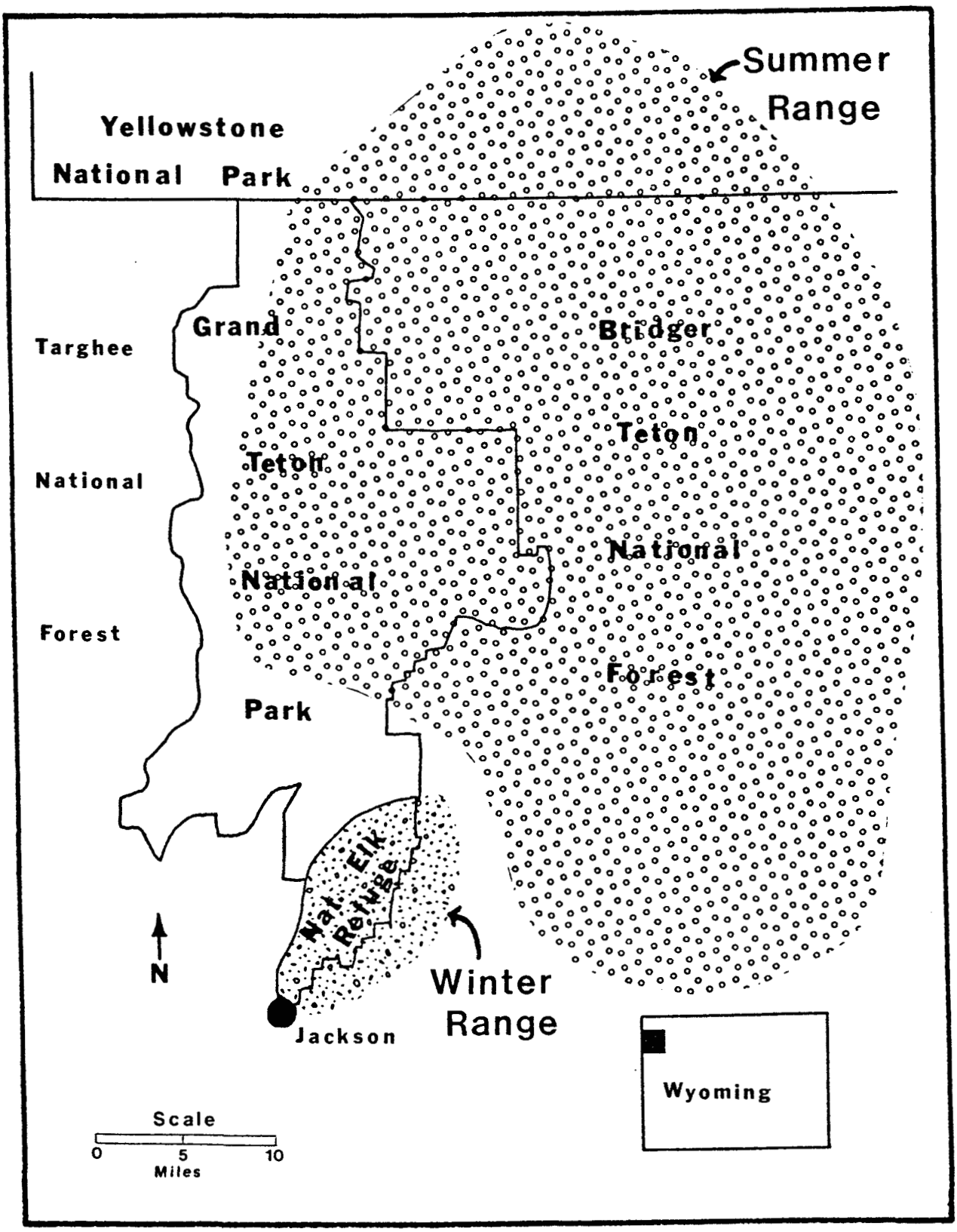

Fig. 1. Winter and summer ranges of the elk that winter on and adjacent to the National Elk Refuge.

addresses and guides certain aspects of elk management on the NER including responsibilities and cost sharing of supplemental feeding, range management, elk censuses and research, and the elk hunting program on the NER. In addition, the Cooperative Agreement specifies that the Jackson elk herd will be managed so that a maximum of 7,500 elk winter on the Refuge annually. The Wyoming Game and Fish Department's objective for the Jackson elk herd is a post hunting season population of 11,029 elk, of which 7,500 shall winter on the NER; 2,400 on three State of Wyoming feedgrounds in the Gros Ventre drainage, and the remaining 1,129 wintering on native winter ranges of the NER, BTNF and Grand Teton National Park (GTNP).

Management of the Winter Range

Unlike the early years of the Refuge's history, the NER is now managed as a winter range. Initially, the very limited land base provided no more than a place for the elk to be fed to keep them from wandering onto private lands and depredating haystacks. In 1938, following expansion of the Refuge to 20,000 plus acres, the south and west boundaries of the Refuge were fenced (Fig. 1). The fence kept the elk off private lands in the Jackson Valley and, probably just as important, it permitted a later starting date for supplemental feeding while promoting greater utilization of the Refuge's standing forage crop.

The winter feeding program employed on the NER is termed "supplemental feeding" as it's purpose is to supplement the natural forage produced on the Refuge winter range. Winter feeding of the elk is mandated by Congress in the establishing legislation of the Refuge. The necessity of feeding arises from three factors:
1) Public demand for large numbers of elk.
2) Limited forage availability. At 6,240-7,200 feet elevation, significant snow pack accumulates on the Refuge most winters, reducing elk mobility and accessibility of forage.
3) Reduction of winter mortality among the elk herd.
Initiation of supplemental feeding is largely dependent upon environmental conditions, primarily snowfall.

Many of the 22 elk feedgrounds operated by the State of Wyoming are quite small and sandwiched among private ranchlands. Feeding on those areas begins soon after the elk arrive because of the limited amount of standing forage, the need to prevent depredations on adjacent lands, to reduce road kills, and the importance of keeping brucellosis infected elk from coming in contact with livestock.

Various range management practices are employed to increase forage production. These include: irrigation of approximately 2,200 acres, prescribed burning, harrowing fields in spring, and renovation of brome/alfalfa fields which have declined in vigor with grassland plantings (Wilbrecht, 1982). The objectives are to maximize forage production and utilization of the forage by elk thus reducing the need for supplemental feeding. Since forage production surveys were begun in 1973, there has been a significant ($r = 0.604$, $df = 14$, $p < 0.05$) positive trend in herbaceous forage production on the Refuge (Table 1).

Table 1. Herbaceous forage production, National Elk Refuge, 1973-1987.

Year	Tons of Forage Produced
1973	11,815.7
1974	12,742.2
1975	13,815.2
1976	12,946.0
1977	12,497.0
1978	16,482.9
1979	9,108.0
1980	13,065.6
1981	17,747.3
1982	13,577.5
1983	15,889.0
1984	15,468.0
1985	19,706.6
1986	17,599.3
1987	14,821.0
Mean	14,484.2
SD	2,717.7

Table 2. Annual forage production (tons) by major plant groups on the National Elk Refuge, 1983-1987, as measured from clipping surveys each year during September and October.

Year	Herbaceons	Shrubs	Total Production
1983	15,889	3,320	19,209
1984	15,468	6,885	22,353
1985	19,707	3,048	22,755
1986	17,599	4,850	22,449
1987	14,821	3,127	17,947
Mean	16,652	4,246	20,943
Sd	2,027	1,649	2,209

Over the past five years, annual production of herbaceous forage has averaged 16,697 ±1,972 tons (Table 2). Another 4,246 tons of current annual production of shrubs increases the total to 20,943 tons of production. Elk are primarily responsible for removal of forage, although the growing Jackson bison herd, which winters on the NER and averaged 85 animals over the past 5 years, probably consumes 100 plus tons. We estimate a daily intake rate of 10 pounds of forage/elk (2% of body weight for a 500 pound elk; Nelson and Leege, 1982). The mean weight of elk in the NER herd over the past 20 years was 443 pounds (Table 3). Ten pounds of forage therefore equals a 2.3% daily intake rate. We can calculate the adequacy of the annual forage crop as follows: 7,500 elk x 165 days x 10 pounds/elk/day = 6,188 tons; 16,697 ÷ 6,188 tons = 2.77.

The herbaceous production is approximately 280% of the forage requirements of 7,500 elk during the 5.5 months (mid-November to early May) that they spend on the NER. This assumes total utilization of all herbaceous forage which is unrealistic due to reduction of availability due to snow and non-uniform distribution of use across the Refuge, and limited palatability of some forage. Furthermore, even for cured grasses, allowable use should probably not exceed 75 - 80% (T. Hobbs pers. comm.). In reality, utilization ranges from 5 - 20% on northern management units in the Gros Ventre hills where snow accumulations are greatest, and 60-85% on certain units of the south half of the Refuge adjacent to supplemental feeding areas (Figure 1). The mean weighted average utilization from spring utilization surveys from 1984 to 1988 was 30.0% (Table 4). Thirty percent of 16,697 tons = 5,009 tons of forage consumed.

Consequently it is not an insufficient quantity of natural forage that precipitates the need to supplementally feed elk, but rather limited availability of forage beneath the typical snow-pack in Jackson Hole plus increased density and crusting of the snow-pack as winter wears on. During the 76 years of the Refuge's history, no supplemental feeding was necessary nine winters. Because much of the Refuge is flat or gently sloping, and because Jackson Hole is subject to windless periods of extreme temperature inversions, snow received after October often remains on the ground until late March or April. But during those occasional winters of below normal snowfall, the elk herd can free-range on the standing forage crop on and adjacent to the Refuge for most or all of the winter. During such winters, far more elk do not migrate down to the Refuge and remain in GTNP or the BTNF (Boyce, 1988). We are presently working toward developing a nutritionally based model of carrying capacity for the NER.

Supplemental Feeding

Type of Feed.--Since 1975, pelleted alfalfa hay, distributed by mechanized equipment, has been fed to the elk herd. The feed is purchased on contract through a competitive bid process. The contract specifies that the contractor must deliver and store the feed in the Refuge's four covered haysheds, each of which holds approximately 850 tons. We enter each winter with all sheds filled to capacity

Table 3. Elk weights and herd composition on the National Elk Refuge, 1968-1987.

	Winter Elk Herd				
	Bulls	Spikes	Cows	Yearling Cows[b]	Calves
% Composition	15	6	55	6	18
Mean Weights[a]	522	389	500	364	245
N	17	8	270	11	31

[a] from Smith and Robbins 1984 and National Elk Refuge files.

[b] total cows = 61%; the % yearling cows is assumed to approximate the % spike bulls in the herd and is not derived from census data.

Table 4. Forage utilization spring 1984-1988 on the National Elk Refuge. Utilization is frequency of plants grazed along permanent transects. Mean weighted averages are calculated by weighting forage utilization for each transect sampled by the acreage it represents.

Utilization	1984	1985	1986[b]	1987	1988	Mean
Mean	50	32	NS	47	57	51.4
Mean weighted	32	22	NS	27	39	36.4
No. transects sampled	34	[a]	NS	47	48	35.4

[a] Occular estimates
[b] Not sampled

(approximately 3,400 tons) to ensure sufficient feed is on hand for the worst case scenario (largest number of elk and longest feeding period anticipated).

The hay pellets purchased are 0.75 inch diameter x 1.5 - 2.5 inches long made from sun cured, first or second cutting alfalfa. The final product must contain less than 10% non-alfalfa hay and may contain up to 2% bentonite, a binder. No other additives are allowed. The alfalfa hay is ground, injected with dry steam, then extruded through dyes and cooled. Over the past 5 years, the cost of delivered pelleted hay has ranged from $102 - 117/ton and averaged $108/ton.

Feeding Techniques.--In December, the Refuge biologist and a biologist from the Wyoming Game and Fish Department's Office in Jackson begin weekly monitoring of snow conditions, forage utilization by elk, and forage availability. The Refuge biologist also observes and maps elk distribution on the Refuge 2-3 times/week. The biologists determine from this information when supplemental feeding should commence and so recommend to the Refuge Manager and District Supervisor of the Wyoming Game and Fish Department. To allow the rumen flora to adjust to the change from standing forage to alfalfa hay, supplemental feeding begins while natural forage remains available. The ration is increased over a week's time from only 3 or 4 pounds/elk/day to a level commensurate with environmental conditions and natural forage availability.

Initially, the elk on the Refuge are separated into four herds at traditional feeding areas, 1 mile or more apart, by luring them with feed trucks. Two caterpillar crawler tractors pulling feed trailers with capacities of 10 and 13 tons, and a Kenworth truck, (military surplus Viet Nam troop transport) modified to carry 20 tons of pelleted hay, are used to feed elk. The herds of elk are fed daily at 8:00 a.m. and the feed trucks remain with each herd for 30-45 minutes while the drivers count the elk and observe and record elk behavior.

The feed is spread in long, thin (approximately 1.5 pounds/foot), parallel lines to distribute the elk on the feed. The feed is dispensed rapidly to provide an entire herd equal access to the feed. Feed for a herd of 2,000 elk is dispensed in 20-30 minutes. With mechanized, over-snow equipment, elk can be moved on a regular basis to clean feeding areas and to areas where natural forage remains available, but where large numbers of elk may not travel and free-range on their own once supplemental feeding has begun. From 1968 to 1987, the elk were fed an average 79.1 $\pm$18.2 days/winter. The average beginning date of feeding was January 21 and April 10 was the average ending date. Termination of feeding depends upon snowmelt and subsequent spring green-up. The daily ration level averaged 7.63 $\pm$1.34 pounds/elk during those years. Feeding trials (Smith and Robbins, 1984, Oldemeyer et al. this proceeding) established the basis for intake requirements but the daily supplemental ration may range from 3-12 pounds depending upon daily environmental conditions, available natural forage, and elk behavior.

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If we assume a daily intake rate of 10 pounds/elk/day during the 165

days that the majority of the elk herd remains on the Refuge (mid-November to May 1), then we can calculate percentages of natural forage and supplemental feed comprising elk diets.

Supplemental Feed
79 days x 7.6 pounds/day x 7,319 elk - 2,000 pounds/ton = 2,197.2 tons

Natural Forage
79 days x 2.4 pounds/day x 7,319 elk - 2,000 pounds/ton = 693.8 tons

86 days (before and after supplemental feeding period) x 10 pounds/day x 7,319 elk = 3,147.2 tons

Total = 693.8 + 3,147.2 = 3,841.0 tons

Total Dietary Intake = 6,038.2 tons; 36.4% supplemental feed and 63.6% natural forage.

Cost of Feeding.--The following calculations of annual costs of supplementally feeding elk on the NER are based upon current labor and fuel costs, daily feed levels for the past 20 years, and our objective number of 7,500 elk.

$$\frac{7.6 \text{ lbs./elk} \times 7{,}500 \times \$108/\text{ton}}{2{,}000 \text{ lbs./ton}} = \$3{,}078/\text{day}$$

Cost of Fuel for Equipment/day at $1.12/gal.
135 gallons/week for crawler tractors and Kenworth plus 10 gallons/week for forklift divided by 7 days/week = $23.20/day.

Cost of Labor
3 laborers x 3 hours/day x $11.25/hour = $101.25

Total Feeding Cost/day

Feed	$3,078.00 (28.5 tons)
Labor	101.25
Fuel	23.20
	$3,202.45/day
x	79 days
	$252,993.55/winter

Cost/elk/year = $33.73.
Administrative costs and costs of equipment purchase and maintenance are not included.

Advantages of Mechanized Feeding of Pelleted Hay.--Compared to feeding elk with long hay from horse-drawn sleighs, which is how elk were formerly fed on the NER, mechanized feeding of hay on the NER provides several advantages (Smith and Robbins 1984):

A. Pelleted Alfalfa Hay
   1. Is more compact, thus reducing storage and handling requirements.

2. Is of consistently high nutritional value, averaging 16.5% crude protein and 60% digestibility, compared to former long hay sources available in northwest Wyoming.
3. Is less wasteful than long hay.
4. By virtue of being compressed into pellets, the most nutritious portion, the leaves, are not lost in snow or blown away by wind.
5. Maintains its quality over several years and does not spoil if protected from moisture.

B. Mechanical Handling and Feeding of Pelleted Hay
1. Reduces labor costs dramatically and reduces total feeding cost, despite the higher price of pellets vs. long hay, by about 12% in 1975 (Robbins and Wilbrecht 1979) and 8% in 1982 (NER files unpublished). These savings may not be achievable when small numbers of animals are being fed.
2. Enables animals to be fed rapidly, reducing competition for food.
3. Permits feeders to move elk long distances from feed storage sheds to areas of available natural forage, and to feed on clean sites on a daily basis to reduce potential for transmission of parasites and disease organisms.

Winter Mortality.--One measure of the supplemental feeding program's success is survival of elk. Each winter an effort is made by the Refuge staff to locate and document all winter mortality acaross the Refuge. Baseline information on age, sex and evidence of parasitism, disease, and injuries are recorded (Smith 1985). Over-winter mortality of elk on the National Elk Refuge has averaged 1.4% of the herd annually during the past 20 years. Given that this is a relatively old-aged elk population because nearly 75% of the elk summer in Yellowstone and Grand Teton National Parks and are difficult to harvest (Smith and Robbins in prep.), the mortality rate is remarkably low.

Conclusions

Supplemental feeding of elk on the NER has proven, over the past 76 years, to be an effective means of maintaining large numbers of elk on an area representing only 25% of the historic elk winter range in Jackson Hole. Likewise, it has reduced natural mortality rates to about 1.4% of the herd/year and eliminated winter depredations on Valley ranchlands. However, supplemental feeding is an extremely costly program. Concentration of large numbers of elk for several months increases the potential for disease transmission and is probably responsible, in part, for the incidence of brucellosis (Murie 1951, Thorne et al., 1979), scabies (Smith, 1985) and possibly other diseases (Franson and Smith, in press) in the Jackson elk herd.

Winter feeding can be utilized to maintain elk numbers in the face of habitat degradation or usurpation by humans. However, it should not be viewed as an alternative to sound land management practices and planning that provide sufficient high quality habitat for wildlife.

Literature Cited

Anderson, C. C. 1958. The elk of Jackson Hole: A review of the Jackson elk studies. Wy. Game and Fish Comm. Bull. No. 10. 184pp.

Boyce, M. S. 1989. Elk management in North America: The Jackson elk herd. Cambridge Press, Cambridge, U. K.

Brown, C. 1985. Sand Creek elk: Population status, movements and distribution. Id. Dep. Fish and Game Job Compl. Rpt. Boise, Id. 118pp.

Cole, G. F. 1969. The elk of Grand Teton and Southern Yellowstone National Parks. National Park Service Res. Rpt. GRTE-N-1. Washington, D. C. 80pp.

Franson, J. C. and B. L. Smith. 1988. Septicemic Pasteurellosis in elk (Cervus elaphus) on the United States National Elk Refuge. J. Wildl. Diseases 24(4):715-717.

Murie, O. 1951. The elk of North America. Stackpole Books, Harrisburg, Pa. 376pp.

Nelson, J. R. and T. A. Leege. 1982. Nutritional requirements and food habits. Pp. 323-367 in J. W. Thomas and D. E. Toweill (eds.). Elk of North America: Ecology and Management. Stackpole Books, Harrisburg, Pa. 698pp.

Oldemeyer, J. L., R. L. Robbins, and B. L. Smith. 1988. Effect of feeding level on elk weights and reproductive success at the National Elk Refuge. This Proceeding.

Robbins, R. L. and J. E. Wilbrecht. 1979. Supplemental feeding of elk wintering on the National Elk Refuge. Pp. 225-258 in M. S. Boyce and L. D. Hayden-Wing (eds.). North American elk: Ecology, Behavior and management. Univ. of Wyoming Press, Laramie. 294pp.

Smith, B. L. 1985. Scabies and elk mortalities on the National Elk Refuge, Wyoming. Pp. 180-194 in R. W. Nelson (ed). Proc. Western States and Provinces Elk Workshop. Alberta Fish and Wildl. Div., Edmonton. 218pp.

_____., and R. L. Robbins. 1984. Pelleted alfalfa hay as supplemental winter feed for elk at the National Elk Refuge, Wyoming. U. S. Fish and Wildl. Serv., National Elk Refuge. Jackson, Wy. 73pp.

_____., and _____. In prep. Migrations and management of the Jackson Elk Herd, Wyoming.

Thorne, E. T., J. K. Morton, and W. C. Ray. 1979. Brucellosis, its effect and impact on elk in western Wyoming. Pp. 212-220 in M. S. Boyce and L. D. Hayden-Wing (eds.). North American elk: Ecology, behavior and management. Univ. of Wyoming Press, Laramie. 294pp.

Wilbrecht, J. E. 1982. National Elk Refuge: History and management including use of prescribed fire. Pp. 101-113 in J. E. Lotan (ed.). Proc. Intermountain and Rocky Mountain Fire Council. Missoula, Mt. 113pp.

_____. and R. L. Robbins. 1979. History of the National Elk Refuge. Pp. 248-255 in M. S. Boyce and L. D. Hayden-Wing (eds.). North American elk: Ecology, behavior and management. Univ. of Wyoming Press, Laramie. 294pp.

THE EFFECTS OF SUPPLEMENTAL FEEDING ON ELK WINTER MORTALITY PATTERNS IN SOUTHEAST IDAHO

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Abstract

The ecology of elk (Cervus elaphus) was studied in southeast Idaho from 1976 to 1984. An unusually harsh winter (1981-1982) offered an opportunity to evaluate the effects of a supplemental winter feeding program on an elk population. A late-winter survey of herd mortality indicated that a herd fed alfalfa hay at <4 lbs./animal/day suffered greater mortality ($P<0.01$) than an adjacent herd not offered supplemental forage. Utilization of mark-recapture techniques to estimate total mortality indicated that 58+/-1 ($P<0.05$, S.E.=0.43) elk provided supplemental feed died. No dead elk were observed on the adjacent winter range where no supplemental forage was available. The major age class (n=40) affected was calves (78%). The results of this study suggest that the utilization of stored hay was probably a function of opportunism by elk rather than starvation. The losses at this artificial feed site were caused by inadequate daily rations (<4 lbs./animal/day) and failure to properly disperse the feed in a manner to reduce the effects of social dominance in elk.

Introduction

Idaho's approach to elk management is to maintain elk populations within existing forage supplies and depends upon the ability of the habitat to support self-sustaining elk populations. However, like other western states, Idaho does routinely provide supplemental winter forage for some elk. This is, however, limited in Idaho to a few small sites in the south-central part of the state where encroachment by urban and agricultural development has eliminated critical elk winter range. Generally, Idaho's policy is to feed only on an emergency basis during "critical periods of stress". The intent of the policy is to "provide emergency feed for big game animals only during those periods of critical stress and not as a sustaining program which would carry larger game populations than the range can normally support". Only a small proportion (<1%) of Idaho's elk population has ever received artificial feed.

The implementation of emergency and/or supplemental artificial feed operations for elk in winter is controversial, inconsistent with contemporary game management principles, and symptomatic of greater habitat problems (Boyd 1978, Peek 1986). Others regard properly administered feeding programs a prudent, feasible, and an acceptable method to sustain larger ungulate populations if harvest is adequate to control herd size (Ozoga and Verme 1982). In any case, the presence of large numbers of elk associated with stored agricultural crops during demanding winter weather, often triggers the interpretation that elk are unable to locate adequate forage. The underlying premise being, if not fed over-winter, mortality and loss of productivity will occur. Through policy and action the implementation of artificial feeding operations insinuates that supplemental feed is required to eliminate the deleterious effects of lost or inadequate natural carrying capacity.

The unusually harsh winter (1981-82) in southeast Idaho provided the opportunity to evaluate commonly used, but subjective, indicators of nutritional stress; 1) apparent scarcity of natural foods, 2) displacement from normal winter range, 3) use of stored hay and other agricultural crops, and 4) combined with severe winter conditions are valid indicators of starvation in elk. Based upon the above criteria, the Stump Creek elk herd received supplemental hay for the first time during the 1981-82 winter. After an unusually high incidence of mortality was detected in early spring on the Stump Creek winter range, a study to document mortality was designed and implemented. The objectives were to document and compare winter elk mortality on the Stump Creek winter range and a companion but unfed elk herd on Schmid Ridge.

This work was supported by the Federal Aid in Wildlife Restoration Act under Pittman - Robertson Project W-160-R.

Study Area

Based on previous telemetry work to investigate the impacts of phosphate mining on elk, the Stump Creek and Schmid Ridge areas in southeast Idaho were recognized as important elk winter ranges (Kuck 1984). The Schmid Ridge and Stump Creek winter ranges lie approximately 24 and 48 km (15 and 30 miles) northeast of Soda Springs respectively and are two of five major northwest-to-southeast ridges characterized by the presence of open wind-swept ridges at elevations from 2,100 to 2,400 m (7,000 to 8,000 feet). These wind-swept ridges normally remain relatively snow-free, although only limited forage, primarily of cured grasses and small shrubs is available. The steppe-like vegetation on these ridges is characterized by annual and perennial grasses dominated by bluebunch wheatgrass (Agropyron specatum), needle-and-thread grass (Stipa comata), bluegrasses (Poa spp.), cheatgrass (Bromus tectorum) and Idaho fescue (Festuca idahoensis). Low shrubs include big sagebrush (Artemisia tridentata) and blacksage (Artemisia nova). Southern slopes adjacent to ridges are dominated by big sagebrush and upland shrubs, including Saskatoon serviceberry (Amelanchier alnafolia), common chokecherry (Prunus virginia), and common snowberry

(Symphoricarpos occidentalis), interspersed with stands of quaking aspen (Populus tremuloides). Douglas-fir (Pseudotsuga menziesii) and mixed Douglas-fir-aspen communities predominated adjacent northern slopes.

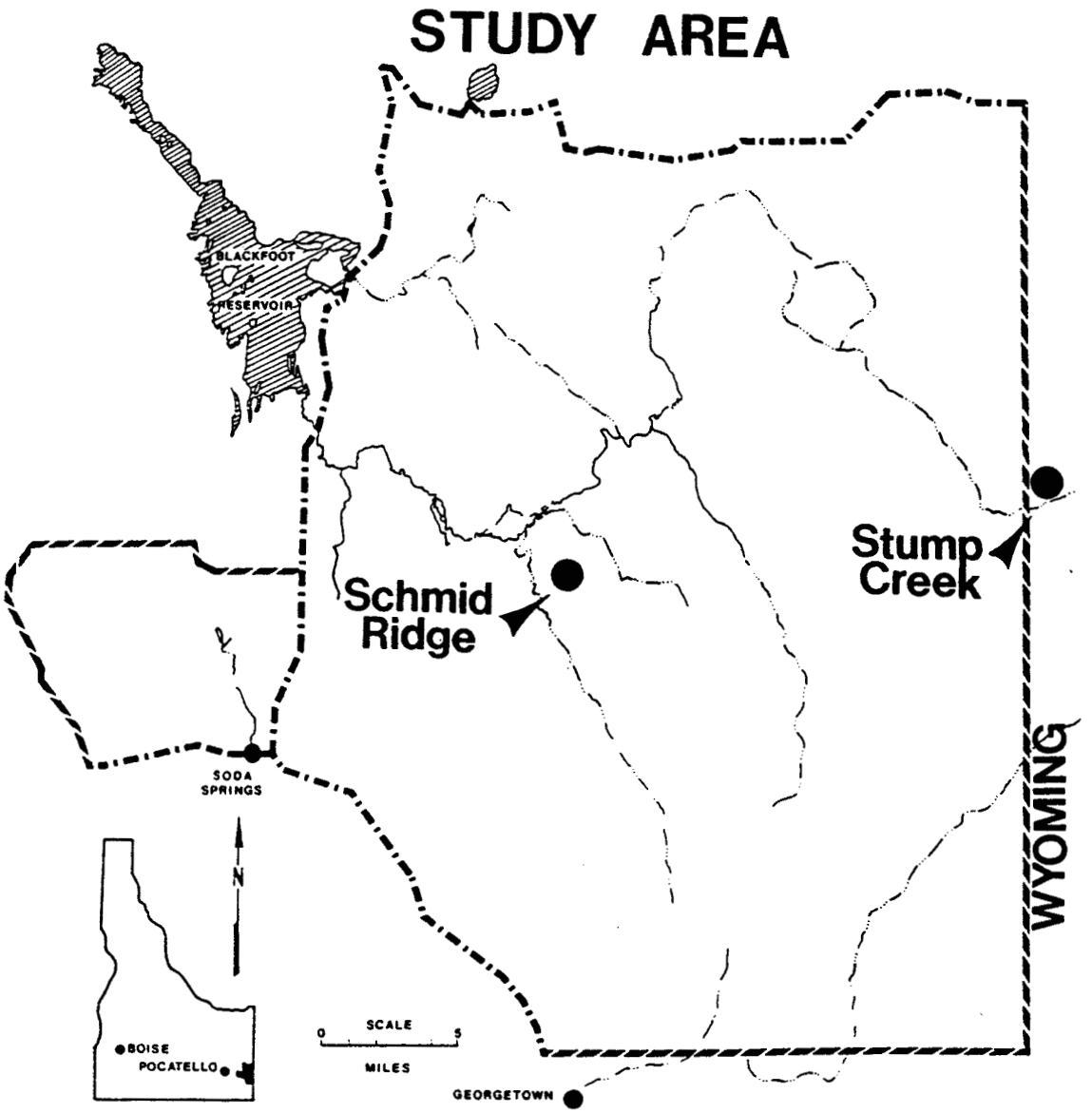
Winter weather is typically harsh, with snowfall on about one-third of winter days. Approximately half of the annual precipitation is received between November and May in the form of snow. Mean daily temperature in January is -9 degrees C, and minimums of -29 degrees C regularly occur. Snow cover occurs at low elevations from late November until April, longer at higher elevations. Average annual precipitation varies from 38 cm at low elevations to 114 cm at high elevations. Weather conditions during the 1981-82 winter exceeded normal extremes and the first two weeks of January were unusually harsh.

Previous radiotelemetry data demonstrated that the wind-swept steppe vegetation type was highly selected for by elk in winter, although it's availability was limited (Kuck 1984). Adjacent stands of aspen and conifer were also used frequently throughout the winter but under different conditions. Conifer stands offered browse and protection from storms and wind, as well as shallower snow than other areas during periods of severe winter conditions. Aspen stands on south slopes provided forage as well as milder temperatures during sunny weather. Use of vegetation types varied considerably from year-to-year, depending on depth of snow, extent of stormy periods, and how much crust developed. All aspects were used, although south and southwest exposures were selected for, and moderate and steep slopes were preferred. Based upon helicopter inventories the pervious winter at least 168 and 52 elk wintered on the Stump Creek and Schmid Ridge winter ranges in 1981 (Kuck 1985).

Methods

The possibility of a significant elk mortality near the Stump Creek feed ground was detected during a fixed-wing aerial sage grouse (Centrocercus urophasianus) lek survey on April 28, 1982. Initial observations were confirmed the following day when 25 dead elk were observed near the mouth of Stump Creek during another fixed-wing flight to monitor movement to individual radio-tagged elk.

The total number of dead elk on the Stump Creek winter range was estimated by the use of a capture/recapture technique (Rice and Harder 1977) that required marking a sample of dead elk on the winter range. This was done by having twelve observers (five on horseback, seven on foot) search the area of known mortality. At each observed carcass, a three by twelve inch section of white nylon belting was staked one to two feet north of the carcass. This type of mark fulfilled the requirement of being visible from an observation plane 100% of the time, but still small enough to not increase the visibility of the marked animal. After marking, two flights were independently conducted to count marked and unmarked carcasses. The numbers of each were used in the estimator presented by Rice and Harder (1977) to provide an estimate of the number of dead elk present.


STUDY AREA
BLACKFOOT
RESERVOIR
Schmid
Ridge
Stump
Creek
WYOMING
SODA
SPRINGS
N
BOISE
POCATELLO
SCALE
0
5
MILES
GEORGETOWN

After each carcass was marked, the sex of each carcass was determined and the lower jaw collected. Males were determined by the presence of antler pedestals. Estimates of age from jaws was later determined from tooth replacement and wear (Quimby and Gaab 1957) by a team of three observers.

To compare relative mortality of elk on the Stump Creek winter range with the elk on the Schmid Ridge winter range, fixed-wing flights were conducted. Two flights were conducted on each winter range along predetermined flight lines 0.5 mile apart. All live and dead elk observed were counted on each winter range. A difference of proportion test (Rice and Harder 1977) was done to determine if observed differences were significant.

Results

The aerial survey of winter mortality comparing elk losses on Schmid Ridge to Stump Creek indicate that losses for fed elk on Stump Creek far exceeded ($P<0.01$) those for unfed elk on Schmid Ridge (Table 1). The average proportion of dead animals to total animals counted during two surveys on Stump Creek was 0.25. No dead elk were observed on Schmid Ridge.

Table 1. Observed elk mortality on Schmid Ridge and Stump Creek, study areas, southeast Idaho, 1981-82.

Date	Location	No. Dead	Total Observed	Ratio (No. Dead) Total	Significance
5/1/82	Schmid Ridge	0	131	0.0000	
	Stump Creek	29	117	0.2497	$P < 0.01$
5/12/82	Schmid Ridge	0	89	0.0000	
	Stump Creek	35	142	0.2465	$P < 0.01$

Utilization of mark-recapture techniques to estimate total mortality indicated that at a 95% level of confidence, 58+/-1 (S.E. + 0.43) elk died in the vicinity of the Stump Creek feeding area. Three additional elk were buried on the feeding area prior to this survey indicating that a minimum of 60 elk had died in the vicinity of the feed ground.

The age of dead elk, based on tooth eruption and wear of 40 jaws collected, indicated that the major age class affected was calves (<1 year, Table 2). One calf and one yearling exhibited symptoms of lumpy jaw. No other symptoms of disease were apparent. The presence of antler pedestals proved on unreliable indicator of sex in calves and no conclusion could be drawn for this parameter.

Table 2. Mortality of elk on Stump Creek by Age Class.

Age Class	Age	Number	Percent
Calf	< 1 year	31	78
Subadult	1-2 years	3	8
Adult	3-8 years	4	10
Old	> 8 years	2	5
TOTAL			100

Discussion

Elk have successfully adapted to the harsh winter conditions that typify their winter habitat in southeast Idaho. Winter ecology, within the phosphate impact area of southeast Idaho is characterized by the successful utilization of numerous windswept ridges (Kuck 1984). Windswept ridges appear to dictate winter distribution by serving as travel lanes where energy expenditures are minimized while elk search for adequate forage supplies (Pianka 1978). The principle of optimal forage assimilation through the minimization of energy loss suggests that selection for these ridges is primarily a function of lack of snow deposition and not the quality or quantity of forage available. Forage supplies of higher quality and quantity are available in other areas not associated with these ridges but greater snow depths apparently increase the cost of forage assimilation beyond their value.

Both Stump Creek and Schmid Ridge elk herds normally compensated for harsh winter conditions by using adjacent stands of aspen and/or Douglas-fir. Highly preferred were northern exposed conifer stands with a network of trails that were established through repeated use during periods of heavy snow accumulations. Apparently under these conditions elk were able to secure enough nourishment without excessive energy loss. No abnormal level of over-winter mortality was detected during other harsh winters.

Use of windswept ridges may be an important adaptive strategy to minimize interspecific competition with mule deer and moose. Deer are less tolerant of deep snow than elk and concentrate at lower elevations where snow accumulations are typically less (Kuck 1984). Moose, which are more adapted than elk for successful survival in a snow environment, do not concentrate but are widely dispersed and utilize deeper snow areas dominated by aspen and conifer (Kuck 1984).

This system of winter distribution and habitat partitioning by mule deer, elk, and moose was, however, not maintained under the extreme winter conditions of 1981-82. This breakdown in traditional winter range utilization was particularly apparent for elk during the first two weeks of January. It appeared that normal elk winter distribution is dependent on prevailing westerly winds. The first two weeks of January were characterized by strong, southerly winds in association with heavy snowstorms. These southerly winds, extreme temperatures, and an abnormal amount of snow on traditional elk winter ranges may have created an unusual

energy deficit situation for these elk herds. The elk responded to this abnormal situation by abandonment of traditionally used winter ranges. This abandonment may have been an effort to minimize energy loss rather than an indication of serious physiological stress and/or malnutrition.

The absence of stress and/or nutritional deficiency is further supported by observations of elk on Schmid Ridge and other wintering elk populations within the region. Those elk that did not encounter stored hay or active livestock feeding operations during the intense winter storm period later reestablished normal habitat use patterns without suffering detectable mortality. This observation is corroborated by the successful survival of 12 Schmid Ridge calves that were previously trapped at birth and fitted with expandable radio-collars (Kuck et al. 1985).

The only discernable difference between the Stump Creek and Schmid Ridge population was the availability of stored hay at an active livestock feed ground 1 mile east of the traditional winter range. The intense weather conditions which caused the displacement and concentration of elk at the livestock feed operation led to the interpretation that elk were under stress and a decision to feed the elk was made. The decision was compounded by pressure from the general public and, specifically, by the individual landowner whose livelihood was being affected by the elk. The complexity of the decision was compounded by questions of jurisdiction when the 250-300 Idaho elk shifted onto a private livestock operation in Wyoming.

Excellent winter survival of the Schmid Ridge herd suggest that the initial use of hay at Stump Creek was a function of hay availability rather than need. The initial accumulation of elk at the mouth of Stump Creek was in response to short-term weather conditions on their traditional winter ranges and not the long term need for forage. Despite equally hard winters in the past, "old timers" of the valley cannot remember elk ever concentrating at the mouth of Stump Creek. Elk are opportunists, once the hay was encountered, the scenario was set for the interpretation that the elk were in nutritional stress.

The decision to implement an emergency feeding operation can effect elk behavior in succeeding years. Once the availability of hay is established, elk often return in subsequent years independent of habitat and/or weather conditions. Such a situation occurred on Stump Creek. A decision based on an erroneous assumption of physiological stress, encouraged by public pressure can change elk behavior and lead to a long term feed ground operation. The Schmid Ridge elk herd demonstrated that elk are remarkably hardy and adaptable. An inaccurately justified feed ground that evolved to compensate for perceived lost habitat, blocked migration routes and other habitat deficiencies can permanently prevent the reestablishment of natural foraging strategies and distribution for elk. The decision to feed elk is important and must be based upon solid site specific information and an appreciation of the consequences.

Elk were fed at Stump Creek through a cooperative arrangement established with the involved livestock operator. Evidence indicates that the Stump Creek herd was fed hay at a rate of less than 4 lbs./animal/day,

substantially below the recommended levels of 6 to 8 lbs./animal/day for leafy alfalfa hay or 10 to 12 lbs./day for grass hay. Apparently enough hay was fed to hold the elk to the feed ground but not enough to sustain and/or maintain a healthy herd. A combination of inadequate daily rations, a mortality rate in excess of 20% of the population, and mortality heavily weighted towards calves suggest that starvation has to be considered the cause of elk mortality on Stump Creek. The impact of inadequate rations and limited distribution of feed by the operator intensified the dominance hierarchy in the elk and, apparently prevented access to feed by subordinate animals.

Literature Cited

Boyd, R. J. 1978. American elk. Pages 11-29 in J. L. Schmidt and D. L. Gilbert eds., Big game of North America. The Stackpole Co., Harrisburg, Pa. 494 pp.

Kuck, L. 1984. Cooperative wildlife-phosphate study, Phase I: baseline studies. Idaho Dep. Fish Game, Boise. 268 pp.

Kuck, L., G. L. Hompland, and E. M. Merrill. 1985. Elk calf response to simulated mine disturbance in southeast Idaho. J. Wildl. Manage. 49(3):751-757.

Peek, J. M. 1986. A review of wildlife management. Prentice-Hall, Englewood Cliffs, New Jersey. 486 pp.

Pianka, E. R. 1978. Evolutionary ecology. Harper and Row, Publ., New York. 397 pp.

Ozoga, R. J., and L. J. Verme. 1982. Physical and reproductive characteristics of a supplementally-fed white-tailed deer herd. J. Wildl. Manage. 46(2):281-301.

Quimby, D. C., and J. E. Gaab. 1957. Mandibular dentition as an age indicator in Rocky Mountain elk. J. Wildl. Manage. 21(4):435-451.

Rice, W. R., and J. D. Harder. 1977. Application of multiple aerial sampling to a mark-recapture census of white-tailed deer. J. Wildl. Manage. 41(2):197-206.

ELKHORN WILDLIFE AREA: ARTIFICIAL FEEDING OF ELK

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Abstract:

The project was initiated in 1971 with the acquisition of approximately 7,600 acres. Land acquisition to date totals approximately 10,000 acres.

The project consisted of ten feed sites established at approximately 4,000 feet in elevation and spanning 27 miles along the east slope of the Elkhorn Mountains. The program provided subsistence feed for 1,400 elk from November 25 through April 15, for approximately 145 days each year. The objective was to alleviate damage by elk to private lands in the Baker Valley.

Introduction

Wildlife managers in Oregon have been involved in providing subsistence or supplemental feed for elk since the early 1950's. The objective of Oregon's feeding programs is to alleviate damage by elk to private lands. Currently, three programs are being funded for this purpose.

The first program funded was the Wenaha Wildlife Area near Troy in northwest Oregon. This program began in 1953. Currently 500 to 600 Rocky Mountain Elk receive supplemental feed each winter.

The second program was begun in 1969, at Jewell Wildlife Area, located in the coastal mountains of northwest Oregon, near the town of Jewell. There are 150 to 200 Roosevelt Elk receiving supplemental feed each winter.

The third program was begun in 1971, at the Elkhorn Wildlife Area located in northeast Oregon, near Baker. There are 1,400 to 1,600 Rocky Mountain Elk receiving subsistence or supplemental feed each winter. The Elkhorn program is the most intense in artificial feeding as to numbers of elk, amont of feed, and the length of the feeding season. This paper will address the history, program, objective and biological consequences of the Elkhorn program.

History

The Elkhorn Wildlife Area was established in 1971, to alleviate damage caused by elk to private lands adjacent to the Elkhorn Mountains in Baker and Union Counties. The area now consists of approximately 10,000 acres in several tracts along the east slope of the Elkhorn Mountains.

There is an abrupt transition between summer and winter range in this area. Elevations rise from 3,000 to 8,000 feet in the span of two to three air miles. The Elkhorn Mountains provide excellent elk habtat during the summer, but inadequate winter range. In winter elk migrate to the valley floor where private lands are managed primarily for livestock, cereal grains and hay. Damage by elk to private lands has caused conflicts between private land owners and elk, dating back to the early 1940's.

Description

Ten feed sites span 27 air miles along the east slope of the Elkhorn Mountains. These sites have been established in areas where the elk damage to private lands has caused conflicts in the past. Feed sites are located at approximately 4,000 feet in elevation, which is the mixing area for elk migrating from different drainages at

higher elevations. The numbers of elk fed at each site range from 75 to 400.

Program

High quality hay is provided as supplemental or subsistence feed for approximately 1,500 elk, from December 1 thru April 15 each winter.

Feed sites are located in remote areas and access is limited during the winter which requires feed to be stored at each site. Second and third cutting alfalfa hay is purchased from local producers or received from share cropping on Department lands. Baled hay is used instead of cubes or pellets due to the fact there are so many feed sites, distance between the sites, expense of cubed hay and the equipment to handle it.

Hay is dispensed over the feed sites daily as in livestock feeding operations. The number of elk at each feed site is estimated and the quantity of hay is fed accordingly. Elk are fed eight to ten pounds of hay during severe weather (+20 degrees and below) and five to seven pounds during milder conditions. Average consumption per elk for the 145 day feeding season is six to seven pounds daily.

The annual expenses included in this program are 24 man months, 600 tons of hay, mileage, taxes and assessments. Approximate cost per elk is $100.00 for the 145 day period or $.69 per day.

Objective

The objective of this program has been to alleviate damage by elk to private lands in Baker and Union Counties adjacent to the Elkhorn Mountains. This objective has been accomplished and will continue. The benefits from meeting this objective include:

- Winter feed for 1,500 elk.
- Reduced or eliminated elk damage complaints in this area.
- Eliminating a need for game-proof fences.
- Improving the Department's image with hunters and non-hunters.
- Improves Department/land owner relations.
- Helps meet management objectives in the Starkey and Sumpter Units.

Biological Consequences and Studies

Past history of large feed sites for elk indicate that under crowded conditions elk may develop contagious diseases such as Brucellosis. Seventeen years of feeding elk at the Elkhorn Wildlife Area has, to our knowledge, proven to be free of highly contagious diseases.

An elk feeding plan was adopted in 1986. This plan addresses concerns of livestock producers in the area of diseases transmitted from big game animals to cattle. The plan identifies that ten percent of all big game animals using feed sites will be blood tested.

A portable elk trap was designed, built, and is equipped with a squeeze chute for the purpose of taking blood, tagging, etc. In 1987, 70 elk were trapped and blood tested. In 1988, 267 elk were trapped and blood tested. All animals tested negative to Brucellosis, Blue Tongue and Leptospirosis. Antibodies of P13, IBR, BVD, BRSV and

Hemophilus are being detected in some blood samples. This data is still being analyzed to determine over all health of feed site elk.

Other biological studies such as reproduction, nutrition, etc., have not been conducted in this area, but should be comparable to findings of studies in other western states.

Summary

The Elkhorn feeding program has proven to be a successful management tool when dealing with limited or inadequate winter range.

With the increased demand from hunters and non-hunters for more elk and demands from ranchers for relief from elk damage, artificial feeding of elk is one of the management tools to meet these demands.

Q - Do Oregon and Idaho both pay damages?

A - (ID) The Idaho legislature has just passed a bill under which we will pay landowners up to $2,000. There are certain stipulations in the bill that will work in our favor but as of now we are faced with the problem of payments.

A - (OR) At this time Oregon does not pay compensation.

A - (WA) In Washington, we are required to pay compensation.

Q - I know I may sound strange but what exactly is brucellosis?

A - Brucella arbortus is the name of the bacteria that cause brucellosis. It is an extremely serious problem in the cattle industry. It is a disease that man actually gets - called Bangs Disease - undulating fever is another name for it. The most serious consequences to elk is they usually lose their first calf. Female elk infection rates in the northwest vary from 22 to 40 percent.

A - (WA) Washington has just been declared brucellosis free. The implications to us however are that should our elk ever test positive for brucellosis there will be concern within the livestock industry as to where it came from.

Q - (for Boyce) On the question of aspen regeneration -- has there been any work done specifically on aspen regeneration?

A - Yes, the Forest Service did a burn several years ago (1981). The consequence was that the burn was a real attractant for the elk which hammered the heck out of it. There weren't any aspen regenerated on that burn site because the animals really concentrated on that burn site. If you are going to burn in an area and be effective, it must be on a grand scale, thus far the Forest Service hasn't found it appropriate to burn on a large scale.

Q - (for WA) What is the total cost of feeding you referenced; the cost per elk and what is source of funds used to feed those elk?

A - A comparison between 1974 and 1987 surprises us because our prices are roughly the same without using building costs, land values, and that type of information. In 1974, we estimated the cost per elk we were feeding at $33 per elk. Now, our recent evaluation in using the same criteria shows we are up to about $40 an elk -- source of funds we use for our feeding program include Pitman-Robertson funds for emergency feeding operations

built into our budget a feeding appropriation as part of our wildlife area management program.

A - (Ken Emerson) - Basically the difference between the $33 figure for Washington and Jackson Hole elk and the $100 figure per elk from Oregon is due to the fact that not only am I figuring the tax and assessments on a piece of land but I am sure you are all aware that the more elk you feed the cheaper the program gets. You reach a point there where the man hours are here anyway and they can just about feed another 2-3 hundred elk at each site as readily as they can feed a few. So, the more elk you get, the cheaper the cost is going to be. We are talking about an Oregon feeding program for 1,500 elk compared to 5,000 or 6,000 in Washington.

Q - (to Lon Kuck) - In the two studies you referenced, one had mortality and one didn't - what caused the mortality in the one situation?

A - Basically, we didn't feed them enough. We fed only four pounds a day, and the standard ration is 10 to 12 pounds a day. Then we didn't distribute the feed properly. It was put in a very concentrated area, the dominant animals got enough to survive but the subordinate animals didn't.

Q - (to Boyce) - In regard to the elk/aspen issue, what kind of input, if any, have you received from the recreational community about how they feel about dumping all the aspen for the elk?

A - (Boyce) - That group is not particularly well organized in terms of expressing their opinion. There has been concern expressed by people in the last 50 years over the fact that elk were causing the decline of aspen. It is a question of magnitude of pressure -- it is one side versus the other. We have one of the most outspoken spokesman for the aspen in this room. Aspen is spectacular, particularly in the fall, and it really makes for a scenic view. At the same time, elk are very important to the valley and in general people are much more supportive of maintaining large elk numbers than they are of restoring aspen.

THE IMPACT OF RECREATIONAL VEHICULAR TRAVEL ON ELK IN THE BLAST ZONE OF MT. ST. HELENS

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Abstract

The response of an elk herd to a more than ten-fold increase in recreational vehicular traffic in the Mt. St. Helens National Volcanic Monument was monitored using radio telemetry techniques in summers of 1986 and 1987. Management agencies were concerned that opening the road to recreational traffic would eliminate the elk from the blast zone. Elk continued to use the blast zone habitat after the road was opened, but patterns of elk use were altered. Portions of the drainage previously used were now avoided, including a 500 meter corridor along the road. However, there was no shift in plant community types used overall. The impacts of the shifts in use patterns, and the loss of range along the road corridor are not considered significant to the well-being of the population, as it is currently below carrying capacity.

Introduction

In recent years, numerous studies have focused on the effects of human disturbances on elk (Cervus elaphus) habitat use patterns. Logging and hunting, in particular, have been the primary concerns. As the human population grows, along with ever-increasing levels of environmental awareness and appreciation, a third human activity enters the conflict; public use of backcountry areas for recreation. The purpose of this study was to determine the impact of opening a Forest Service road to recreational travel on Roosevelt elk (C. elaphus roosevelti) in the volcanic blast zone of Mt. St. Helens.

The principal hypothesis of the study was that recreational vehicular travel would reduce the suitability of the blast zone for elk. Secondary hypotheses were: 1) distribution of elk in the study area would be altered after the road is opened to the public; 2) elk use of the area adjacent to the road would be reduced; and 3) elk use of the available plant community types would change after the road is opened, with a shift toward plant communities with greater cover components.

Study Area

The study was conducted in the Clearwater Drainage in the northeastern corner of the Mt. St. Helens National Volcanic Monument (Fig. 1). Most of the Clearwater drainage in the study area was devastated by the eruption of Mt. St. Helens. It is now in the early stages of reforestation, and fits the USDA (1984) definition of transitory range, as it is predominantly a rangeland which has become available as a result of total removal of overstory cover, and the management objective for the drainage is to restore the timber stand as soon as possible. The blast zone plant community is

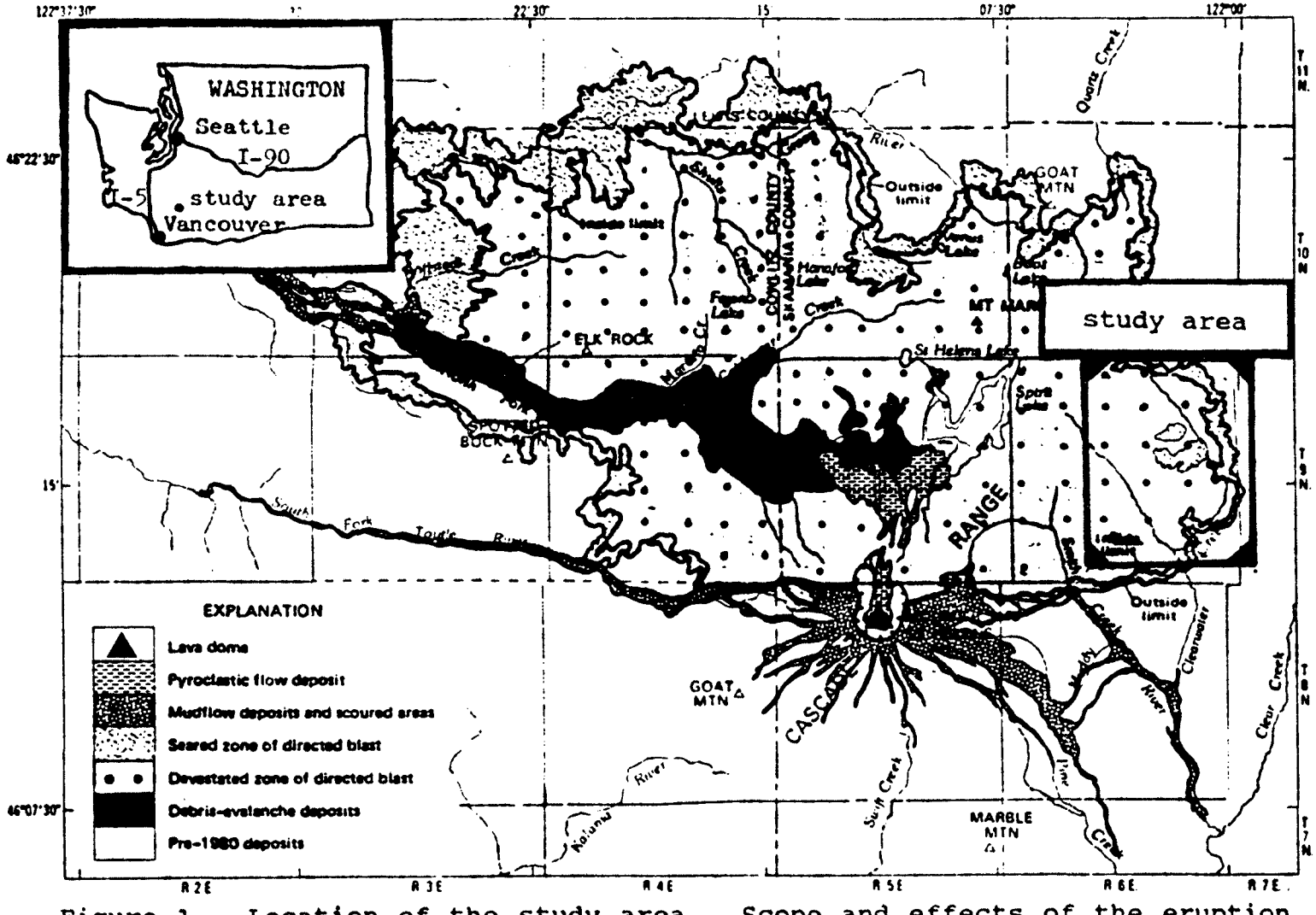

Figure 1. Location of the study area. Scope and effects of the eruption of Mt. St. Helens are also featured. Most of the blast zone is transitory range.

dominated by annual forbs, planted fir seedlings, and perennial grasses. Elk have used the Clearwater blast zone intensively in recent years.

That portion of the drainage not devastated by the eruption lies within the Pacific silver fir zone as described by Brockway et al. (1983). It is dominated by mature Pacific silver fir (Abies amabilis) and contains a number of recent clearcuts (up to 30% of the total area).

The topography of the study area is extremely varied. The Clearwater valley floor is an extensive plain, covering most of the area below the road in elevation. Clearwater Creek runs southward, dropping from about 2400 feet above sea level at its junction with the 2560 bridge to about 1800 feet at its confluence with Bean Creek. High elevations of the surrounding ridges are about 4500 feet. Slopes range from ero degrees on the valley floor to ninety degree cliffs on both east and west ridges. The average slope of each ridge, from valley bottom to peaks, is approximately 35 degrees.

The 2560 road, opened to public travel in 1987, leads from U.S. Forest Service road 25 high on the east side of the Clearwater Creek drainage to USFS road 99 at the head of Bean Creek (Fig. 2). The 2560 provides access to viewpoints of Mt. St. Helens. Much of the 2560 lies within the Clearwater valley, and about four miles of the road is situated between the Mt. St. Helens blast one edge and the valley floor.

Methods

Traffic on the 2560 was monitored with traffic counters at the junction of the 2560 and 25 roads. The counters recorded the number of vehicle trips passing that point.

Elk use of the study area was monitored by radio telemetry and direct observations. Six cow elk were equipped with radio collars, and two were equipped with visual collars. Radio-collared cows were located by triangulation approximately ten times per week at varying times of the day. Visual observations (of any elk) were recorded as they occurred.

Plant communities in the study area were defined by plot sampling and delineated using aerial photography and field reconnaissance.

Secondary variables that could have influenced elk habitat use patterns included weather and additional types of human disturbance. Weather was monitored using rainfall at the local ranger station and discharge measurements of Clearwater Creek. Human disturbance included logging, hunting, and administrative activity. The amounts and locations of each were monitored by periodic interviews of the parties involved and by field observations.

Results

Traffic on the 2560 --
In summer and fall of 1986, administrative traffic accounted for about 2,200 counts at the roadhead. In 1987, the 2560 was open to the public from 0800 through 1700 hours, and summer and fall traffic was mainly recreational travel, with over 60,000

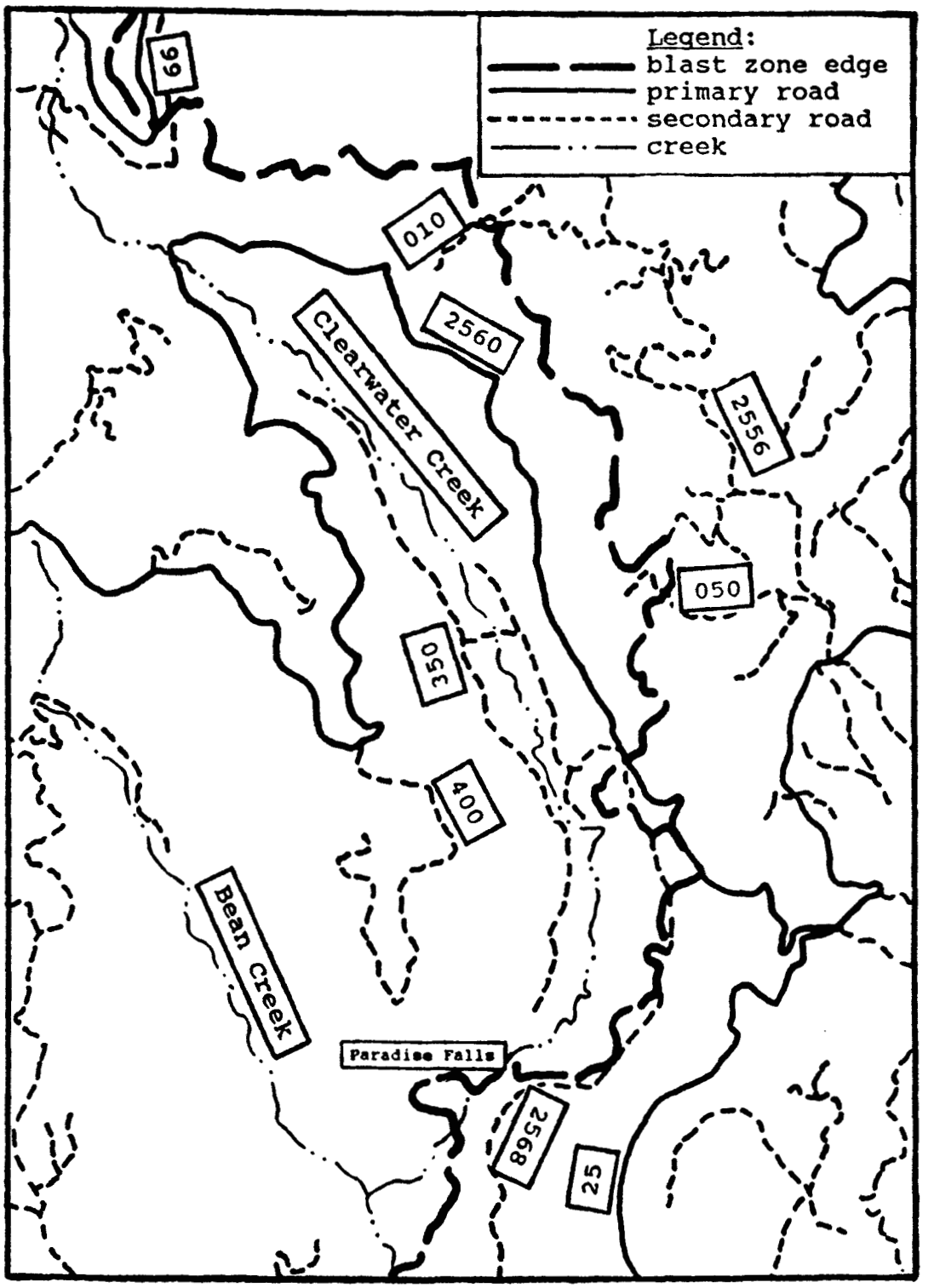

Figure 2. Study area.

counts obtained at the roadhead. In addition to the numeric difference, there were also major temporal differences in the distribution of traffic. In 1986, traffic was heaviest on weekdays during working hours, with very little traffic on weekends. In 1987, traffic peaked around 1800 hours and was heaviest on weekends.

Elk Numbers and Distribution Within the Study Area --

General Elk Distribution in 1986 --
Approximately 175 elk used the Clearwater blast one during the summer and fall. Most of these elk belonged to one of four bands. The Paradise Falls band (approximately 30 elk) used the study area nearly every day. They fed in the blast one during dusk, nighttime, and early morning hours, and bedded in the timber to the east during the rest of the daylight hours.

The northern band (50 to 100 elk) had a home range centered in the timber-clearcut complex on the eastern edge of the study area. They came into the blast one to feed about every two weeks. Once in the study area core, their activity patterns were similar to those of the Paradise Falls band.

The southern band (15 to 18 elk) spent most of the study period south and southeast of the study area core. Earlier in the summer they had mingled frequently with the Paradise Falls band, but during the time period when radio location data were obtained they seldom entered the blast one.

The home range of the Bean Creek band (approximately 40 elk) included the south and southwest margins of the study area of the Clearwater drainage, downstream from Paradise Falls and in adjacent Bean Creek.

Elk did not use the study area in a uniform manner in 1986. They preferred some sections and avoided others. Of the five preferred sections, four were dominated by blast one habitat. Four were avoided; only one of the avoided sections was dominated by blast one habitat. The avoided blast one section contained an active timber salvaging operation.

General Elk Distribution in 1987 --
The distribution and social structure of the Clearwater elk herd was similar in 1986 and 1987, in the sense that the same four main bands were present. However, there were also major differences. Most notable were the more frequent use of the blast one by the southern band, the intermingling of the northern an Paradise Falls bands within the latter's home range, and the reduced sie of the northern band (down from about 55 to about 35 animals in 1987).

Elk Response to Recreational Traffic --

The increase in vehicular traffic on the 2560 road in 1987 did not result in a reduction in the relative frequency of elk use of the blast one communities when compared to the surrounding forest communities ($X2 = 0.41$, $df = 2$, $p = 0.52$). Although there was no significant difference in overall elk use of the Clearwater blast one, a comparison of the 1986 and 1987 elk location data indicate that the elk did not use the study area in 1987 as they did in 1986 ($X2 = 99.73$, $df = 14$, $p < 0.01$). Elk use decreased in seven sections and increased in four (Cech 1988). Perhaps the most direct measure of elk reaction to the 2560 is their distribution in relation to the road (Fig. 4). Elk did not use the blast one uniformly with regard to the road in 1986 ($X2 = 7.38$, $df = 2$, $p < .05$), and in 1987, elk did not use the

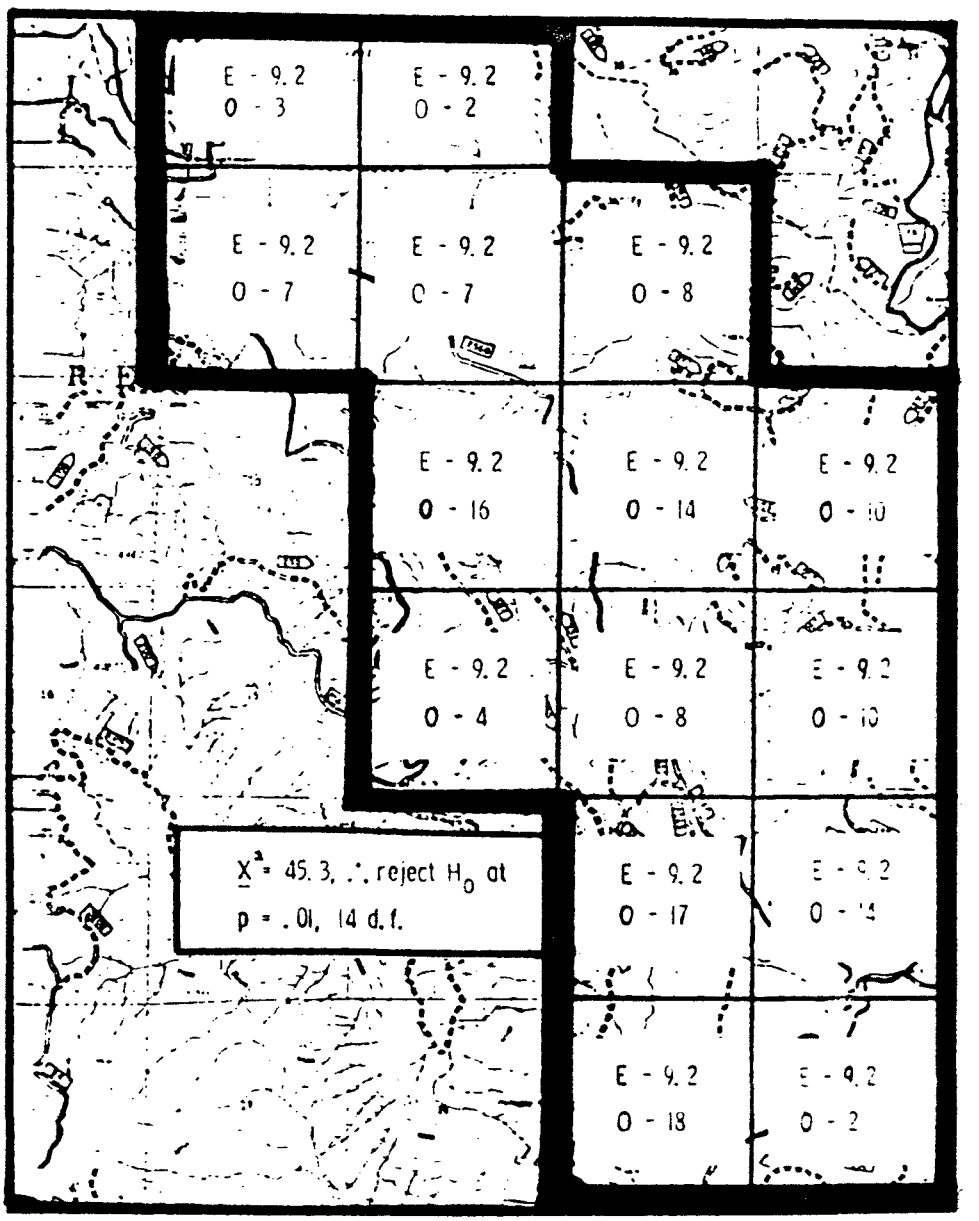

Figure 3. Observed and expected frequencies of all elk - 1986.

blast one in a manner consistent with that in 1986 ($X2 = 20.01$, $p < .01$). In 1987 there was a distinct shift away from the road opened to recreational traffic, whereas in 1986 elk used the areas closest to the road more than other areas. There was no major difference in use of the plant community types between years ($X2 = 8.97$, $df = 5$, $p = 0.11$) (Cech 1988). The mixed forb and snags plant communities were not included in the utiliation analyses because the expected frequencies of locations in each of these types were less than five for each year of the study.

Secondary Variables

Weather --

There was no measurable change in weather patterns in the Clearwater vicinity from 1986 to 1987. Both study seasons were drier than average.

Human Disturbance --

With the exception of the increased recreational traffic on the 2560, there was generally more human disturbance in the study area in 1986 than in 1987.

In 1986, the last Mt. St. Helens blowdown salvage sale, located approximately in the middle of the Clearwater blast one, was active during most of the study period. As noted above, this area was avoided by elk. In 1987 the blowdown salvage was completed in June, and then three smaller sales were conducted on the edge of the blast one to the east.

The major administrative activities included research, silviculture work, and watershed projects. Riparian research was conducted in 1986 but not (to a significant degree) in 1987. Silviculture work (plantation surveys and improvement) occurred in both years, but was more common in 1986 than in 1987. The watershed department's major projects in the Clearwater were riparian planting, hydromulching, aerial seeding, and skid road ripping. The majority of this work was conducted in 1986.

The blast one portion of the study area was difficult to access by hunters in both years. Although the 2560 was open to the public in 1987, it was closed to hunting access. Bow hunter numbers and effort were greater in the study area in 1986 than in 1987, and the bow season was one month later in 1987. Rifle seasons for elk were conducted after the study seasons in both years.

Disscussion

Elk Response to Traffic on the 2560 --

The heavy recreational traffic on the 2560 did not reduce elk use of the blast one. Nearly the same number of animals fed in the blast one when the road was open to recreational use in 1987 as in 1986 when there was only administrative activity in the valley. However, elk use was reduced along the 2560 corridor, and there was a shift in distribution of the elk in the valley. These results are consistent with other studies that have shown that elk avoid the areas of roads in general (Hershey and Leege 1976, Perry and Overly 1976, 1977, Thiessen 1976, Lyon 1979, Rost and Bailey 1979, Lyon and Jensen 1980, Irwin and Peek 1983, Grover and Thompson 1986). As predicted by the road density model of Lyon (1983), sections with the highest density of open road were most impacted by vehicular traffic.

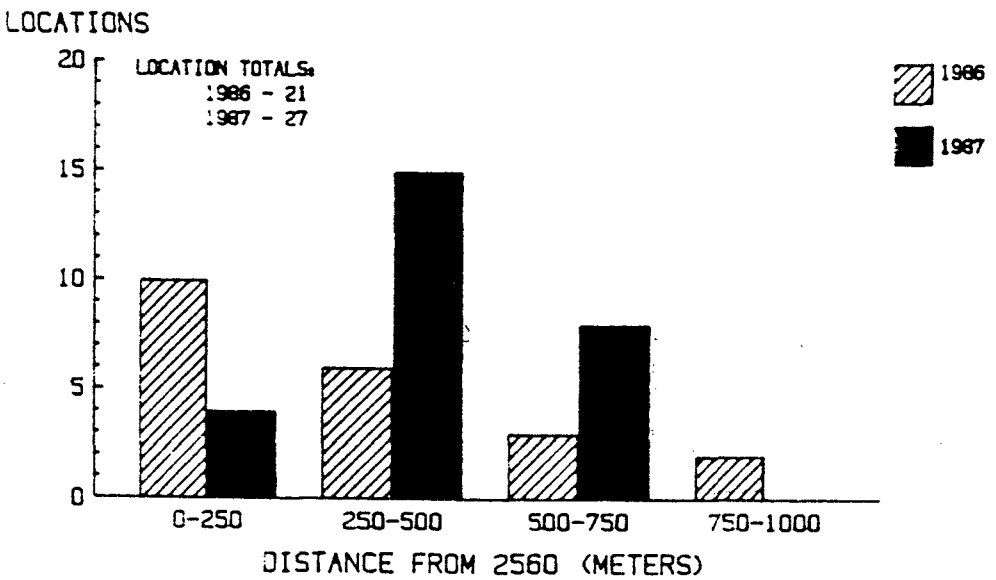

Figure 4. Number of locations in four distance-from-road categories, 1986 and 1987.

The results of this study are significant in several ways. First, road traffic in this study disturbed elk even though it was limited to recreational travel through the area, and was not associated with hunting or other negative stimuli. The administrative traffic of previous years was insufficient to habituate the elk to vehicular traffic. Second, the elk use of the different blast one plant communities types was not significantly different between years. This is explained by the nature of the study area. In the valley floor, where road-associated disturbance influenced elk use, the habitat is relatively homogeneous, and the differences that do exist are largely independent of cover characteristics. Irwin and Peek (1979) and Leckenby (1984) reported altered habitat use patterns by elk in the presence of human disturbance. However, these results were obtained in study areas with greater habitat heterogeneity. Third, the distance-to-road test (Fig. 4) showed that in 1987 elk avoided a 500 meter wide corridor along the 2560 in the blast one, while in 1986 this corridor had the highest levels of use. More interesting than the former is the latter. One possible explanation is the abundance of grasses along the 2560 due to roadside seeding. This explanation is consistent with other studies that showed that elk usually avoid the human disturbance which accompanies roads rather than roads per se (Coop 1971, Ward et al. 1973, Marcum 1976, Schult and Bailey 1978, Ward and Cupal 1980, Edge 1982).

Population Implications --

The movement away from the 2560 is, in effect, loss of summer range habitat. If the elk population in 1987 were at or above the carrying capacity of their summer range (including the 2560-centered corridor), this loss of range would have a direct and detrimental impact on the population. Elk would have to find other suitable range to compensate, or enter the winter seasons in poorer condition, in which case winter survival and calf production would decline (Ward 1977, Lieb 1981, MacArthur et al. 1982).

The Clearwater elk population does not appear to be above the carrying capacity of the study area, since there is little evidence of over-utiliation of the Clearwater's range resources. This is at least partially due to rapid recoloniation of the blast one by forage species. Further, most Cascade elk populations are limited by winter range conditions (Raedeke and Taber 1979). Immigration of neighboring elk bands and rapid recruitment, such as found by Raedeke et al. (1986) in another portion of the volcanic blast one, could cause an increase of the herd substantial enough to surpass the plant recoloniation process. This scenario would occur sooner with the lack of availability of a 2560-centered corridor.

Experimental Validity

The interpretation of the results of this study is limited to a degree by the lack of experimental control. To test for effects of the road traffic we must assume that all secondary variables were unchanged from 1986 to 1987 (Marcum and Scott 1985), and that any changes in elk use patterns were attributable only to the opening of the 2560 to heavy recreational traffic. As noted above we were able to test for changes in weather and administrative disturbance to a limited degree. However, human disturbance factors (other than recreational traffic) did not remain constant over the study period. They were greater in 1986, and perhaps masked the full impact of recreational traffic in 1987. A complete discussion of secondary variables is given in Cech (1988).

Management of Recreational Traffic

Visual observations indicated that elk respond negatively to the following in increasing order: consistent, non-stop traffic; irregular traffic (stopping, rapid acceleration, etc.); moving vehicles with head or arms protruding from windows; parked vehicles with head or arms protruding; and human beings visible as a separate entity from their vehicle. Elk response ranged from increased alertness to flight (Cech in press).

The magnitude of elk response to recreational traffic, and the relationship of the elk population to its carrying capacity, would determine the degree of recreational traffic management needed. Given the conditions in the study area, impacts of recreational traffic could be reduced if the following road management was implemented: 1) keep roads closed to the public at night; 2) keep spur roads closed at all times, and install gates on spurs which are particularly conducive to elk disturbance; 3) designate most portions of roads as non-stop routes (except for established interpretive sites or for emergencies); and, 4) close roads to travel by hunters.

Literature Cited

Brockway, D.G., C. Topik, M.A. Hemstrom, and W.H. Emmingham. 1983. Plant association and management guide for the Pacific silver fir one - Gifford Pinchot National Forest. USDA For. Serv., Pacific Northwest Region. R6-Ecol-130a-1983. 122 pp.

Coop, K.J. 1971. Habitat use, distribution, movement, and associated behavior of elk, Little Belt Mountains, Montana. Mont. Fish & Game Dep., Helena, Comp. Rep. W-120-R-1 and R-2, 61 pp.

Cech, B. 1988. The impact of recreational traffic on elk in the volcanic blast one of Mt. St. Helens. M.S. Thesis, Univ. Washington, Seattle. 74 pp.

Cech, B. (in press) Behavioral response of elk to human disturbance in the volcanic blast one of Mt. St. Helens. pp. 000-000, In Proceedings of the Ungulate Behavior Conference, College Station, TX.

Edge, W.D. 1982. Distribution, habitat use and movements of elk in relation to roads and human disturbances in western Montana. M.S. Thesis, Univ. Montana, Missoula. 98 pp.

Grover, K.E. and M.J. Thompson. 1986. Factors influencing spring feeding site selection by elk in the Elkhorn Mountains, Montana. J. Wildl. Manage. 50(3):466-470.

Hershey, T.L. and T.A. Leege. 1976. Influences of logging on elk on summer range in north-central Idaho. pp. 73-80, In Hieb, S.R (ed). Proc. Elk-logging-roads symposium. Univ. Idaho, Moscow. 142 pp.

Irwin, L.L. and J.M. Peek. 1979. Relationship between road closures and elk behavior in northern Idaho. pp. 199-204, In Boyce, M.S. and L.D. Hayden-Wing (eds). North American elk: ecology, behavior, and management. Univ. Wyoming, Laramie. 294 pp.

Irwin, L.L. and J.M. Peek. 1983. Elk habitat use relative to forest succession in Idaho. J. Wildl. Manage. 47(3):664-672.

Leckenby, D.A. 1984. Elk use and availability of cover and forage habitat components in the Blue Mountains, northeast Oregon, 1976-1982. Wildlife research report no. 14. Oregon Department of Fish and Wildlife. Portland, Oregon.

Lieb, J.W. 1981. Activity, heart rate, and associated energy expenditure of elk in western Montana. Ph.D. Thesis. Univ. of Montana, Missoula. 200 pp.

Lyon, L.J. 1979. Habitat effectiveness for elk as influenced by roads and cover. J. For. 77(10):658-660.

_____ 1983. Road density models describing habitat effectiveness for elk. J. For. 81(9):592-595.

Lyon, L.J. and C.E. Jensen. 1980. Management implications of elk and deer use of clearcuts in Montana. J. Wildl. Manage. 44(2):352-362.

MacArthur, R.A., V. Geist, and R.H. Johnston. 1982. Cardiac and behavioral responses of mountain sheep to human disturbance. J. Wildl. Manage. 46(2):351-358.

Marcum, C.L. 1976. Habitat selection and use during summer and fall months by a western Montana elk herd. pp.91-96, In Heib, S.R. (ed). Proc. elk-logging roads symposium. Univ. Idaho, Moscow. 142 pp.

Marcum, C.L. and M.D. Scott. 1985. Influences of weather on elk use of spring-summer habitat. J. Wildl. Manage. 49(1):73-76.

Morgantini, L.E. and R.J. Hudson. 1979. Human disturbance and habitat selection in elk. pp.132-139, In Boyce M.S., and L.D. Hayden-Wing (eds). North American elk: ecology, behavior, and management. Univ. Wyoming, Laramie. 294 pp.

Perry, C. and R. Overly. 1976. Impact of roads on big game distribution in portions of the Blue Mountains of Washington. pp. 62-68, In Heib, S.R. (ed). Proc. elk-logging roads symposium. Univ. Idaho, Moscow. 142pp.

Perry, C. and R. Overly. 1977. Impact of roads on big game distribution in portions of the Blue Mountains of Washington. Washington Game Department. Environmental Management Division. Applied Research Section. Bulletin no. 11.

Raedeke, K.J., and R.D. Taber. 1979. Mechanisms of population regulation in western Washington forests for Cervus and Odocoileous. Intern. Congress of Game Biologists 14(1982):69-79.

Raedeke, K.J., E.H. Merrill, and S.M. McCorquodale. 1986. Estimates of intrinsic growth rates in three elk populations in Washington. pp. 235-244.

In Eastman, D. (ed). Western States and Provinces Elk Workshop Proceedings, Coos Bay, Oregon. Rost, G.R. and J.A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. J. Wildl. Manage. 43(3):634-641.

Schult, R.D. and J.A. Bailey. 1978. Responses of national park elk to human activity. J. Wildl. Manage. 42(1):91-100.

Thiessen, J.L. 1976. Some relations of elk to logging, roading and hunting in Idaho's game management unit 39. pp. 3-5, In Hieb, S.R. (ed). Proc. elk-logging roads symposium. Univ. Idaho, Moscow. 142 pp.

USDA. 1984. Forest Service Handbook 2209.21. Range analysis and management handbook. Amendment 3. p. 050--8.

Ward, A.L. 1977. Elk responses to human disturbances as determined from heart rate. pp. 44-45, In Denney, R.N. (ed). Proceedings Western States Workshop. Colorado Div. of Wildlife. Denver, CO.

Ward, A.L. and J.J. Cupal. 1979. Telemetered heart rate of three elk as affected by activity and human disturbance. pp.47-56, In Dispersed recreation and natural resource management. Utah State Univ., Logan.

Ward, A.L., et al. 1973. Elk behavior in relation to cattle graing, forest recreation, and traffic. Trans. N. Am. Wildl. Conf. 38:328-337.

Questions from the Audience:

Q - Were radio locations gathered just during daylight hours?

A - No, we have location data from throughout the 24 hour period, seven days a week, every week for three months periods in 1986 and 1987.

EFFECTS OF LAND USE PRACTICES ON ROOSEVELT ELK WINTER RANGES, WESTERN WASHINGTON AND OREGON

Gregory L. Schroer, Gary Witmer, and Edward E. Starkey

Abstract

Conflicts between migratory Rocky Mountain elk populations and human development are well documented in the literature. We believe that similar problems exist for many populations of Roosevelt elk, but are less well documented because the migrations are less dramatic and because populations are of lower densities and more dispersed. Nonetheless, the potential for conflict is real because Roosevelt elk are adapted to using riverine corridors for movement between summer and winter ranges -- the same areas that are ideally suited to many human developments and activities. We discuss some case histories of Roosevelt elk-human development conflicts in several areas of western Oregon and Washington. Near such places as Coquille and Reedsport, Oregon, and Olympic and Mt. Rainier National Parks, Washington, we have observed elk encountering problems with paved roads, fenced pastures and agriculture lands, residential development, and hydroelectric development. Some developments, such as powerline right-of-ways, provide new habitats for elk and result in shifts in habitat use patterns. During winter, elk have difficulty meeting energy needs and are sensitive to harassment. Human development forces elk to avoid important habitats, to be more alert and flighty, and to adopt behavioral strategies such as nocturnal activity. Future conflicts can be lessened by pre-planning developments with knowledge of, and incorporation of, elk movement and habitat use patterns. Management suggestions include road closures, obstruction-free corridors, purchasing lands of wintering elk use, buffer zones around developments and creation of foraging areas.

Introduction

Habitat modifications such as residential development, forest management, and roads can cause adverse impacts on elk populations (Klemmedson 1967, Leege 1984, Lyon 1982). Elk on winter ranges are especially vulnerable to these impacts because of biological and physical constraints caused by winter weather (Thomas et al. 1976). Extensive habitat alteration and various human uses of Roosevelt elk winter ranges have prompted debates about the effects of human disturbances and proper habitat management. The issues are becoming more complex due to intensified land uses and management, and on-going incremental changes over large areas. The objectives of this paper are to outline some impacts on Roosevelt elk winter ranges, provide discussion of case examples from Oregon and Washington and propose management considerations to reduce impacts to those winter ranges.

General Habitat Use Patterns

Numerous studies have described Roosevelt elk habitat preferences during the winter (Jenkins and Starkey 1984, Schroer 1987, Witmer and deCalesta 1983, Schroer 1988, Youds et al 1985). Habitats selected by Roosevelt elk during the winter include deciduous forests, deciduous/coniferous forests, and young clear-cuts. Old-growth (older than approximately 200 years) coniferous forest is also selected or used in

proportion to its availability. Topographic characteristics selected by Roosevelt elk include valley floors and lower slopes of the valley walls (Schroer 1987, Schroer 1988, Jenkins 1979, Jenkins and Starkey 1984). These areas are also popular for human activities and developments such as roads, farms, hydroelectric plants, residential, urban and recreational siting. Human land use practices may force elk to avoid important habitats, to be more alert, and to adopt behavioral strategies such as nocturnal activity patterns (Geist 1971, Schroer 1987, Witmer 1985). Conflicts between human land uses and Roosevelt elk winter range use appear to be increasing in many parts of Oregon and Washington. Impacts on wintering Roosevelt elk vary according to the specific environmental, historic and current human use characteristics of each area. Insight can be gained by reviewing some case studies from both Oregon and Washington.

Case Studies

1. Queets Valley - A case study of impacts from extensive forest harvesting. The range of Roosevelt elk coincides with some of the most productive coniferous forests in the world. The economic value of these trees has led to extensive harvesting. Most low elevation forests within the range of Roosevelt elk have been cut at least once or will be cut within the next few decades. A majority of the old-growth coniferous forests have already been eliminated. The commercial forest management strategy is to replace these old-growth forests with stands of trees that will undergo a harvesting cycle of 50-90 years. The loss of most old-growth forests has long term consequences for Roosevelt elk populations as well as numerous other wildlife species.

Many studies have shown that old-growth forests are preferred or at least used in proportion to their availability by Roosevelt elk during most seasons (Witmer and deCalesta 1983, Jenkins and Starkey 1984, Youds et al. 1985). A particularly relevant example comes from a study conducted in the Queets River Valley on the west side of the Olympic Peninsula during 1986-1987 (Schroer 1988). The primary objectives of the 12 month Queets Valley study were to determine habitat use patterns, movements and home range size of five radio-collared cow elk. The study area included lands managed by Olympic National Park, Washington State Department of Natural Resources and Olympic National Forest. Results of the Queets Valley study indicate that old-growth forests were important to Roosevelt elk during all seasons except for spring. These types of forests now only make up approximately 10 percent of the forest land outside of the national park boundary in the lower Queets River Valley.

Another result shows that the elk significantly avoided all forest stands with ages of approximately 1-5 and 16-150 years. Presumably, the first group of stands did not provide adequate cover, while the latter group of stands did not provide adequate forage (Schroer 1988). These results, as well as information from other studies (Jenkins 1979, Witmer and deCalesta 1983, Hanley et al 1984, Alaback 1982), strongly suggest that, except for areas with old clear-cuts (approximately 6-15 years of age), many managed coniferous forest stands do not provide preferred elk habitats. Managed forest stands can be manipulated to at least partially meet the habitat needs of Roosevelt elk (Witmer et al. 1985, Harper et al. 1985).

One of the most common recommendations is to provide a mixture of forage and cover areas at a size and spacing that is attractive to elk. Other techniques, such as thinning and forage seeding can increase the interspersion of forage and cover.

Many areas in the vicinity of the lower Queets River Valley, however, did not have the management that creates a high degree of forage-cover interspersion. This was especially evident on some state and private forest lands where extensive forested areas (> 3,000 acres) were harvested within a 20 year period. Such management will eventually result in an extensive area of even-aged forest that has an abundance of thermal cover, but a very limited amount of forage. The low quality habitats of the managed forest stands, combined with the decreasing quantity of old-growth forests, could have major repercussions on the Roosevelt elk populations in the lower Queets River Valley.

Dosewallips and Duckabush River Valleys - A case study of impacts from developments on valley floors. An example of the conflicts created by human developments along river bottoms is found in and around the town of Brinnon, Washington, located adjacent to the Hood Canal. Brinnon is a non-incorporated community of approximately 500 residents. Most developments are within the winter-spring home ranges of two Roosevelt elk herds. Greater than 90 percent of these residences were located on the relatively narrow (.5 - 1.0 km) valley floors; these areas are also preferred by Roosevelt elk. During 1984 - 1986, 9 radio-collared elk were studied to determine habitat use patterns, movements and home ranges.

The research indicated that deciduous and deciduous/coniferous forests on valley floors were preferred habitats (Schroer 1987). Mesic-riparian areas with an abundance of herbaceous vegetation were also selected, particularly during the late winter and spring. Residential lawns were selected during winter and early spring because they contained some of the earliest herbaceous vegetation growth of the year. The affinity for lawns declined during March and it was insignificant during May and June, perhaps due to the abundance of new spring growth throughout the home ranges. Although the elk preferred young seral communities on valley floors, that use was temporaly limited by human disturbances when it occurred near roads and residences. Distances of elk from residences and paved roads were significantly greater ($P<0.01$) during the day than during the night.

In addition, the elk of the Duckabush and Dosewallips Valleys utilized areas within 300 m of residences and paved roads almost entirely during night - the period of least human activity. Day-time motor vehicle traffic appeared to be the primary factor responsible for the avoidance of areas adjacent to roads and possibly a factor in the avoidance of areas adjacent to residences. Motor vehicle traffic was estimated with weekly observations. Average traffic levels on paved roads, excluding Highway 101, were highest during the day (6 vehicles/hour) and lowest at night (of 0.5 vehicles/hour). Developments in the Duckabush and Dosewallips Valleys could also influence the migratory movements of elk.

A majority of the elk that winter in the Brinnon area migrate to summer and rutting season home ranges in the subalpine regions of the Olympic Mountains. The spring migrations began during late April for mature bulls and June for the cows, calves and young bulls. The migrations continued for approximately 45 days for the cow/calf groups. During that time, elk selected habitats with an abundance of herbaceous and shrub vegetation such as riparian deciduous forests (primarily alder flats) and avalanche chutes. Autumn migrations began in early October, prompted by an intense, week-long rain storm and cool temperatures. Most elk of the two herds arrived on the winter range about 30 days later. Although a majority of the migratory routes of these two herds are within National Park and National Forest lands, some potential for developments, such as small-scale hydroelectric projects exists.

A current proposal for such a project on the Dosewallips River could cause a temporary delay in migratory movements during construction activities.

Oregon Coast Range - A case study of impacts from roads and agricultural development. Roosevelt elk in the Oregon Coast Range currently do not face some of the impacts that elk encounter in the Cascade and Olympic Mountain Ranges, such as urbanization and widespread residential development. Threats to wintering elk in the Oregon Coast Range are primarily from logging, roading and agricultural land uses. Elk populations on private forest lands in the Oregon Coast Range face "boom and bust" cycles similar to that described above for the Queets Valley of Washington. Extensive clear-cutting of large areas (hundreds of acres versus 30-60 acres per clear-cut on public lands) and short rotation cycles (50-60 years versus 80-100 years on public lands) has led to periods of good forage and cover conditions, followed by many years of poor forage conditions with landscapes dominated by dense, young coniferous forests (Harper et al. 1985, Witmer et al. 1985). These cycles have been documented in southwestern Oregon (Millicoma Tree Farm area) and northwestern Oregon. Many areas of public forests have fewer problems of excessively large cover areas or forage areas because of a good interspersion of moderately sized clear-cuts among forest stands.

Other problems, such as a high road density, however, exist for elk on these lands. Roads are common in valley floors, riparian habitats, and, especially, on intensively managed forest lands where densities may reach 6 miles of roads per square mile of forest land (Starkey et al. 1982). The negative effect of motor vehicle traffic associated with forest roads, especially paved roads, on Roosevelt elk habitat use has been documented (Witmer and deCalesta 1985). Road closures can reduce or eliminate that negative effect.

In western Oregon, wintering elk using agricultural lands have provoked a large number of damage complaints from landowners (Harper et al. 1985). Most of these complaints (83%) are for crop and fence damage. Furthermore, the number of complaints has increased with increasing intensity of land use. Damage is usually controlled by trapping and transplanting nuisance elk, or by special (permit) anterless elk hunting seasons which have become common near agricultural lands in Western Oregon (Harper et al. 1985).

If wintering elk are allowed to use agricultural lands, higher productivity in herds can be realized (Ramsey and Krueger 1986). The Oregon Department of Fish and Wildlife (ODFW) in conjunction with local landowners and other state and federal agencies have established two public areas with a mix of agricultural and forest lands for the benefit of local elk herds: the 1,200 acre Jewell Meadows Wildlife Area, and the 923 acre Dean's Creek Elk Viewing Area (Harper et al. 1985, BLM and ODFW 1986). Management of these areas includes pasture management using proven farming techniques, occasional supplemental feeding, compatible forest management on adjacent lands, restricted access and roading, restricted hunting in the immediate area, removal of excess or injured animals, and development of safe viewing/educational areas and regulations.

Considerations for Managing Roosevelt Elk Winter Ranges

It is possible, in many cases to integrate human activities, land uses, and developments with the needs of wintering elk. To do so, however, requires careful

analysis of the existing situation and pre-planning to assure that the long-term needs of elk and people are met in the area. The following list of management considerations have been compiled by the authors, based on their own experiences and drawing upon the works of Harper et al. (1985) and Witmer et al (1985). It is not meant to be comprehensive, but rather, to stimulate thought for those assessing a Roosevelt elk winter range situation.

- Make a careful assessment of a local herd's habitat use patterns before siting or approving a large, structural project. - Consider the potential for cumulative impacts to elk in their winter range.

- Use a habitat effectiveness index to determine current value, and as an aid to future management, of elk winter range.

- Control the extent and intensity of land uses and developments by using land-use planning and by using landowner/state/federal agreements.

- Restrict human access and disturbance to wintering elk by limiting the number of roads, using road closures, and maintaining vegetative cover along roads.

- Consider the public purchase and management of important elk winter ranges.

- Protect natural openings and important foraging areas.

- Improve the quantity and quality of forage, especially on manmade openings.

- Maintain some stands of high quality forest cover (i.e., optimal cover) on important winter ranges.

- Maintain buffer strips of forest cover along streams.

Literature Cited

Alaback, P.B. 1982. Dynamics of understory biomass in sitka spruce-western hemlock forests of southeast Alaska. Ecology 63: 1932-1948.

Bureau of Land Management and Oregon Department of Fish and Wildlife. 1986. Dean Creek Elk Viewing Area - Habitat Management Plan. BLM, Coos Bay District, Coos Bay, OR. 20 pp.

Geist, V. 1971. A behavioral approach to the management of wild ungulates. Pages 413-424 in E. Duffey and A.S. Watt (eds). The Scientific Management of Animal and Plant Communities for Conservation: the 11th Symp.British Ecol.Soc. Oxford-Blackwell Sci.Publ.

Hanley, T.A., Bunnell, F.L., Starkey, E.E., Stevenson, S.K., and Harestad, A.S. 1984. Habitat relationships of cervidae in old-growth forests. In: New Forests For a Changing World: Proceedings of the 1983 convention of the Society of American Foresters (Portland, Oregon: 16-20 October).

Harper, J.A., and His Colleagues. 1986. Ecology and management of Roosevelt elk in Oregon. Oregon Department of Fish and Wildlife, Portland, OR. 70 pp.

Jenkins, K.J. 1979. Home range and habitat use by Roosevelt elk in Olympic National Park, Washington. M.S. Thesis, Oregon State University, Corvallis, OR. 84 pp.

Jenkins, K.J., and E.E. Starkey. 1982. Social organization of Roosevelt elk in an old-growth forest, Olympic National Park, Washington. J. Mammalogy 63:331-334.

Jenkins, K.J., and E.E. Starkey. 1984. Habitat use by Roosevelt elk in unmanaged forests of the Hoh Valley, Washington. J. Wildl. Manage. 48:642-646.

Klemmedson, J.O. 1967. Big-game Winter Range - a Diminishing Resource. Trans. N.Amer. Wildl. and Nat. Res. Conf. 32:259-269.

Leege, T.A., 1984. Guidelines for evaluating and managing summer elk habitat in Northern Idaho. Idaho Dept.of Fish and Game, Wildl. Bull. No.11. 37 pp.

Lyon, L.J., and A.L. Ward. 1982. Elk and land management. Pages 443-478 in J.W. Thomas and D.E. Toweill (eds.). Elk of North America: Ecology and Management. Stackpole Books, Harrisburg, PA. 698 pp.

Ramsey, K.J., and W.C. Krueger. 1986. Grass-Legume seeding to improve winter forage for Roosevelt elk: a literature review. Department of Rangeland Resources, Oregon State University, Corvallis, OR 28 pp.

Schroer, G.L. 1987. Seasonal distribution and movements of migratory Roosevelt elk in the Olympic Mountains, Washington. M.S. Thesis, Oregon State University, Corvallis, OR.

Schroer, G.L. 1988. Seasonal movements, distribution, and habitat use by Roosevelt elk in the Lower Queets River Valley, Olympic National Park, Washington. Final report to the National Park Service, Olympic National Park, Port Angeles, Washington. 62 pp.

Starkey, E.E., D.S. deCalesta, and G.W. Witmer. 1982. Management of Roosevelt elk habitat and harvest. Proc. N. Amer. Wildl.and Natur. Resource. Conf. 47:353-362.

Thomas, J.W., R.J. Miller, H. Black, J.E. Rodick, and C. Maser. 1976. Guidelines for maintaining and enhancing wildlife habitat in forest management of the Blue Mountains of Oregon and Washington. 41st Trans. N.Amer. Wildl. and Nat. Res. Conf. 41:452-476.

Wisdom, M.J., L.R. Bright, C.G. Carey, W.W. Hones, R.J. Pedersen, D.A. Smithey, J.W. Thomas, and G.W. Witmer. 1986. A Model to Evaluate Elk Habitat in Western Oregon. Publication No. R6-F&WL-216-1986. USDA Forest Service, Pacific Northwest Region, Portland, OR. 36 pp.

Witmer, G., M.Wisdom, (and others). 1985. Chapter 11: Deer and Elk. In: Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. E.R. Brown (ed.). Publication No.. R6-F&WL-192-1985. USDA Forest Service, Portland, OR. pp 231-258.

Witmer, G.W., and D.S. deCalesta. 1985. Effects of Forest Roads on Roosevelt elk habitat use. Northwest Sci. 59:122-125/

Witmer, G.W., and D.S. deCalesta, 1983. Habitat Use by Roosevelt elk in the Oregon

Coast Range. J. Wildl. Manage. 47:933-939.

Youds, J., K. Brunt, and D. Becker. 1985. Vancouver Island Roosevelt elk/intensive forestry interactions: progress report 1981-1984. Research Ministries of Environment and Forests, IWIFR-21, Victoria, British Columbia. 71 pp.

Question from the Audience:

Q - Did elk also avoid areas that were not hunted but still had a lot of human disturbance?

A - The whole winter range area in the Duckabush and Dosewallips drainages were open to hunting. Consequently, those elk are very wary and the disturbance created by residential activity was definitely a factor that, I believe, caused them to stay away from residences and paved roads. There were no areas closed to hunting.

TITLE: Systems Dealing with Access to Public and Private Lands in New Mexico

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ABSTRACT: In New Mexico there exists several "systems" dealing with access to private and public lands. The first system involves the use of private elk authorizations for use exclusively on the assigned ranch. The second system involves the use of private land authorizations on public lands in exchange for access to private lands. The third involves the public land license on public and private lands. The fourth involves the "unitization" or the trading of public for private land access and to gain continuity in areas of mixed land patterns.

All "systems" have advantages and disadvantages as some gain access for the public and others select for paying clientele.

The ranch only authorizations are found on large land grants (100% deeded) and generally contain migrating herds. Those authorizations appeal mostly to the pay hunter. The private land authorizations on publice lands can be found in game management units which are mostly state or public lands. Those authorizations may be sold. The public license is authorized for the entire unit and access is mostly free.

The "utilization" of public lands for private lands usually results in mutual benefits for the public, and the private hunters and landowners alike.

Questions from the Audience:

Q - Are you trading fee titles of state lands for this unitization?

A - In unitization, we trade the trespass rights and the hunting rights from state to private lands and lock up an area and sign contracts with that landowner. With the intermixing of land ownership in New Mexico there might be portions of roads that lead to public lands over private land that are closed off. What we do is trade off some of that land for some of those hunting rights somewhere else on that ranch, and that allows the hunters to go through that property to other hunting areas.

Q - Does the private landowner get fee titles?

A - No

Q - You mentioned that there is about 7,600 elk and antelope authorizations sold each year for a dollard value of 13 million dollars.

A - No, there are 7,600 authorizations between pronghorn and elk. The 14 million is from access fees sold by landowners for elk in association with the authorization. The authorization is an authorization to buy a license from the state.

Q - Do you have any estimate of the average price of the allocation licenses?

A - Some are in the thousands and others in the hundreds. The average price is around $3,000.

Q - How many deer and elk licenses does New Mexico sell?

A - New Mexico sells around 100,000 deer licenses and 35,000 elk licenses.

Q - What is the minimum acreage required to receive authorization?

A - We do not have a minimum acreage, we have a formula that is used in each unit. We have criteria that each unit uses to get that number of authorizations. They are set by proportion of public versus private land and animal numbers that exist are estimated numbers of animals that exist on different land ownership.

Q - What is your average?

A - They are different. Some of them require as many as 2,000 acres and others as little as 120. Because of the distribution of elk and the densities we can't set up a minimum acreage because it's

Q - Does New Mexico Game and Fish, recognizing the average cost of these licenses is 3,000 dollars, really feel like they are increasing public opportunity?

A - The cost of licenses for nonresidents is $213. The $3,000 is the access fee that the landowner charges. This program has opened up some areas that would be closed. Most of the people that have authorization have authorizations in numbers 1 to 3 and those people don't sell their authorizations for $3,000 - they sell theirs for $100, $300, or even a load of wood.

Q - Do you have any idea what your cost would be if you had to pay damages?

A - A couple years ago we had a bill introduced for the state to pay damages, and that was somewhere around two million dollars.

Q - Is the only way a nonresident can hunt elk in New Mexico is to obtain an authorization?

A - No, in New Mexico you can apply for any hunt and be in the public draw. We don't have a cap on nonresidents and we don't have them in separate draw or hunts. Everyone is drawn out of the same bin.

THE ROLE OF FEES IN RATIONING THE DEMAND AND SUPPLY OF ELK HUNTING

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Abstract

A major problem faced by an economy is how to discover and satisfy citizens' values in the face of scarcity. Since both the suppliers and demanders of elk hunting reveal their values by their choices, fees have an important role to play on both sides of this market. This paper addresses the role that fees can play to enhance elk hunting by sending proper signals to both the supply and demand sides of the market.

Elk can be supplied in various quantities and age-sex characteristics. If people pay the supplier for the privilege of hunting, then the supplier can judge how much of the habitat it is optimal to take from other possible uses and devote to producing elk. He can also then make a judgement about what kind of hunting to provide. If people are charged for the privilege of hunting, then they can judge how much, and what kind, of hunting they want by comparing alternative forms of recreation. Only if proper fees are charged can suppliers and demanders make the proper choices about the amount and kind of hunting to provide. If the fee is too low, or zero, too much hunting will be demanded, and too little will be supplied, producing a shortage and decline in the quality of hunting. If the fees are set too high, just the opposite will occur. Casual observation seems to reveal that the former case prevails today.

The proper level of fees for the various possible kinds of hunting can only be determined by allowing a private market for hunting to exist. Various methods are discussed for making a transition from the present form of regulating elk hunting to one that relies more on market incentives driven by fee hunting.

Introduction

Economics is often termed the science of choice, and choices are made by people in markets. In keeping with my role as an economist, I propose to look at the market for elk hunting by investigating the forces that bear on the choices made by elk hunting demanders and suppliers.

Of course, no one would argue that well-developed markets for elk hunting presently exist. And it is quite possible that under our present elk hunting framework that such markets can never exist. Yet, there is no question that market forces are present--elk hunting is supplied and demanded, as the economist puts it. Elk hunters choose to go, or not to go, elk hunting, and habitat managers choose to supply, or not to supply, it. Supply and demand thus provides a useful framework within which game managers, and the public, can gain useful insights into the problems that currently face elk hunting.

Looking at elk hunting in this way leads to the conclusion that these problems stem from the fact that we have not allowed the necessary market institutions to develop and do their job. I shall also argue that appropriate use of market institutions, including elk hunting fees, can play a useful corrective role even within our present elk hunting framework.

The Problem

In technical terms, the problem now faced by elk hunting results from allowing the over-exploitation of a common property resource--elk--due to too few restrictions on access. The problem is analagous to fishery management, with which we in the Northwest US and Canada are all too familiar. While the problem of completely unrestricted access to elk was solved in the early part of this century with the introduction of hunting restrictions, seasons, and licenses, the resource is again faced with excessive demands relative to supply. Thus, from the economist's perspective, the basic manifestation of the elk hunting problem is that demand exceeds supply.

On the supply side, most of the habitat that produces elk hunting is under public control, primarily the Forest Service. Not only are such managers under intense political pressure from many sides, but they have economic pressures in some of the markets in which they operate. However, in the provision of elk habitat, Forest Service managers operate in a non-market environment in the sense that they do not receive any revenues from the elk habitat they provide. Since the payoff to these managers for supplying elk habitat is strictly non-economic, as opposed to the more tangible revenues received from the sale of timber and grazing, these managers quite naturally choose to supply less elk habitat than would occur if elk hunting yielded revenues. When elk do not yield revenues, and there is a trade-off between money and elk, the elk lose.

Further, many private land owners who supply elk habitat-- especially winter habitat--get no economic benefit from supplying it, thus giving them little incentive to preserve or augment it. This, again, implies that less habitat is being supplied because these landowners do not have an economic interest in doing so.

Thus, no matter who controls the habitat, the only conclusion is that the supply of elk hunting is below what would be provided if suppliers had an economic interest in it.

On the demand side, people chose to go, or not to go, elk hunting by weighing the benefits and costs of doing so. The primary elements of cost are the (nominal) price of licenses and permits, possibly the cost of a guide, the cost of equipment, and time. Over the past few decades, rising personal income has stimulated the demand for elk hunting, making people increasing willing to bear the cost of equipment, etc., and the loss of time in elk hunting. In addition, improved access due to massive uneconomic USFS road building, has steadily reduced the relative cost of access and contributed to a steady growth in demand.

Thus, the widening gap between supply and demand for elk hunting. The test of any theoretical view of the world is its ability to explain and predict what is going on. A fundamental law of economics is that when demand exceeds supply

price will rise. If price is not allowed to rise, then either outright shortages, or declining quality, or both, inevitably appear. This is exactly what has happened to elk hunting, where demand exceeds supply, price has been held down, and therefore quality is deteriorating.

In normal markets, the fees paid by demanders for any good or service go to those who incur the costs of supply, and fees adjust to bring the two together. When oil became more scarce, all energy prices rose to clear the market, and this rise in price provided important incentives for demanders to conserve and for suppliers to look for more.

This is not true in elk hunting markets. Hunting license and permit fees are fixed by, and go to, Game and Fish Departments and are not realized by the suppliers of habitat. Thus, the supply of elk hunting is largely isolated from demand, and fees have not been allowed to adjust to bring the two together. With the normal role of fees ruled out in the elk hunting marketplace, the market is being forced to clear by a rise in some of the other costs of elk hunting and a fall in quality.

The decline in the quality of elk hunting is well-known. In the early part of this century, when elk populations sufficiently recovered to produce a harvestable surplus, bull-only seasons were usually instituted to protect the population and promote growth. Only in remote areas, where high access costs limited demand, were any-elk seasons allowed. Rising demand relative to supply created continuing pressure toward management for maximim yield, but with declining quality, manifested by crowded hunting and young herds with very low bull/cow ratios. This is most apparent in Washington and Oregon, but it is beginning to appear in other states like Idaho. As quality deteriorated further, hunters who want higher quality hunting increasingly reveal their preferences for such hunting by opting for costly backcountry hunting. As demand rises there, outfitters' prices for backcountry hunting rise. However, since outfitters typically do not have exclusive hunting rights, and therefore have little incentive to protect their herds, over time the rising demand for quality elk hunting produces a decline in hunting quality there. The response of Game and Fish Departments, again seeing the political emphasis on maximizing the size of the harvest, then protects the herd by further raising the cost (but not the price) and reducing the quality of elk hunting: seasons are shortened, bugling season is limited, and special primitive hunts are instituted. Eventually, the quality of such hunting will deteriorate further until permit-only, drawing, or first come-first served hunts are instituted, first for politically impotent non-residents, and then for residents too. This is Arizona-type hunting, and elk hunting in the Western US is already well down this path. Alberta recently shocked hunters by going to permit-only, drawing, hunting.

If these inevitable consequences of present elk management are to be avoided, then the gap between supply and demand must be closed in some manner before low-quality hunting becomes entrenched, as it has in Washington and Oregon. Biologists concentrate on the supply side--habitat improvement. But given the complete economic separation between elk hunting demand and supply, closing the gap by such a purely supply-side approach will fail. We are then left with demand-side management. If declining quality and permit drawings are ruled out, the choice is a tough one, especially politically: how can hunting pressure be reduced? Who gets to hunt and who does not? I suggest that we eliminate the low-valued elk hunting. The problem is how.

Discovering the Value of Elk Hunting

Elk hunting is only one kind of outdoor recreation, and outdoor recreation is only one kind of recreation in general. For some of us, outdoor recreation means barbecuing hamburgers on the patio, and for others it means climbing Mt. Rainier. Some of us never go elk hunting, and some hunt for several months every fall. This is merely another way of saying we all have differing recreation values.

A corollary is that elk hunting has substitutes. For those who place a high value on elk hunting, these substitutes are remote. For others, going to a football game on the weekend is a reasonable alternative. Each of us participates in those forms of recreation that, given our different preferences and constraints, give us the most satisfaction. In other words, people will reveal their recreational values in the marketplace by choosing among the alternatives before them, and, again, because of differing preferences and constraints, people will have different trade-offs between the various forms of recreation.

For the economist, willingness-to-pay is a measure of value on the demand side of the market. More generally, demanders reveal their preferences by how they spend their time and incomes in the market place.

Thus, hunters will express their desire for elk permits by their willingness to give up other things for such a permit. If someone would rather spend $250 on some other form of recreation than spend $250 on an elk hunt, it must be presumed that he values the alternative more than the elk hunt. If someone is willing to pay $250 every year for an elk permit, he does so because he values the elk permit more than the other goods and services he could buy with the $250.

This presumes that elk hunters know their own preferences best. Even though I might not do the same thing, I presume that others are honestly expressing their values when they are willing to pay $250 to go elk hunting. And I see no reason why, in fact, he should not be allowed to pay that much if he can get others to supply the necessary resources at that price. One the other hand, if another person chooses go to a football game on the weekend--an outing that also might cost $250--rather than go elk hunting, I can see no reason why he should be denied that choice. In short, I presume that people will choose to go hunting, or not to go hunting, by weighing the benefits and costs to them of doing so, and that whatever they choose to do is best from their individual standpoints. Such freedom lies at the heart of our system of government and economy.

The objective of maximizing the satisfaction of elk hunters can be expressed in the following way: we should strive to allocate the available elk permits to those elk hunters who value them the most. Thus, given success rates, etc., if hunters must be limited to, say 10,000, in order to preserve hunting quality, the permits should go to the 10,000 hunters who value them the highest. The problem is how to identify those hunters.

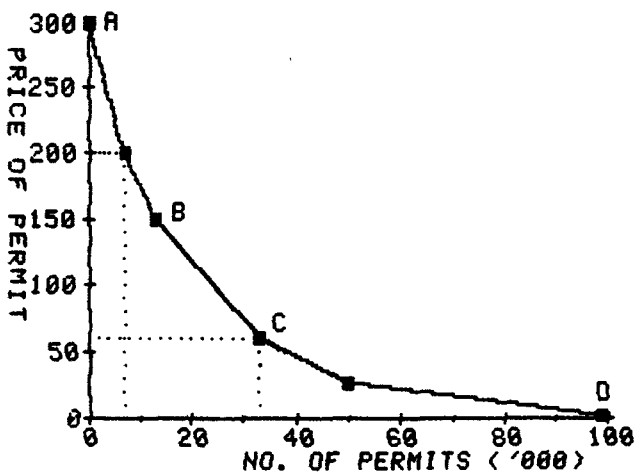
Let us go through an exercise to see how the marketplace can be used to discover hunters' valuations of elk permits. Suppose we approached a hunter, swore him to tell the truth, and asked him if he would buy an elk permit for $1,000. Now, most of us would immediately say, "No." (But, of course, some might honestly

answer "Yes.") Then suppose we lowered the price to, say, $900, and asked the same question, and got the same response. Suppose we continued lowering the proposed price and received the same answer until we reached $150 and the hunter said, "yes." We would have then discovered the maximum this hunter would pay for an elk permit, and the hunter, by saying he would give up $150 worth of other goods for the elk permit, has revealed his valuation of an elk permit.

I am not suggesting that in fact we go through such a procedure to allocate elk permits, although there is no conceptual reason why we could not do so. Nor am I suggesting that each of us be required to pay the maximum we would be willing to pay for an elk permit. What I want to illustrate is that people, including elk hunters, will reveal their values by their behavior when they face prices. If their valuation is higher than the price they face, they will buy. If their valuation is lower than the price they face, they will not buy. These are the kind of decisions each of us goes through hundreds of time a year, and, since each of us places a different value on the various goods and services we buy, it is in this way that we are able to gear our purchases to fit our unique values and maximize our individual well-being.

This same little experiment could be repeated with each potential elk hunter. The result would be the discovery of each's valuation of an elk permit. I would expect that some might place a very high value on such a permit, and others would place a lower value. If we arrange these in decreasing order and plot the results, we get a curve like ABCD in Figure 1. This curve shows that about 8,000 permits are valued at $200 or more and that 100,000 permits have some positive value. Hunters who place a relatively high value on an elk permit are located on the upper part of this curve and those with lower values are located on the lower part.

Figure 1. A demand curve involving permit level and permit price.



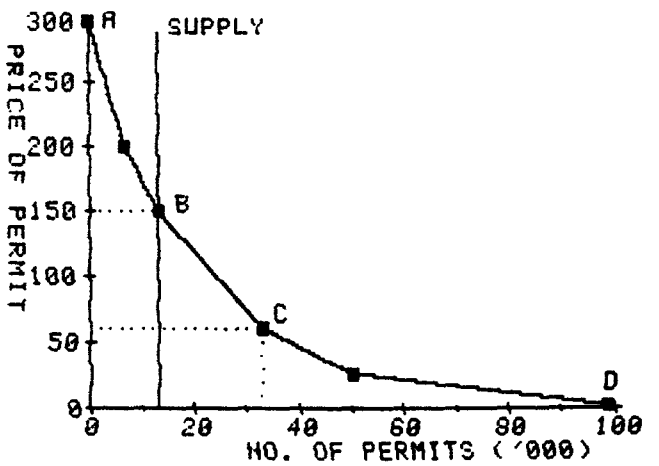
Instead of looking at this curve from underneath, where it shows the value placed on elk permits, this same curve can be looked at as a demand curve for elk permits. Suppose a price of $200 were charged for permits. Only those people who valued such permits at $200 or more would voluntarily purchase permits at this price. In the present example, this amounts to about 8,000 hunters. At a price of $60 more permits would be demanded--about 33,000 in our example.

A Mechanism for Maximizing Hunters' Satisfaction

We can now analyse a method for allocating elk permits so they would go to those hunters who valued them the most.

Suppose the Game and Fish Department determined that about 2,000 elk should be taken from the herd in a year, and that hunters have a 15 percent success rate. This means that about 13,330 permits can be issued. In the jargon of the economist, we say that the supply of permits is fixed at 13,330. Such a line is plotted in Figure 2 along with the demand (value) curve derived earlier. The intersection of the supply and demand curves then shows the price that the Game and Fish Department would have to charge so that only the 13,330 hunters who valued the permits the most would buy them. In our example, this occurs at a price of $150 per permit. At this price only the 13,330 hunters who valued the permits the most would purchase them.

Figure 2. A supply of 13,300 permits on the demand curve results in price of $150 per permit.



It is important to note the following. If the Department offered elk permits for $150 each, anyone would be free to buy one, but only about 13,330 would choose to do so. The rest value permits less than $150, and therefore would choose to spend their money in some other fashion, like going to a football game.

The essence of this way of allocating elk permits is that a price is set for permits that screens out those who place the lowest value on such permits. This is what is meant by the economist's assertion that prices should be set to reflect the value of the resource. This is the way price allocates resources in most of our economy. The forces of supply and demand take price to the level at which demand is voluntarily rationed to the available supply. Only those who value the good above this price will buy, and only those suppliers who are able to produce at a cost less than the price will survive in the market. In short, in a market economy goods and service go from the lowest cost producers to the demanders who place the highest value on the product.

The objection to this proposal for allocating elk permits is that it is not "fair." I am not sure exactly what this assertion means--fairness is one of those things that can always be used to attack anything, usually as a stalking horse for one's own self-interest. But I also think that a pretty good case can be that the alternative of a permit-drawing system is less "fair" because it gives permits to some hunters who value them very little and denies permits to some who value them very highly.

Before proceeding with this fairness issue, let us interpret the permit- drawing method of allocating permits using the supply and demand tools developed above.

The Economics of Permit Drawings

One of the fundamental laws of economics is that if a price is set too low in any market this will produce a shortage and/or a decline in the quality of the product. For hunts where hunters have access to permits without going through a permit-drawing system, and other access costs are low, the too-low price for elk permits is manifested primarily in a declining quality of elk hunting. Under a permit-drawing system the too-low price is manifested in a shortage of permits that are allocated randomly. Instead of setting the price at the market clearing level, $150 in the above example, the present price for a permit is set at, say, $60, as it is in Arizona. At this price, the demand for permits exceeds the supply by about 20,000, and a random drawing selects 13,330 from the thirty-three thousand that apply.

What is wrong with this system of elk permit allocation? Aside from the fact that this system is very costly to administer relative to the market system suggested above, the major defect of the present system is that it does not satisfy the criteria that the permits go to the hunters who value them the most. In fact, since the lucky hunters who are drawn are scattered randomly along the curve from A to C in Figure 2, some hunters are drawn who value permits at less than $150, while others are not drawn who value the permits at more the $150.

The major arguments in favor of the permit-drawing system revolve around the "fairness" issue. Usually it is asserted that the present system is fair because "everyone has an equal chance to get drawn for a permit." And it is argued that charging a market clearing price is "unfair" because it reduces demand to supply by "pricing people out of the market" and would "hurt the poor."

Aside from the general comment that charging a market- clearing price is the way in which most resources are allocated in our economy, I offer the following.

First of all, even under the present system, price is partially used to reduce demand to supply. By charging $63 for a resident permit, as is done in Arizona, all those who value elk permits less than $63 are already screened out. And, of course, there are lots of others who would not go elk hunting even if the price of a permit were zero because they value elk hunting low relative to the other "prices" that must be paid to go elk hunting--rifle, ammunition, camping equipment, clothes, etc., to say nothing of pickups, horses, saddles, and time. Price relative to valuation is already a major limitation on the supply of elk hunters, and all I am suggesting is that its use be increased to solve the problem.

Second, the question is not whether to reduce demand to the available supply--that must be done no matter what. The question is whether or not using price is the best way to do this. To me, the primary advantage of rationing by price is that it leaves the allocation mechanism in the hands of the person who benefits from the resource. Only individuals really know their tastes, values, preferences, etc., and the market gives people a place where they can express them. When other methods of allocation are used, individual values are suppressed in one way or another, and resources do not rise to their highest valued uses. "Pricing people out of the market" really means "finding out who really values elk hunting." If you are priced out of the market, all this means is that you don't value going elk hunting very highly relative to alternative uses of your income. Finally, using price to allocate the resource can direct money to the supply side so that both the quantity and quality of the resource might be augmented.

Third, using the market for elk hunting to "help the poor" is very inefficient. There are much better ways to help the poor. The problem with the poor is that they do not have enough income and keeping elk permit prices down does nothing to relieve that. It makes no sense to cause a massive deterioration in quality for all elk hunters in order to help the ten percent or so who might be classified as poor.

Questions from the Audience:

Q - What might be an example of incentives to outfitters?

A - Let me give you a radical one - let the outfitter control all the hunting on his land - therefore, he is not in competition with people who don't pay him and he could have two or three different kinds of ways- he could pack in and give them a deluxe hunt or let them drive up in their pickups as they do anyway for 50 bucks. The point of the matter is for the outfitters to have better control over the total amount of hunting on their land, then they have some incentive to manage it. Right now it is shoot the animal before somebody else spots them - at least that has been my experience.

Q - Should the outfitter control hunting on lands he doesn't own?

A - I'm just talking about managing the resource - I don't care who owns what - what I am concerned with is that the resource gets managed better - I don't care who owns it.

Q - How are you going to get the general public to continue to fund the management of public habitat and populations of animals that belong to the people of the state if they are priced out of the market?

A - Well, first of all, I would say most habitat is not paid for by the public - 90% of the elk live on Forest Service land and I fail to see any dime of mine that ever made it to the Forest Service directly, not that I know of. As far as the people having the vision that they own the elk, there is no question about it, but they had that vision of the buffalo and look what happened to it.

TITLE: Wildlife Belongs to the People

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ABSTRACT: Wildlife conservation evolved in the United States as an effort to preserve a resource we as a people held in common. As such, a resource wildlife conservation has and continues to enjoy broad public support.

The history of public land designation and management, likewise, has enjoyed a populist tradition. The disposal of privatization of wildlife and land resources has been a repeated public debate. The issue has taken on many forms over the years. Access fees are simply the contemporary version of an unending effort to make private something that, by its nature, is public and held in common.

The aspect of this issue that advocates access fees for use of public lands must address three basic points. These points are: equity, necessity and tradition. Assessing access fees while the mining laws and timber subsidies are continued is devoid of equity. Collecting fees to facilitate land manipulation when the land needs to be left alone is unnecessary. Collecting tribute for passage on the American commons violates our tradition and threatens the populism that sustains American conservation.

Questions from the Audience:

Q - You made a couple of references to wildlife in its wild state. Are you leaving open some provisions for captive bred wildlife? What about privately owned and operated herds?

A - I would hope we have our conferences in separate halls. We are talking about some form of animal husbandry using things that look the same maybe even from the same stock. I think you are talking about two totally different worlds. I find the idea of raising penned animals to have people shoot them frankly quite degrading to the whole recreation aspect of hunting as we have been trying to preserve. I would hope that people who want to raise captive animals, take dollars from people who come in and shoot them, collect some exotic species so that we wouldn't get native and exotic animals confused. At any rate there is certainly a difference between free ranging wildlife and captive wildlife raised for commercial purposes, they are totally alien concepts.

Q - Do you feel that wildlife management on private property that is economically based would necessarily detract from management of wildlife on public lands?

A - I have something in my brief case that answers that - but at any rate, there is a lot of it going on and - I think we need to make distinctions about how we expend public resources. Private people that have some kind of enterprise that involves a habitat emphasis and they charge people for a recreational experience - I don't have a particular problem with that - where I have the problem is where they somehow cross the public interest line and start demanding of the public or state agency the granting of a certain kind of privilege; in other words, if you could go between here and Spokane and design an optimum pheasant habitat and farm consistent with that and bring in guests who pay you for your services within the season the state of Washington sets. I would think that would be a really neat kind of deal - where I have a problem is where somebody has to come to a state like New Mexico and demand certain rights to sell that are at the expense of the public interest, but Leopold answers all of my questions. Leopold says we must bait the farmer with subsidies to induce him to raise the forest, or with gate receipts to induce him to raise game, we are merely admitting that the pleasures of husbandry in the wild are as yet unknown both to the farmer and to ourselves. I think we gather in conferences like this, and we beat the point of what kind of inducement we have to give a private landowner to raise game so that he can make money. Profit is only one aspect - the first thing we do wrong there is we lump all private landowners in the same category and they are not, they are as individual as everybody in this room - they are a very individualistic group. There are many private landowners I know and all of you know who love the idea of a certain amount of

husbandry to wild things. Instead of simply creating and helping those people, we concentrate on the guy who has to be paid for it. I think a lot can be done and should be done .. with landowners. A lot of them don't expect anything more than recognition and certain amount of gratitude and if a guy charges a fee for a service, he renders more power. I just have a problem when those people come forward and say I demand so many deer or elk licenses or I demand to have exclusive rights to this or that because wildlife conservation is put together by everybody working on it, everybody working together - and they always jump the fence. Thank you.

Panel Discussion

"Fee Access on Public and Private Lands"

Moderator: Rolf Johnson

Speakers: Joe Jojola
Jack Ward
Doug Pineo
Arthur Solomon, Jr.

FEE ACCESS HUNTING: A TRIBAL PERSPECTIVE

Joe Jojola, White Mountain Apache Game and Fish Department, P.O. Box 220, Whiteriver, Arizona 85941

Abstract

Several southwestern Indian reservations have been involved in fee access hunting (fee hunting) for elk since the early 1970's and some even earlier. These tribes include the White Mountain Apache, Mescalero Apache, Jicarilla Apache, San Carlos Apache, the Hualapai and the Southern Ute. Most of my comments will pertain to the White Mountain program.

Fort Apache Hunting Program

Since the introduction of the Rocky Mountain elk into Arizona and its eventual establishment on the Fort Apache Indian Reservation, elk has been considered as an important resource. Through progressive management efforts, the tribe has developed a trophy hunting enterprise that, we feel, is unsurpassed by any other in North America.

The Fort Apache Indian Reservation is located in the White Mountains of east central Arizona. The reservation contains 1.6 million acres of land, of which approximately 764,000 acres is considered as elk habitat. Of the 764,000 acres, roughly 150,000 is winter range, 404,000 acres is summer range and about 210,000 is utilized year round.

Two distinct elk herds occur on the reservation, referred to as the east end and west end herds. The west end herd occupies slightly over 200,000 acres of reservation land ranging in elevation from 4,500 feet to 7,800 feet. Vegetation is primarily oak chaparral, juniper woodlands and Ponderosa Pine. This herd is less productive than the eastern herd and it numbers approximately 500.

Roughly 554,000 acres of elk habitat occurs in the eastern portion of the Reservation, of which as much as 150,000 acres is winter range, consisting of Oak chaparral, Pinyon-Juniper and Ponderosa Pine. The remaining 404,000 acres are primarily summer range, but also contains transitional range. Summer range occurs from 7,500 feet to over 11,000 feet. Vegetation types consist of Ponderosa Pine, mixed coniferous forests and spruce-fir. Mountain meadows occur throughout much of these forest types. Precipitation averages about 18 inches and is considerably greater at the high elevations. The east end elk herd is productive and numbers nearly 7,000 during the summer period.

Since 1980 aerial composition surveys have been performed and we have classified nearly 12,000 elk. The average bull:cow ratio is 35 bulls:100 cows, while the calf:cow ratio is 49 calves:per 100 cows.

The trend in the bull-cow ratio over the last three years has increased dramatically and is attributed to the restrictions imposed on tribal member hunting. In 1986, the bull:cow ratio was 31:100, in 1987 it was 36:100 and in 1988 it increased to 47 bulls:100 cows. The percentage of branch antlered bulls observed during this same period were 68% in 1986, 70% in 1987 and 77% in 1988; about half of the branch antlered bulls are mature bulls 6 points or larger.

Tribal members are permitted to hunt elk on the reservation. Their season generally starts in mid-November and extends into mid-December. The number of tribal permits issued has averaged about 1,900 over the last three years. Tribal elk permits are issued by zone. Three elk hunting zones have been established on the reservation with quotas determined for each zone, each hunting season. Tribal members are permitted to take one elk per season. Tribal regulations currently permit the harvest of cows, calves and spike bulls only. However, each season a very limited number of "any elk" tags are issued by drawing. These tags allow the tribal member to harvest any elk, including branch antlered bulls. Despite the number of permits issued, tribal members harvest only 300-400 elk per year, the majority of which are cows and calves.

The tribe has been operating a trophy elk hunting program (fee access) since the mid-1970's and is currently considered as perhaps the top trophy elk producer in North America.

Each year approximately 58 trophy bull permits are sold to non-Indian hunters at a cost of $10,000. Permits are full package seven day hunts that includes access onto the reservation, one on one guiding, food, lodging and care of trophy, i.e., capping, skinning, as well as taking the meat to a meat packing facility. The hunter success rate has averaged 93% over the last eight years. The hunts are operated out of two camps, with 25 hunters accommodated on three separate hunt periods. Hunts begin the latter part of September and continue through the first part of October. The maximum number of hunters per camp per hunt is ten, thereby providing a hunter density of one hunter per 31 square miles. The average age of bulls shot is 7 1/2. The average net Boone & Crockett score is 345. A total of 31 Boone and Crockett Record Book elk have been taken on Fort Apache, 24 of these since 1980. Bookheads include the unofficial number one bull in the non-typical category, scoring 447 7/8 points; and two, 400 plus point typical bulls. Under Safari Club International scoring, seven of the top ten listed bulls have come from Fort Apache, including the current world record.

The early years of non-Indian hunting, 1960 through the early 1970's, on the Reservation could be truly considered as fee access hunting, since non-Indians could purchase tribal permits, in addition to the state license, and hunt practically where they desired within the reservation. The number of tags that were available to non-Indian hunters were set by the state. Consequently, the tribe had little control over non-Indian hunting. During this period, the number of non-Indian hunters ranged anywhere from 200 to as many as 400 each year. The fees charged by the tribe to hunt on the reservation ranged from $75 and $150. As the tribe became more aware of the potential economic benefits from elk hunting, and existing tribal/state management conflicts greater efforts were made by the tribe to assume regulatory control over elk hunting.

The White Mountain Apache tribe, being a progressive tribe that they are, chose to develop a trophy hunting enterprise as opposed to maintaining a general elk hunt, or closing the reservation to non-Indian hunters.

Fee access has had considerable economic benefits to this and other Indian tribes in the southwest. Income that is generated assists the tribes in developing and maintaining tribal game and fish programs, that entail not only the management, but also the protection and enhancement, and in some cases research of wildlife populations and their habitats. Since outside funding sources are generally unavailable to tribal programs, the economic aspect can be extremely important to a

tribe's management capability. Allowing non-Indian access on Indian lands is often an incentive for Indian tribes to properly manage these resources.

Perhaps the most important key as to why tribes are willing to begin, or continue, permitting non-Indian hunting access is that they are recognizing and asserting total regulatory jurisdiction over non-Indian hunting. If the tribes did not have this control, it is likely that few if any tribes would consider fee access hunting on their reservations. Despite the economic benefits the White Mountain Apache tribe generates from fee access (or fee hunting), the tribe considers the elk resource as a tribal resource first and foremost. In other words, if elk for some reason were to become limited, then non-tribal hunting opportunities would no longer be available except to members of the White Mountain Apache tribe.

Finally, I don't know how many noticed that the list of tribes I mentioned were all southwestern tribes. There is presently not one Indian reservation in the Northern U.S. that offers fee access (or fee hunting) for elk. I believe it is related to the fact that nearly all Indian reservations were established based on treaties, while the majority of the reservations in the southwest were established by Executive Order: therefore, hunting by tribal members on these reservations is generally considered more of a privilege than a right, as opposed to the treaty tribes in the north where hunting is clearly expressed as a right.

It is very evident that treaty tribes maintain a greater cultural relationship with wildlife, particularly elk, than non-treaty tribes. Therefore at this time it is likely that few if any treaty tribes will ever consider promoting or developing fee access elk hunting programs.

Cultures are also distinctly different between treaty and non-treaty tribes. While the northern tribes have been totally dependent on game for subsistence, the southwestern tribes have been extensively involved in agriculture. Therefore, hunting did not play a critical role in survival. In the southwest, deer have always had a greater cultural significance to tribes than elk. On Fort Apache, for example, while non-Indian elk hunting is readily accepted, a great deal of reluctance is expressed by the tribe toward non-Indian deer hunting, consequently non-Indian deer hunting is not allowed on the reservation.

Summary

I have attempted to illustrate several points regarding fee access (fee hunting) on Indian lands:

1. Cultural values, beliefs, and traditions differ in each region of the country, and among tribes within those regions, therefore a diversity of perceptions exist on the concept of fee access hunting.

2. Fee access hunting in the southwest has been met with greater acceptance, or perhaps tolerance in some cases, than in other parts of the country.

3. An important incentive for allowing non-Indians access to Indian lands has of course been economic returns, which means improving the ability of Indian tribes to develop and maintain programs, jobs for tribal members, overall tribal economic improvement and tribal recognition.

4. There are many Indian reservations in the western United States that have substantial, as well as significant, elk resources.

5. Indian tribes are fully capable of developing and maintaining quality hunting and overall wildlife management programs.

6. Indian tribes can make significant contributions to public recreational hunting opportunities.

An important decision Indian tribes have been faced with and will continue to struggle with in the future regarding fee access, is whether to continue maintaining cultural traditions and values for wildlife resources or to begin applying commercial values for these resources to improve reservation economies.

FEE ACCESS ON CHAMPION INTERNATIONAL'S WASHINGTON AREA TIMBERLANDS

Jack Ward, Champion International, 31716 Camp 1 Road, Orting, Wa. 98360.

Abstract

Champion International owns substantial acreage nationwide and 300,000 acres in Washington State. Prior to 1987, Champion allowed recreational users to enter champion lands free of charge. Annual costs associated with these users was $20,000 - 25,000. In 1986, mandatory registration for persons entering Champion lands was initiated but no fees were charged. In September of 1987 a fee access system was implemented. The fee access systems and wildlife inventory system is summarized.

Overview

For those of you in the audience not familiar with Champion International, I would like to spend a brief time discussing Champion's timberland ownership and management philosophy in the United States, and in the State of Washington.

Champion is one of the top five forest products companies in the United States. The company owns 6.5 million acres of timberland nationwide and within the State of Washington 300,000 acres. There are 190,000 acres west of the Cascades and 110,000 acres on the eastside in Klickitat County. Champion's primary goal in land management is the production of wood fiber. The corporation also places a very high priority in management of other natural resources such as wildlife, fisheries, and water.

In eastern Pierce County, where I would like to concentrate my presentation, the company owns 135,000 acres of which 113,000 are subject to access fees. This area is broken down into two blocks: the larger block being the Kapowsin Tree Farm, and the smaller 13,000 acre Buckley block. The main tree farm is located on the west side of Mt. Rainier National Park, southeast of the town of Orting, northeast of the town of Eatonville, and the headwaters of the Puyallup River flow through the center of the larger Kapowsin block.

Why did Champion enter into a fee access system in September of 1987?

As you can see from this graph, Douglas Fir stumpage prices experienced a severe drop in the early 1980's. Stumpage values were at an all time high in 1979 when they plummeted to a recent history low by 1982, holding at that low level until only recently. Timber and lumber prices are very volatile since they are subject to drastic market swings that can occur during any given year. During the early 1980's this caused severe financial problems in the forest products industry, especially in the northwest.

During this unstable time, Champion, like others went through major restructuring efforts. As an example, our Washington area salaried staff was reduced by 40%. Great emphasis was also placed on cost containment. Prior to 1987, Champion allowed recreational users, basically hunters, to enter our tree farm during a six week period in the fall on a free basis. The annual cost associated with these recreational users was approximately $20,000-$25,000.

Champion also established a goal for land managers to develop multiple sources of revenue to help cash flow during poor timber markets. Two of the ways to do that are:

1. Develop and sell parcels of land as real estate - we have done a little bit of that.

2. Join into a cooperative agreement with other parties and develop hydroelectric or mineral projects.

At Champion we have chosen to manage our wildlife and fisheries more intensively and develop the recreational potential and tree farms. To implement such a system takes a lot of money, and it takes a lot of time. Therefore, we feel justified in charging an access fee in order to realize a return on our investment.

Another very important reason we entered into a fee access system is because the Kapowsin Tree Farm is an ideal location. It's an area of accepted controlled access; it's an area where one company owns 95% of the land; it is also located immediately adjacent to Mt. Rainier National Park which allows for migration of big game to and from the park.

<u>The history of Champion's wildlife management and research policies from the 1940's until 1987.</u>

During this time our tree farm was only open to public vehicle traffic during general buck season and special permit hunting. The rest of the year, the only way the public could enter the area was by foot. Thus there was very little poaching that occurred at the tree farm. As a result we were experiencing very high deer populations. During the late 1970's this led to serious deer browse of our plantations. We knew the populations were too high, and we also felt there were too many does and too few bucks. So in 1979, we started our own research to verify our beliefs. At that time we hired Dr. Ken Raedeke to assist us in this research which has continued through at the present time.

In 1983 we entered into our first cooperative agreement with the Department of Wildlife to establish a road management area. This is an area set aside with very limited vehicle access which provides a quality recreational experience as well as providing an escapement area for big game. In 1984 we established designated camping areas. These areas were identified and established to concentrate people in low fire hazard locations. In 1985 we added another road management area. In 1986 we again expanded our road management areas to a total of four units encompassing 18,000 acres. We also found it necessary to install 13 new interior gates to help restrict vehicle traffic because the green dot or sign honor system was not working. Also in the fall of 1986 we started aerial elk census work, which has continued at the rate of two flights per year, one in September and one in January. Another major change we made in 1986 was to start requiring everyone who entered the tree farm, including foot traffic, to obtain a permit. It was a free permit, but never the less, required. We were then able to determine exactly how many people were using the tree farm as well as what their activities were.

In September, 1987 we implemented the fee access system. Also during 1987 we expanded our road management areas to a total of seven different units encompassing 38,000 of the 100,000 acres of the Kapowsin Tree Farm. We now maintain 17 interior

gates that are associated with these road management areas. As a result of surveys handed out to our permittees, we are not enlarging the road management areas. A vast majority of the users agree with and like the system.

In September of 1988 we plan to add an area called the Buckley block to our fee access program. This is an area encompassing approximately 13,000 acres located immediately east of the town of Buckley.

From 1980 through 1987 we have spent approximately $45,000 on deer and elk research. This research has collected data on census counts, harvest numbers, reproductive rates, and physical conditions.

How Champion's fee access system works.

Again, the company owns 300,000 acres in this state. There are 113,000 acres out of that 300,000 that are now subject to access fees. The remaining acreage is still open to free access. Our Kapowsin Tree Farm access area is open the year round to all recreational users. All users are charged an access fee. It is not a hunting fee. The same fees apply all year, and we feel these fees are moderate, and we are flexible. In fact, as a result of comments made last year, our day rate was reduced by 33%, which became effective July 1 of this year.

Now, what does Champion provide for the purchaser of an access permit?

Access. Our King Creek gate is open seven days a week. The only day it will be closed this year is Christmas day. Our Kapowsin gate and our Buckley gate will be open from September 1 through December 31.

Designated Campgrounds. We now have eight different designated campgrounds where people can pitch their tents and park their campers for up to 14 consecutive days.

Firewood. Cured and split wood at campsites.

Sanikans in high use designated camping areas - a 1988 addition.

Garbage Collection. Dumpsters are at each gate location so as a permittee exits our tree farm, they can deposit their garbage.

Security. Year round security is provided by a professional contractor. This individual has developed an excellent rapport with several different law enforcement agencies and has developed an exceptional relationship with the Department of Wildlife. He not only works on Champion trespass problems, but he has also worked in close cooperation with the Department of Wildlife on several different game violations.

Newsletter. Another benefit of the fee access system is that we are producing a newsletter which will be published twice a year. The first issue was just published and mailed in mid-June.

Animal Retrieval from road management areas. During elk season we supply retrieval from all road management areas, and this year we added deer retrieval from one particular road management area.

Wildlife Research and Habitat Enhancement

Since the program was initiated we have tripled our research and census expenditures; we already have the longest continuous deer research program in the state. This program will continue and will be expanded further into other species like elk and cats. We are currently making plans to log specifically designed clearcuts to provide elk feeding habitat. These areas will be managed for deer and elk forage, not for timber, on a long term basis; our salaried staff are currently making herd composition counts and are recording them for Department of Wildlife reporting purposes; and since all hunters exit through controlled gates, the fee access system provides a unique opportunity to have almost total control on harvest data. For example, we will have very accurate information on success ratios, game health, harvest levels, etc. This program has also fueled a real interest in wildlife among our staff. This year alone, we have attended three wildlife seminars and three Wildlife Commission meetings. In previous years we might have attended one Wildlife Commission meeting.

This pie chart, taken from our newsletter, shows where we spent our money in 1987: 38% of our expenditures were on wildlife management, of which 50% was direct research; 27% was spent on security; 25% people management - entry gates, road management gates, and signs; and 10% on services - firewood, garbage, etc.

Summary

In this program, Champion has a goal of win, win, win. First of all the users win - they gain expanded access, improved physical facilities and security. They will also gain an improved quantity and quality of wildlife to enjoy. Wildlife and fisheries win - as a result of this program, wildlife/fish habitat and populations will be better managed. And for Champion there should be improved profitability to help smooth out the volatile curve, and there will also be improved public relations.

The bottom line is this: Champion International has implemented a fee access system. It is a dynamic system that will remain flexible. It is here to stay, and it is a fact that fee access already has, and will continue to have, a positive impact on wildlife management on Champion lands.

FEE ACCESS: A PERSPECTIVE FROM THE COMMON MAN

Arthur Solomon, Jr.
Inland Northwest Wildlife Council
Spokane, Washington

Time is running late - I want to explain a little bit about myself. I'm kinda wondering what I am doing here right now. First of all, I am not a biologist, I am not a scientist. I certainly am not a scholar; - about all I really know how to do is read a balance sheet and income statements and that's where I spend most of my life. But, always with an interest in wildlife.

It is true I represent a group in Spokane formerly called Inland Empire Big Game Council, now called Inland Northwest Wildlife Council. Essentially, it is a group like most of us main stream Americans concerned about wildlife, concerned about hunting, concerned about fishing, concerned about resources and very definitely concerned about the direction that it is taking.

If my time is cut short today, it would be of great delight that I at least say that if any message I could have stated as eloquently as the gentleman from Montana, Mr. Posewitz, that is how our people feel. You have a public trust.

As I sat here and listened to the various individuals talk, good speakers, good topics, good subjects, and I recognize some people out in the audience that are just like myself - are interested in these. Everyone is talking to us and at us telling us what you gotta do. No one is talking with us. There is a vast army of private citizens, many with no great wealth but have a lot of great experience who are willing to give their time and talents to wildlife. What does this have to do with fee hunting, what does this have to do with access, what does this have to do with everything?

Obviously an organization, such as the one I represent, does not support the premise of paying a fee to someone to use for hunting or fishing. Not everyone is a Champion. The gentleman from New Mexico had some thought provoking comments to make. The gentleman that followed him talks on a subject that I feel very concerned about, economics of wildlife. We are going to lose it all unless we work together.

You can have the support of the people - not everyone - there will always be differences of opinion. In no way, does the organization I represent want to place ourselves in a position of supporting any type of game ranching, game farming, fee hunting, any commercialization of wildlife. It is perhaps against, as the gentleman from Montana said, the public trust. Now, there are going to have to be compromises - I am not dumb - I don't think. A lot of people would probably say I am unyielding, because I too have a strength of purpose. Remember I come from the private sector, and

that's all I really knew until eleven years ago someone asked me how I would like to do what I am doing now. I represent the common man.

Most of the agencies are supposed to be representing everybody, the rich, the poor, the sick, the healthy, somewhere along the line. I am not going to end at this point simply by saying, there is another idea that no one has stated here that might generate some revenue. In the State of Washington, we have a tax relief measure that's called, for want of a better term, open spaces. Generally, the open spaces concept is for nonproduction. Let us consider using the open space technique for compensation or some type of remuneration to landowners. I too agree that all landowners, small, large, corporate, or individual have got to be compensated. I have a great deal of difficulty with providing a product or a service that belongs to me, by right of citizenship, at no cost or below market cost for someone else to use to make a profit on. Thank you.

ACCESS FEE ALTERNATIVES: THE CHALLENGE FOR WILDLIFE MANAGEMENT IN WASHINGTON STATE

Doug Pineo

Abstract

Wildlife management on private lands is reviewed. Wildlife managers should become market oriented and take advantage of management opportunities. Disincentives for the private landowner to wildlife management are discussed. Potential quality wildlife experiences on private lands are identified. Experiences in other states are reviewed and a Washington Wildlife Cooperative proposed.

Introduction

Those of us employed in wildland resource management generally entered our professions out of a great personal attachment to wild things. Also Leopold pointed out there are those of us who can live without wildlife, and those of us who cannot. And in her song "Big Yellow Taxi", Joanie Mitchell observed ruefully, "Don't it always go to show, you don't know what you got 'til it's gone; Pave paradise, put up a parking lot..." (Mitchell 1970).

That song was written during the "greening" of America, the first great popular American realization in the late 1960's that, as a nation, we'd achieved unprecedented wealth and prosperity, but at the cost of seriously tattering the ecological systems which sustain us. We'd lost a great deal in our rush toward industrialized wealth. While Leopold wrote about this in the early youth of wildlife management as a technical discipline (Leopold 1949), things had to get a lot worse before our popular culture, from which the great sea of changes come, recognized the problems.

Two concepts inform this anxiety about loss, as it relates to wildlife and wildland management in the last years of the 20th century. On the rational, intellectual side, economists show us that the first condition upon which a market can exist is value. The concept of value flows from a perception of scarcity. Emotionally (and ultimately therefore politically), the perception of scarcity often accompanies or results from a sense of loss. Our reaction to loss is usually a grieving process, which begins with anger and denial (Kubler - Ross 1977).

Even as scarcity triggers market development for wildlife and other wildland resources, many of those who already feel a sense of loss from declining wildlife feel further threats of loss from these developing markets. These threats of loss are felt by wildlife agency professionals, who have understandably developed a proprietary attitude about the resource, and recreationists who see access-for-a-fee as loss of recreational opportunity. A sense of loss induces a grieving process marked first by anger and denial.

Becoming Market Oriented

As professionals, we have managed wildlife and other natural resources as best we could, given the many institutional and economic constraints we face. We have done so with Leopold's land ethic, born out of the Progressive Era of Roosevelt and Pinchot, in our hearts.

Like Weyerhaueser and other wood fiber producers, and farmers since the Depression years, we have been concerned with production - the supply side - rather than changing markets - the demand side. In fact, since so many of us have been employed in the public sector for most or all of our careers, the concept of markets has often been foreign, even vaguely "dirty" to us.

Even those in the private sector can lose their competitive acuity. Big timber producers were lulled into a production mindset by decades of postwar increases in demand for wood fiber. Agricultural producers were preoccupied with production by more than two generations of federal subsidies, and the "green revolution." It was America's destiny to feed the world...wasn't it?

In Washington State, wildlife managers may have been lulled into a production orientation by early blooms of elk and deer populations resulting from the first phases of post-war clearcutting and intensively managed high-yield forestry, on the west side of the state (Brown 1985, Taylor and Johnson 1977). In eastern Washington, unprecedented populations of waterfowl and pheasant were a bountiful byproduct of the Columbia Basin Project (Wolfley, et al 1979).

It has been a rude awakening for foresters and wildlife managers to realize society now wants high yield forestry, to be sure, but with diverse outputs, beyond merely wood fiber. And deer and elk populations are no longer increasing with demand (Pineo 1987). Pheasant populations in the Columbia Basin peaked in 1967 (Zeigler 1978), when the state's human population was less than 75% of its current size.

A byproduct may also be called an economic externality, and agriculture has become more efficient at turning inputs into saleable commodities, thus reducing inefficiencies, or externalities (Wolfley, et al 1979). More efficient agriculture, narrowly defined by traditional markets in agricultural commodities, has been the main cause of declining pheasant populations nationwide (Olsen 1978).

More intensive forest management for fiber production has been a major cause of reduction in diversity and biomass of wildlife in forest lands (Thomas 1979, Brown 1985). Declining richness, diversity, and extent of habitat is a fundamentally different problem than the classic market failures (unregulated hunting) of the 19th century, which produced the first major reductions in North American wildlife populations (Tober 1981).

Leopold told us that "we need to recognize the landowner as the custodian of public game on all private land, protect him from the irresponsible shooter, and compensate him for putting his land in productive condition..." (Leopold 1949). But we wildlife managers have learned so well to distrust markets in the arena of wildlife management, that we have paid only lip service to this realization, for the most part. Examples where landowners have been helped and recognized certainly exist, but these are the exceptions rather than the rule (Kruckenburg 1985).

The institution of regulated limits on hunting, and scientific management of wildlife populations using ecological principles was highly successful in restoring many wildlife pouplations, in much of the 20th century. But increasingly intensive economic use of wildlands and agricultural lands, for food and fiber production, institutionalized wildlife management in North America.

We simply must find acceptable institutions to allow wildlife to compete more effectively with other economic uses of private and public land, if we are to maintain quality elk hunting, and other wildlife oriented outdoor recreation. We need to become more market oriented in our thinking.

Disincentives for Wildlife Management on Wildlands and Agricultural Lands

Landowners and land managers in the public and private sectors face the same three areas of costs which are imposed by the presence of wildlife on their property. In the absence of ways to recover these costs, they act as disincentives to manage for, much less tolerate wildlife in the working landscape (Pineo 1985). These are:

1. Social Costs - As the human population of North America has increased and become more urbanized, demand for dispersed outdoor recreation, including hunting and appreciative use of wildlife, has also increased. The whole hunter-landowner relationship revolves around the social costs incurred by landowners, because the public wants to pursue wildlife oriented recreation on private lands. Vandalism and theft, litter, gates left open, are only the most onerous examples of social costs.

   Incurred on private and public lands, these costs are also joined by more benign costs such as taking time to respond to recreationists' requests for access, giving directions, providing and maintaining campsites and roads. These expenses amounted to over $27,000 during elk and deer seasons in 1986, on the 112,000 acre Kapowsin tree farm in western Washington (Ward 1986). Similar costs obtained on National Forests and National and State Parks, for all types of recreational activity.

2. Production Costs - When wildlife consumes crops or forage, or landowners contemplate the practice of active wildlife management, production costs are incurred. These are direct, out-of-pocket costs.

3. Opportunity Costs - Land remaining in, or planted in vegetation for wildlife cover and food results in income forgone, since it cannot be planted in saleable crops. Time invested in wildlife and recreationist management cannot be invested in other income-producing activities. A land manager has a limited land base from which to make a living, and a fixed amount of time in each of the four seasons to do it in. These are among the very real opportunity costs of wildlife and active wildlife management, especially on private lands.

The Quality Wildlife Experience

As increasing demand for wildlife recreation is placed on a shrinking resource base, the quality has often deteriorated. Elk hunters are familiar with the crowded, narrow seasons, and the generally truncated age structures of many elk herds. Elk hunting has always been popular, so there is little wonder that much of the development in fee access hunting has centered on it. The most highly valued hunting in North America, as measured in economic activity, is for waterfowl and trophy elk.

This occurs on private or reservation lands, where land managers control access, or public lands, where outfitters provide the knowledge, hospitality and support to put the recreationist together with a quality opportunity. The two elements which distinguish quality outdoor experiences are:

1. Reasonable Expectation of Success - A review of the travel and guest ranch advertisements in Audubon magazine, reveals that appreciative wildlife users will pay large sums just as elk hunters will, if they know they will have the opportunity to see the wildlife. Reasonable expectation of success implies the habitat is healthy, and extensive enough to produce the resource. Wildlife richness and diversity often depend on active wildlife management (which may well include just leaving it alone).

2. Exclusivity - Few will pay to experience wildlife recreation with crowded conditions, elbow to elbow with those whose appreciation is less than their own. People seeking high quality wildlife recreation want solitude. If others are there, they'd better be few in number, and have a similar appreciation and attitude about the experience.

Exclusivity as a component of quality wildlife experiences is not to be confused with exclusionary forms of fee access, which are priced beyond the ability of those with modest means to pay. Moose hunting in Washington is exclusive - only six permits were issued in 1987 - but it is not exclusionary. Access to this hunt is controlled by a lottery. To enter the lottery, the hopeful moose hunter pays $150, which is refunded to those who are not drawn.

Fee access for hunting, fishing and appreciative wildlife use is appearing all over the west. It's not new; only the rate of its spread is a new trend. Many current operations are relatively expensive. If a substantial increment of the private land base is placed under fee access at high prices, the effect will be exclusionary, as has occurred in Texas. There will likely be a political reaction of some sort, to place severe constraints on fee access, most likely through state or local tax codes, however self-defeating these may be.

Constraints on Fee Access Wildlife Recreation

Land managers face a number of constraints in contemplating fee access programs for outdoor recreation. These include taxes, the cost of liability insurance, the size and configuration of the land parcel in question, personal talents and inclinations when dealing with people, and the land's potential for ecological enhancement.

Local political and social considerations may also come into play. If too many neighbors are opposed to the idea, few landowners will risk a major rupture in close-knit rural social settings to pursue fee access programs. A recent, survey which didn't distinguish between farmers, ranchers, or corporate rural landowners in Washington found about 90% not yet willing to charge fees for access to their lands (Landers 1986).

Still, widespread economic distress across rural America, particularly among the nation's ranchers, is spurring interest in fee access (Grosfield 1987). Some basic issues are at stake here. There were 24,000 ranches in Montana in 1987. In just 12 years, by the turn of the century, this number is expected to drop to 6,000 (Jonkel 1987). Many corporate interests, who have no stake or interest in rural American society, are buying up these ranches. While fee access is not a panacea for systemic problems in range management, soil erosion, or declining rural incomes, it could be a major tool for tackling interrelated social and ecological problems in appropriate regions of the American West.

Success or failure relies on an ethical approach by landowners, supported by professional resource managers in the public and private sectors. George Reiger calls the current trend the "Resource Revolution" (Reiger 1988). As Reiger sees it, the narrow view of parochial resource management agencies stifles the best interest of the wild resource, landowners, and the resource professionals.

As in other revolutions, excesses may occur. Yet the fact remains, wildlife managers are increasingly finding professionally challenging work in the private sector, with private non-profit conservation organizations, corporate landowners, and individual landowners who want to realize active wildlife management on their holdings (Miller, et al. 1983). As in the public sector at state wildlife agencies, salaries are often paid by those who use the resources, through user fees.

Colorado has taken among the most progressive approaches of the western states, in working with landowners and the concept of fee access. The state has sought positive solutions in providing technical assistance to landowners, as a straightforward acknowledgement of the potential benefits to wildlife and its various constituencies, from properly approached multiple resource management. Colorado wildlife managers have recognized wildlife management as a legitimate concern of the landowner, without feeling professionally threatened by private consultants (Reiger 1988).

While various forms of fee access have developed throughout North America, as a means of allowing wildlife to compete successfully on private lands, and facilitating a sustainable rural society, it has generally fallen to a handful of states to develop or propose programs which will do this without making wildlife recreation exclusionary.

Oklahoma, Michigan, Wyoming, Nebraska, and New York have all instituted state-run programs to employ fee access to benefit both wildlife, and recreational opportunity at nonexclusionary rates. Fee access can be operated in a nonexclusionary way, and states can lead the way (Pineo 1987).

Diffusion of Innovation

Ranchers in a township in northeastern New Mexico organized in the 1987-88 hunting season, to charge a $25 season fee for access. The area has outstanding lesser prairie chicken hunting, mule deer, and antelope. Yet, rather than pay the equivalent cost of two cases of beer, three quarters of the usual hunters stayed on the northern edge of the township, and shot their birds as they flew over the roads (Weaver 1988).

A former rancher in Montana developed the Big Open proposal, as a way for economically distressed landowners in east central Montana to take charge of their lives and their homes again, while achieving a sustainable land use and livelihood. Bob Scott proposes a 15,000 square mile cooperative, where only the most suitable lands would be farmed or grazed with domestic livestock, but where free roaming buffalo, deer, elk, and bighorn sheep would attract millions of dollars in tourist and related economic activity. Average incomes in Garfield County would more than double. No one would have to give up ownership of their land. The landowners' coopertive would operate the entity, with technical assistance from the state wildlife agency.

However, it's an uphill long haul to sell this idea, because it's a startling innovation. Rural people don't like to gamble on their livelihoods, even though, paradoxically, farming and ranching are risky enterprises by nature (no pun intended). This realization came about in the 1930's when hybrid corn was introduced in Iowa. It was assumed farmers would immediately adopt the new varieties, which promised to double yields.

Yet, the innovation took time to take hold, being experimented with first by a few better educated risk takers who were "early adopters." Their success was not lost on the rest of the rural community, as those who watched the experiments jumped on the bandwagon. As time went by the bulk of farmers adopted the new high yield corn varieties. Finally, a small group of isolated "late adopters" switched to the new corn (Griliches 1960, Jones 1963).

This process was dubbed "diffusion of innovation." The farmer population adopted the high yield corn over time in numbers and rates which resemble the normal curve (Carlson, et al 1977). It is on this and the related social sciences of demographics and survey methodology that the discipline of market research and marketing is based. Bob Scott and the Institute of the Rockies, to their credit, recognize that ranchers are going to take a lot of time to accept the idea of the Big Open.

What's happening in Montana is a paradigm for the adoption of nonexclusionary multiple resource management through fee access in forestland, farm and range lands throughout the west? The only point on which I differ with Jack Ward Thomas's excellent discussion on elk hunter fees on the Wallowa-Whitman National Forest, is that he cites Texas as the "best example" of fee hunting (Thomas 1984). In fairness, Thomas probably had Texas' remarkable whitetailed deer herd in mind. Yet, we wander from the true path of natural resource stewardship, if we allow herds of exotic ungulates in the great plains, intermountain west, and Pacific northwest, while our native wildlife declines.

Our native big game, prairie grouse, nongame, and invertebrate fauna, properly restored in robust, sustainable abundance, will be a spectacle unrivalled anywhere else on this shrinking planet. And while the recreating public in the west is showing a growing acceptance of the concept of fee access (Johnson 1987), it isn't likely to stand for widespread exclusionary fee hunting.

There are always plenty of people around who'll trot out their killer phrases when a new idea is voiced, or someone shows some initiative. "We tried that and it didn't work...Wait 'til you've been around a while longer, you'll see...It'll cost too much to start...The hidden corporate powers will never let you get it off the ground... ." In any bailiwick there's turf to be protected, positions to be defended. The prospect of loss is a powerful incentive for these negative responses to proposed change. These cultural impediments to innovation are, at the same time society's sea anchors, and stifling inertia.

Of the existing programs, the published or otherwise publicized visions of innovative responses to current declines in wildlife habitat and wildlife related conflicts, the Big Open is still the most culturally and socially acceptable concept, that would have a positive impact on an entire ecosystem. The key is selling a cooperative approach which is tailored by and for the people it affects.

The Big Open speaks to a region of farmer-ranchers on the edge of losing the home place. The concept's founders appear to assume that the consuming publics will buy off on the idea, because the appeal is to all wildlife oriented and western outdoor recreationists, with a nonexclusionary access fee. Not a hunting fee, but an access fee (Jonkel 1987).

Those working to get the ranching families of Garfield County, Montana, to mull over, and eventually commit to this concept, are correct to focus on landowners, while opening the door wide conceptually, to all who would seek the experience of the high plains, as they were in the time of Lewis and Clark.

The Washington Wildlife Cooperative

While Bob Scott and Charles Jonkel were developing the Big Open concept, I was taking a similar approach to thinking about ways to stem declining wildlife and wildlife recreation opportunity in Washington (Mottram 1986). There are some important differences between Montana and Washington. Where Montana is a rural state with an average population density of six people per square mile, Washington has a predominantly urban population, averaging about 70 people per square mile (Office of Financial Management 1988). Though 3/4 of the state's residents live in western Washington, much of rural eastern Washington seems crowded compared to Montana. Washington has the second highest population of western states, after California.

This large, dense urban population contains many who moved here to experience the outdoors in the great northwest. For many of us, this means wildlife oriented recreation. Social costs to landowners from the pursuit of outdoor recreation in Washington is as high as anywhere, and land closure rates resemble those of the eastern U.S. Corporate acquisition of farms and ranches in Washington is also a growing trend. The Kapowsin Tree Farm of Champion International Corp, an industrial forest landowner, is the first in the northwest operated on a fee access basis.

A notable similarity among the state's urban and rural populations is their complementary understanding and response to the idea of cooperatives. Ranchers and farmers belong to marketing "co-ops," which sell, store, and in some cases transport their commodities. Much of the rural population buys feed and hardware at cooperative-owned stores. Washington is the home of the country's largest and most successful consumer cooprative, Recreational Equipment Incorporated (REI), a virtual social institution in the northwest. The members of co-ops own the delivery system; marketing co-op, or retail camping/mountaineering co-op, but the people who make the products receive compensation for their goods. It's an old and broadly accepted American idea.

I envision a nonprofit cooperative institution, of landowners, land managers, and recreationists, organized corporately with a board of trustees and executive committee (or other appropriate organizational structure), and a small staff.

The objectives, expressed in a charter, will be to manage half a million acres of Washington forests, rangelands, and farmlands for multiple resource and recreation management, to the satisfaction of all member landowners and recreationists, and the enrichment of the wildlife and habitat resource. Being nonprofit, the cooperative would be eligible for grants for wildlife management research, watershed management, and cooperative wildlife projects with the Department of Wildlife. Depending on

legal constraints, it could be organized for tax exempt status, and eligible for charitable giving.

Briefly, the cooperative would function like this: A fee in the neighborhood of $100 per year (slightly more for families), would buy membership in the cooperative for recreationists. Landowners allowing co-op member access would join free of charge. Cooperative staff would evaluate each farm, forested tract, or ranch for present and potential suitability for recreation (types of recreation, and user days capacity). The present and potential ecological condition of the property would be assessed. The cooperative and the landowner would determine the number and type of user days established for the property.

These elements would be incorporated in a wildlife and recreation management plan developed for the property, and would be a requirement for membership in the co-op. The type of compensation would be negotiated. Some landowners want only relief from social costs of trespass, while others may want some monetary compensation. Others may wish only to have wildlife management, habitat development, and weed control carried out by the co-op.

Member landowners wishing financial compensation would receive a percentage of revenues calculated from user days recorded on the property. Thus the landowner and the co-op each have an incentive to increase the quality of the resource and recreational opportunity, through long term habitat development and recreation management. Member landowners who wish not to allow access by other co-op members would pay the regular membership fee.

Revenues in excess of expenses would be returned to the resource, in the form of habitat development, acquisition, or less than fee protection, and developing recreational resources such as hardened campsites. Spending priorities would be determined by the governing body in accordance with the charter, with regular member input.

There is no real reason why the Department of Wildlife cannot administer a similar program for enrolled private lands. For a $50 to $100 "special management area stamp," the agency could use techniques similar to the cooperative proposal outlined above, to regulate entry of recreationists onto enrolled private lands, which are actively managed for wildlife. The landowner would receive compensation (if desired) as specified in authorizing legislation. The agency could perform emphasis patrol on these lands, for trespass control.

What Lies Ahead?

As land use intensifies, and a growing population simultaneously demands more wildlife-oriented dispersed recreational opportunity, traditional modes of protecting wildlife resources through investing this public trust in institutions such as the Department of Wildlife, have become increasingly ineffective, because public wildlife agencies don't control much of the habitat base. When founded 50 or more years ago, state and federal wildlife agencies could manage the resource relatively well through controlling harvest, based on sound scientific wildlife management principles in conjunction with a sound habitat base.

The habitat base for many species of wildlife has declined, in quality and quantity since the Progressive Era (Tober 1981). Yet, a number of obstacles may hinder the adoption of private initiatives in wildlife management in Washington.

Many sportsmens' groups are highly aware of the potential of fee access to increase the cost of outdoor recreation. Some oppose the trend outright, others see the potential benefits, and others yet demand changes in property tax law if landowners, particularly corporate forestland owners, begin leasing land or charging daily or seasonal fees. Hiking groups are also vigilant to the trend, and like hunters, resistant. Acting as rational consumers, their attitudes are understandable. Opportunistic legislators may be more than willing to change the trespass law, property tax laws, or the timber tax if public sentiment demands.

Anti-hunting and preservationist groups are organized to put an end to all forms of consumptive use of wildlife resources. Though not yet representing mainstream thought, they have challenged federal and state wildlife management programs in court and manipulate public sentiment, drawing resources, and attention away from the real issues of wildlife management and environmental quality (White 1977).

Ironically, anti-hunting sentiment typically perpetuates the Cartesian dichotomy which has so plagued western civilization, with its invocation of fear and contempt of wilderness, and the natural world, as intellectualized by Descartes. By suggesting humans should not hunt because it is immoral, while the rest of the living world does so free of introspection and doubt, anti-hunting groups infer that humanity is separate, and alienated from the environment around, and in us.

The problem is compounded in Washington as elsewhere by inappropriate defenses of hunting, which often cite the role of the hunter as replacement for "natural" predators, which we have thoughtlessly depleted, and for which we must now act as proxy. This another expression of the Cartesian dichotomy, and industrial alienation. It might be more useful to point out that hunters and anglers are legitimate consumers of the productivity of healthy ecosystems. They are very real constituents for environmental quality, exemplified by wildlands and agricultural lands with the ecological integrity to produce a biological or harvestable surplus.

Though often eclipsed in visibility by other environmental activists in recent years, traditional conservation groups like Ducks Unlimited, Trout Unlimited, the Isaac Walton League, Federation of Fly Fishers, and many local and regional groups continue to support, financially and politically, efforts to preserve and enhance wildlife habitat, water quality, and good forest management.

In Washington some of these groups are allied with Audubon chapters, the Sierra Club and other national and regional environmental advocacy groups in the Washington Environmental Council (WEC), to support and promote protection of Washington's environmental quality. These groups, singlely and through WEC could enter into cooperative arrangements with landowners to foster multiple resource management, while retaining affordable recreational opportunity for the majority of committed recreationists.

It is important to maintain a spectrum of recreational opportunity in Washington, which includes free public access. Large state and federal land holdings in Washington, in parks and managed forests, plus extensive industrial forestland holdings in economically distressed counties make it unlikely a situation like the

one in Texas will develop, where most leased hunting is expensive, and virtually all hunting is by fee access.

Furthermore, a window of opportunity exists now to establish private nonprofit entities in Washington which could bring recreationists' money and labor together with the private land managers' habitat base, to enhance the public resources and attendant quality recreational opportunity. If started early enough, such an entity could be a moderately priced alternative to conventional leasing or day use fee access. It could provide an option which might prove attractive to the majority of landowners (over 90% in my survey of 1984, and over 70% in an unscientific survey conducted by Rich Landers of the Spokane Chronicle in 1986), who express some degree of unease about leasing hunting rights on their lands. Over time, this arrangement could become institutionalized as the norm for many landowners and recreationists.

Some appreciative users (often inappropriately called nonconsumptive users) in the conservation and environmental activist community also may oppose broad adoption of recreational fee access to private lands in Washington, especially on forest lands. Enmity toward industrial forest land owners remains, though the Timber Fish and Wildlife process recently adopted by the Forest Practices Board has helped reduce tensions.

Appreciative users can play an important supportive role in promoting multiple resource management on private lands for potential benefits to a spectrum of environmental values, much broader than terrestrial and aquatic game species. Potential primary beneficiaries include riparian and forest habitat management, cleaner water, erosion control, and protection for special and unique habitats, especially Washington's dwindling shrub steppes and deserts, and wetlands.

If appreciative users make themselves heard by landowners, supporting holistic, multiple resource management, or at least refrain from joining inappropriate attempts to abort the trend, the partnership begun among former adversaries in the Timber Fish Wildlife process may extend to other rural components of Washington's working landscape.

It is not precious but isolated wilderness, where humanity is only a visitor, but the working, common landscapes where people live, which must be the primary reservoirs of functional diversity. This diversity is essential to sustainable forestry and agriculture. It is the source of all wildlife oriented recreation, and a cornerstone of the Jeffersonian promise of a just and decent rural society.

Literature Cited

Brown E. Reade (ed.). 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. USDA Forest Service Pacific Northwest Region Publication R6-F&WL-192-1985.

Carlson, J., D. Dillman, W. Lassey, and M. McCleod. 1977. The Farmer, Absentee Landowners, and Erosion; Factors Influencing the Use of Soil Erosion Control Practices. Idaho Wter Resources Research Technical Completion Project A-050-IDA.

Griliches, Vi. 1960. Hybrid Corn and the Economics of Innovation. Science 132: 275-80.

Grosfield, Lorents. 1987. Cooperative Arrangements in Proceedings of the 1987 Pacific Northwest Range Management Short Course; Developing Profitable Resource-Based Recreation on Private Land. Oregon State University. Corvallis, Oregon.

Johnson, Rebecca. 1987. Preferences for Outdoor Recreation Opportunities in Northeastern Oregon. In ibid.

Jones, Gwyn E. 1963. The Diffusion of Agricultural Innovation. Journal of Agricultural Economics 15; 387-409.

Jonkel, Charles. 1987. Institute Explains Position on Big Open Idea. The Jordan Tribune, July 23, 1987. Jordan, Montana.

Krukenberg, Larry L. 1985. Wildlife Values: Wyoming's Approach to Landowner Compensation. Renewable Natural Resources Journal 3(1).

Kubler-Ross, Elizabeth. 1974. Questions and Answers About Death and Dying. McMillan. New York.

Landers, Rich. 1986. Spokane Spokesman Review, June 30, 1986.

Leopold, Aldo, 1949. A Sand County Almanac. Oxford University Press. New York.

Miller, S. Douglas, Thomas M. Franklin, and Daniel L. Leedy. 1983. Wildlife Research by Private Conservation Organizations: Contributions and Opportunities. pp 443-444 in: Transactions of the 49th North American Wildlife and Natural Resources Conference. Wildlife Management Institute, Washington, D.C.

Mitchell, Joanie. 1970. Big Yellow Taxi. Siquomb Publishing Co.

Mottram, Bob. 1986. The News Tribune. Tacoma, Sunday, May 11.

Office of Financial Management. 1988. Washington State Data Book 1987. Office of Financial Management. Olympia.

Olsen, D. 1978. Land Use and Pheasant Populations. Utah Wildlife Sept./Oct.: 14-16.

Pineo, Douglas A. 1985. Wildlife and Recreation Management on Private Lands: A Guide for Washington. Washington Forest Protection Association, Olympia. 90 pp.

Pineo, Douglas A. 1987. Wildlife and Recreation Management on Private Lands in Washington State. Master's Thesis. Washington State University, Pullman.

Reiger, George. 1988. The Resource Revolution, Field and Stream, June 1988 Vol. XCIII No. 2.

Thomas, Jack Ward. 1984. Fee-Hunting on the Public's Lands?--An Appraisal. in Transactions of the 49th North American Wildlife and Natural Resource Conference. Wildlife Management Institute, Washington, D.C.

Tober, James A. 1981. Who Owns the Wildlife: The Political Economy of Conservation in Nineteenth-Century America. Greenwood Press, Westport, Connecticut 330 pp.

Ward, Jack 1985, 1987. Area Manager, Champion International, Inc., Tacoma, Washington. pers. comm.

Weaver, James 1988. Ornithologist and Rancher, Pep, New Mexico. pers. comm.

White, Ronald J. 1987. Big Game Ranching in the United States. Wild Sheep and Goat International, Mesilla, New Mexico.

Zeigler, Don L. 1978a. Upland Game Bird Populations in Relation to Cover and Agriculture in Eastern Washington (Upland Game Bird Investigations Completion Report W-70-R-17, Study IV, Jobs 1 & 2). Washington Department of Game, Olympia

Questions from the Audience:

Rolf: Now it is time for you to ask your panel members a question.

Q - (to Doug Pineo) - Since the system Champion has set up is what they define a non exclusionary, what advantage would there be for Champion to enter into the cooperative you describe?

A - Well, I added up your fees and Champion proposes 400 dollars a year for access. That is really quite low compared to other similar opportunities. The thing I am proposing is to retain what hunters have now. They can go just about anywhere in the state and find some kind of hunting in farms, forest, or range land - that ought to stay there. So you need land all over, and you need a lot of it. But, you want to get more money to work for the resource somehow so that is what I am trying to find. Something that is socially and culturally acceptable. Champion, for instance, can enroll some of that 175,000 acres that remains, that may not be very convenient to patrol. I think that is a think that's a benefit - there is a big PR benefit - it was designed to be motherhood and apple pie from the start, and it is not for profit. I am not saying profit is a bad word, I am just saying this is not for profit and designed to become semi-institutional or institutional and you can buy into that and receive the benefits.

Q - What are the fees on Champion land?

A - Our day rate is now effective July 1 - $10/day, $7.50/day for senior citizens. We have added a new three day consecutive permit for $20. Senior citizens pay $15. We have another fee schedule for the period January to August - $50/per person - $35/for seniors, and $75/for family. The periods this fall are Sept. 1 to Oct. 14 and Oct. 15 - Dec. 31. Then next year there will be two month periods, e.g., Jan.-Feb., Mar.-Apr.. You generally find Jan.-Feb. users are trappers, cross country skiers; March and April are pretty slow, then start picking up some photographers, mountain climbers. Bikes have a lot of potential especially in road management areas. Our uses last fall were 80 percent big game hunting with remainder mixed with photography, bird hunting, mushroom picking.

Rolf - I might point out the fall hunting period coincides more closely with the hunting season this year as well.

(Jack) - That's right.

Q - (to Joe Jojola) What kind of poaching problems are there?

A - We really haven't looked into the poaching problem - on the reservation we do have some incidents both by tribal members and nontribal members. We have extensive logging on the reservation,

and I think we may have had poachers among them also, but basically, it is not very significant at this point.

Q - What is the reason you have such small take by tribal members? I noticed you issued over 1,600 permits but only 300 animals were killed.

A - A couple of reasons. If our elk herd moves off the reservation, and in certain years they moved off the reservation prior to the tribal hunt, those elk therefore are not available to harvest. The other thing is we have high road densities due to logging and unfortunately that has been promoting lots of road hunting and they are just not harvesting the number of elk we would like for them to harvest.

Q (to Jack Ward) - You insinuated that Champion modified their timber harvest program to accommodate wildlife - could you elaborate on that?

A - There are a couple of examples I can give you. We have one area of about 120 acres where the elk wiped us out two years ago. We were really upset. We had the Department of Wildlife out there, and we had the media out there. We bit the bullet, replanted the area, we were hit again, now we are in the fee access system. We are going to leave it like that and in fact we are not going to let trees grow in there. The other one I mentioned was we worked with our local wildlife biologist on design of some clearcuts. Some pure habitat clearcuts in the river bottoms where we are going to promote forage. That's another reason for going to fee access. We are trying to spread out our clearcuts over big areas - we can do that because we are roaded already.

Q - How does the amount of money derived from fee access compare to what Champion makes on stumpage prices?

A - One way to look at this is we can reduce some costs we were experiencing by opening access to the tree farm around the year. Really all I am looking for is reasonable return on our investment - it will never compete with the value of timber if we stay in a non exclusionary role and you can drift all over the place with that one. My thinking is at present times stay the way we are and make a reasonable return on our investment and not try to compete with operations like White Mountain Apache Tribe. We are at different locations in the country. He doesn't have a lot of local people at his backdoor. He can make money by bringing out of staters in and really do well. I have two million people sitting in my backyard so I can approach it from a different angle.

Q - (to Jack Ward) - What is the return on the investment, and what was your participation last year?

A - The return on the investment was negative. Last year we lost more money than the cost we are experiencing with fee access. But that is to be expected - we had a lot of up-front cost. A reasonable return would be anywhere from 10 to 15 percent on our investment on an annual basis, would be great and anything we make over that is poured back in. I would rather not comment on how many people.

Q - (to Jack Ward) - How significant is the fact that Mount Rainier borders Champion's eastern boundary in providing elk on your land?

A - I think we have quite a population of resident elk that do not go into the Park, but there is a definite positive impact especially if we get snow at the right time (in November). You can see the difference in population but there is 400-500 resident elk that are not migrating.

Q - (to Jack Ward) - Does Champion envision going to a more expanded, exclusionary type of program like in Arizona or New Mexico or Deseret Ranch?

A - No, I want this to work the way we have it set up and I think in our tree farm our goal is not to go that route. There are two other options if it doesn't work and continues to be a loser - we can either shut it down or we can go that route, but that's our last resort. There is a possibility of just making a portion of it that way. There's all kinds of things to think about. Our goal is to make this work the way it is right now, and what we need is a lot more nonconsumptive users coming in.

Q - (to Doug Pineo) - What are the added benefits to the average recreationist?

A - I think you'd get probably more access than you have right now. You'd be able to sit in your backyard or you can go over the mountains depending upon which side you live now, whether that's to eastern Washington or to western Washington. Participate the way you would like to. Widespread nonexclusionary fee access has been institutionalized all over the southern U.S. but you get to lease your little 1,000 acres and that is where you get to do your hunting, and for a lot of people that is OK. But a lot of us are used to the notion of roaming around the west and buying a tag, getting drawn... that is one benefit... You'd have a higher quality recreation because it would achieve exclusivity which is not the same as nonexclusionary. Anybody can buy into it but on a given day only an X number of people can be on that property depending on the resource there. There are a number of other benefits that I think are probably similar too - access maps, direct information on what is happening on the area, and the areas will be managed actively for wildlife.

Q - (for Doug Pineo) If you are talking about certain amount of people using an area at certain time, are you talking about a lottery system for use?

A - (Doug Pineo) Not necessarily, especially for small game the major use is in the first two weekends. You would have to go in and assess a piece of ground and determine how many users you can sustain. For instance, birding, there are areas that are attractive for birding that would be incompatible with another use on the same day. You would have days where, in some areas, they would be set up specifically for appreciative use at certain times and specifically for consumptive use at other times. There's going to have to be adjustments obviously and there might have to be premiums on certain high quality goose hunting or something, but again you can turn off the premiums and you can work with that premium ... like joining a food co-op - work a few hours, get cheaper food.

Q - (for Jack Ward) You said you would like to get more nonconsumptive users on your property. How do you advertise?

A - We have been very careful about that. We have to go through a learning curve in implementing the program and dealing with the public. We need to feel real comfortable with our program. We have to settle down with changes we have made and get a little more stabilized; then we are going to go out and advertise. We are thinking about sending a flyer out maybe through REI to mountain bikers. Mountain bikers do not have many places where they can go. We have excellent spots. We have a little money in the budget, but we have to wait two or three years before we get into that.

Q - (for Art Solomon) Could you elaborate on how the open land program you identified might work?

A - (Art) Well, the people that would be able to develop an open space benefits for wildlife would be those landowners that have taken land out of production for the opposite purpose. There should be some encouragement to all landowners to develop land practices not just the big professional corporations that are either food or timber oriented. To manage land in multiple use for wildlife regardless whether it is for hunted or nonhunted species, then you can at least develop a higher curve of use factor for wildlife. Right now there is really no incentive for landowners and one of the problems we face in southeastern Washington is well known to a lot of people in this room. They want wildlife off their land. Elk literally are being eradicated in spots by incensed ranchers/farmers where the elk are competing with them. We are going to have that problem as long as we don't acknowledge that that is private land. There has to be a method of compensation to the landowner to make him want to manage their land for purposes other than their primary product.

Q - How would the money be generated?

A - (Art Solomon) That is always the first question when you talk about a program of this nature. I suppose some form of taxation, specifically, I don't know. By the time it would go to the legislative process it could be anything.

Q - Would it be through the General Fund?

A - Possibility.

Q - Why not a progressive tax on the access fee which goes to help the Game Department develop other lands?

A - I think the way you arrive at something is by this method; conversing and talking back and forth until there is something the legislative process is willing to consider and take before the (legislative) body or take before the people.

Current Elk Management in Western States and Provinces

A status report from each state or province is a traditional part of the western states and provinces elk workshop. Representatives from each state and province have been asked to give us an update on their management programs. Instead of hunter and population data, however, innovative approaches to elk management programs has been requested. For those of you that just want the facts, a status summary from each representative is included in your registration notebook.

ALBERTA STATUS REPORT

Gerry Lynch, Dept. of Energy & Natural Resources, Alberta

I would like to very briefly summarize some of the programs that are ongoing in Alberta to manage elk populations. As Rolf mentioned, there is a status report in the handout you received when you registered. Very briefly, the elk population in Alberta numbers approximately 13,000. Our license sales are about 38,000 so we have twice as many hunters as we have elk. Harvest in 1986 was 2,843, and in 1987 our preliminary analysis of harvest questionnaire indicates that the harvest is down by approximately 1/3 - the final harvest analysis for 1987 will be completed later in July.

Let's consider some of the problems associated with managing elk in Alberta. We are experiencing population decline in some areas though the goal of the Fish and Wildlife Division is to double the elk population by the year 2000. It has not gotten off to a very good start because in many areas we are experiencing declines rather than increases. One of the major problems is the maturing habitat in some of our key elk areas, and some of that is attributed to more effective forest fire protection. Wolf predation in other areas is significant and in some places 80 percent or better of our calves are dying because of being preyed on by wolves. We have tried a trapper education program to enhance the effectiveness of trappers in the taking of wolves but that essentially is not working that well. We do not control wolves for wildlife management purposes because of public relations problems.

Off-highway vehicle use is another problem in some areas and it is contributing to elk leaving some areas. We have laws that prohibit use of all terrain vehicles during certain periods of the hunting season. Some areas of the province are closed to ATV's during the morning. However, much of the harassment due to these vehicles occurs in summertime by people on trail bikes, etc., in mountainous areas. High harvest in some areas is contributing to population declines.

And, what we are attempting to do is to go to more limited entry hunts in place of general season formats. It is not that easy to go to limited entry hunts in Alberta because it is not particularly popular with hunting public and it is not popular with the elected officials; they don't like to get complaints from their constituents.

Another problem causing the population declines in Alberta is inadequate protection of elk in recently logged areas. Because of the road network and general season format the elk are not able to make use of new forage resources on recently logged areas. We require in Alberta more habitat enhancement, more limited hunts, and local wolf control.

A major issue in Alberta has to do with the guiding and outfitting industry, and the whole thing is in limbo at the moment. The province came up with a new guiding and outfitting policy during 1987 and that policy has not received political approval, and the whole thing is in limbo at this time. The problem is that most of the elk outfitters operate in foothills and mountainous areas of west-central Alberta. They operate in areas that have pretty good elk populations, and some of those elk populations use the national parks and roam into provincial lands during the hunting season. Hunter density is very high in some of these places and we get a great deal of competition from outfitters and guides and the resident hunters. The outfitter policy that was supposed to result in allocation of licenses to outfitters, rather than general season format - but that has not gone through at this time.

We also need some sort of limited entry in the alpine areas including limited entry hunts for nonresident hunters.

We recently conducted a public opinion survey and the results just came out last week. It was interesting to note that the majority of hunters complained there were too many hunters. They were asked why they were dissatisfied with hunting in alpine areas and most response was too many hunters. Then later in questionnaire they were asked which management format do you prefer: limited entry type of hunt where there is higher success but your chances of being drawn was less, or do you prefer general season format where you hunt every year but your chances of success is lower. Most hunters complained that there are too many hunters and too much competition, yet two thirds said they preferred the general season format.

I would just mention hunting in Cypress Hills Provincial Park. This is a very large provincial park in extreme eastern Alberta on the Saskatchewan boundary and many people are concerned about hunting. The Provincial Park's people are basically opposed to hunting in parks. There is no season for 1988 but the management objective for Cypress Hills is less than 750 elk population. They will try to maintain the population at 750.

Alberta has a telephone questionnaire where a computer analyst selects samples of hunters for each license types in the province, 25-30 license types, including the game bird and waterfowl hunters. We phone anywhere from 52 to 100 percent of hunters who have a special season or limited entry draw and 20 to 25 percent of hunters with the general season format.

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Eldon Bruns — Alberta (State or Province)

No. of Wintering Elk (note species) 13,000 _____ Comment: _____

Not including some National Parks elk.

Bulls/100 Cows (winter) 12 Range 8 to 24 Comment: Because of forest cover, most surveys underestimate bulls.

Calves/100 Cows (winter) 30 Range 0 to 50 Comment: Production may decline to 0 in some northern areas, wolf predation important.

Resident Tags, Rifle* _____ Bow _____ Total 37,107
1986
Non-Resident Tags, Rifle* _____ Bow _____ Total 782
1986 (*Incl. muzzleloader)
Grand Total 37,889

Comment: Rifle/bow tags not separate. Approximately 2,100 elk bowhunters annually

Take of Bulls, Rifle 1764 Bow 69 Total 1,833
1986 - Resident Only
Take of Antlerless, Rifle 989 Bow 21 Total 1,010
1986 - Resident Only
Grand Total 2,843

Comment: No non-resident survey in 1986.

Bull Hunter Success 5% (3-9%) Total Hunter Success 9%

How is Harvest Data Obtained Telephone Survey

What Census Methods Used (Sample Size) Aerial (RW) winter survey
1986 = 1,940 elk counted in 5 surveys; 1985 = 2,705 elk in 7 surveys
Aerial (RW) Summer Production Surveys; 1986 = 1,309 in 3 areas.

Percent of Hunting by Drawing 1986 = 11 %
1985 = 10

Contact Person for Mgt./Research Information J. Gunson, Unit Leader, Carnivore, Elk and Problem Wildlife Management

Other Comments: Active elk habitat enhancement program.

Ongoing Research Subjects and Investigations:

Experimental timber harvest for elk habitat enhancement in Big Horn Creek

Recent Elk Publications:

Management Plan for Elk in Alberta - in final draft stage.

The interesting thing is that prior to going to the telephone questionnaire, we had also registration of elk. The system, to my way of thinking, was never a very good system - hunters had something like 30 days to register their elk and didn't have to bring elk into wildlife offices for registration. Then once we started with the hunter questionnaire, we discovered immediately that approximately a third of the elk were not being registered, so the questionnaire certainly seems to be more adequate in assessing the harvest. The provincial elk hunting planned is in initial stages of drafting and the final draft is expected in summer of 1988.

ARIZONA STATUS REPORT

Raymond Lee, Big Game Supervisor

In the 1890's Arizona was home to Merriam's elk. This species, like many other large mammals during this period, suffered severe population decline. In fact, the elk was considered to be extinct in Arizona from 1897 to 1913. At that time 86 elk were transplanted from Yellowstone National Park in northeastern Arizona. Another 217 animals were transplanted between 1913 and 1928 and these transplants formed the basis for today's herds which can number in excess of 30,000 animals. This large growth in population and expansion of formerly unoccupied range by what some people would have us believe are non-native wildlife, has led to considerable interaction with private landowners. Occasionally these interactions become somewhat heated.

Cries of too many elk are now frequently heard and the number suggestions to provide relief in various monetary forms has been made. The Arizona Game and Fish Department in cooperation with conservation groups like the Rocky Mountain Elk Foundation and the Safari Club have raffled, and/or auctioned special permits to generate revenue for elk management. These funds are earmarked for elk habitat improvements with the purpose of holding elk off private lands and relieve depredation problems, yet allowing for increases in elk numbers and expansion in new ranges. Recently, one Arizona elk permit was auctioned for $40,000. Now that Arizona has proven capability to provide 400+ point bulls, the Arizona Fish and Game Department is looking forward to the success of this program.

In 1987, nearly 5,000 total observations were made during fall surveys. These surveys resulted in a bull/cow/calf ratio 29-100-55. Bull:cow ratios since 1972 have dropped slightly from 40 to 30 and calf:cow ratios have stayed about 50 to 55 with some fluctuations. A computer model is used to generate population totals from surveys. Harvest data shows steady increases in population from approximately 8,000 animals in 1972 to 32,000 animals in 1987. This is an annual population increase of nearly 22 percent.

Strategic plans developed in 1987 were intended to provide management direction to 1991. Plan goals are to manage the elk to the habitat potential and provide maximum recreational opportunity. Now already these plans have come under scrutiny, particularly within our department. Under these plans elk will be managed under prescriptions defined as either basic, alternative, or vulnerable species management. The basic management

prescription calls for 20 to 35 bulls per 100 cows pre hunt or 15 to 20 post hunt. Hunter success ranges from to 20 to 35 percent for bull hunts and up to 70 percent for antlerless hunts. Alternative management calls for bull to cow ratios to be slightly higher (25 to 45 pre hunt and 20 to 35 post hunt). During the period 1972 to 1987 the total harvest increased approximately 1,200 animals to nearly 4,000 animals.

Archery hunter success starts with three percent for the first hunt in 1972 - archery success is now running at 18 percent (last year). Firearms hunters enjoyed a success rate which averages over 48 percent for the last four years. Last year, the full hunter success rate was 45 percent. Like most other states, Arizona Game and Fish Department has tried to maximize hunting opportunities. To this end, we initiated archery only hunts in 1972. By 1980 nearly 40 percent of the permits were archery only. Remember, in Arizona elk hunting is completely permit only hunting, or what some people call limited hunting only. Virtually all of the increase in permit numbers were made in archery only hunts.

This led many of the modern firearm hunters to complain about the inequities in the system. This year permit levels were set to equalize application rates with harvest rates to provide a fair distribution. Since all of our hunts are permitted, a hunter would apply for either firearm, archery, or muzzleloader. We can look at the applications rates from our questionnaire and we can look at the harvest rates. We allocate permits on the what we call an equal basis. One of the benefits is that way you can go to the group and say if you come up with more people next year, you can have more permits and more elk.

Arizona uses antlerless elk, bull only, and trophy bull (which we consider to be four point or better) - hunting strategies. Typically, less than two percent of permits are designated as trophy bulls.

Arizona Fish and Game Department is presently involved in a movement and mortality study in the White Mountains. Richard Brown of our Department is here, who has been doing the work in that area and you can follow up with him if interested.

In addition, the Department is cooperating with the University of Arizona and Arizona State University on USDA grant proposals to evaluate elk/livestock interactions and attempts to maximize livestock production on multiple use areas. This study will utilize results from the Department's current research. We have also initiated a study team with participants from local conservation groups, academicians, resource managers, and ranchers to determine potential solutions of elk/livestock problems in Arizona. The Department and the Texas Parks & Wildlife Department are also involved in capture and transplant of elk to Texas. This operation which involves a somewhat complex trade of bighorn sheep, antelope, and elk will help Texas reintroduction program and provide Arizona with yet another tool to help manage our expanding elk population.

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Raymond Lee Arizona
State or Province

No. of Wintering
Elk (note species) 22,000 _____ Comment: All Elk are Rocky Mt., originated from reintroductions in 1913.

Bulls/100 Cows (winter) 29 Range 23 to 63 Comment: _____

Calves/100 Cows (winter) 55 Range 46 to 61 Comment: _____

Resident Tags, Rifle* 6500 Bow 3680 Total 10,180

Non-Resident Tags, Rifle* _____ Bow _____ Total _____
(*incl. muzzleloader)

Grand Total 10,180

Comment: Non-resident are not discriminated against in our drawing process.

Take of Bulls, Rifle 2286 Bow 453 Total 2,739

Take of Antlerless, Rifle 804 Bow 190 Total 994

Grand Total 3,733

Comment: The archery elk harvest was the 6th consecutive annual harvest record.

Bull Hunter Success 44% Firearms 17% Archery Total Hunter Success 49% Firearms 18% Archery

How is Harvest Data Obtained A mail survey questionnaire is sent to each elk hunter.

What Census Methods Used (Sample Size) 4921 - Primarily helicopter; fixed-wing and horseback surveys are utilized in appropriate areas.

Percent of Hunting by Drawing 100 %

Contact Person for Mgt./Research Information Raymond Lee,

2222 W. Greenway, Phx, Ariz. 85023

Other Comments:

Ongoing Research Subjects and Investigations:

Savory grazing systems effects on wildlife and various movement studies.

Recent Elk Publications:

Effects of timber management practices on elk: A program analysis. 1987. Richard Brown, AGRO. F.A. W-78-R. 43 pp.

Effects of a savory grazing problem on big game. Richard L. Brown (In preparation).

BRITISH COLUMBIA STATUS REPORT

Doug Janz, Regional Wildlife Biologist from Vancouver Island

I have a few corrections to make on the status report. The status of our elk generally since our last report at Coos Bay in terms of animal numbers is generally stable - 2,500-3,000 Roosevelt and about 35,000 wintering Rocky Mountain elk. The ratios reported here for bull:cow ratios in winter and calf/cow ratios for Roosevelt are obviously wrong. For Roosevelt elk, it is probably in the neighborhood of 20 bulls/100 cows in winter surveys and calf ratios of 30-35 post season. For Roosevelt this last winter got up to about 45 calves/100 cows which is the best we have ever had. We can't really expect much more than that. The range was quite open compared to severe winters and more areas have been subject to wolf predation. So, those ratios can vary from less than 20 to 45. We have roughly about 15,000 elk hunters, harvesting about 3,500 elk. We have quite a diversity of seasons and regulations across the province reflecting diversity of elk populations and biologists.

On Roosevelt elk, essentially limited to Vancouver Island, it's all limited entry hunt. Hunters take anywhere from 115-130 animals/year. There's a lot of demand for Roosevelt because it is a limited opportunity - there is a lot of demand for increase in numbers on the island. About 13 or 14 hundred Rocky Mountain elk are harvested in the northeast corner of the province. The primary regulation is bull only.

Then in east Kootenays where the majority of our elk reside, they harvest anywhere from 2,500 to 3,000. That has been increasing over the last decade due to increasing numbers. There is quite a diversity of game hunting regulations in east Kootenays. We have an early archery season that is primarily directed on damage areas in the Trench. We have Ray Demarchi calf seasons - so you can notice ... for example there is a ratio of three to one in antlerless harvest - three calves to one cow. There is a lot of recreation being directed to the calf component of the population in some areas.

Some of the management programs, other than the harvest regimes include transplant programs throughout the province. In the last few years quite a few elk were trapped in the Kootenays and down the Trench in some of our problem areas, and shipped to the northeast section of the province. We've been moving a few elk around on Vancouver Island, and recently moved some Roosevelt off the island to lower mainland where they occurred historically but were wiped out around the turn of the century. The goal on the mainland is to have two viable Roosevelt elk herds.

There is a lot of prescribed burning especially in the northeast section of Peace and to some extent back in the Kootenays. We have been blessed with a series of mild winters and that is probably one of the best things a manager can have going in terms of increasing numbers. There is a lot of planning activities, both through agricultural ranching and through the Forest Service that are helping integrate management to some extent in terms of incorporating elk requirements into timber sales. A lot of work

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Ian Hatter British Columbia (State or Province)

No. of Wintering Elk (note species) 2500* 35000** Comment: August 1987 Estimates

* Roosevelt Elk, ** Rocky Mountain Elk

Bulls/100 Cows (winter) 51* / 13** Range 44 to 79 / 11 17 Comment: 1987 Winter Survey

* Roosevelt Elk ** Rocky Mountain Elk

Calves/100 Cows (winter) 61* / 35** Range 56 to 79 / 9 48 Comment: 1987 Winter Survey

* Roosevelt Elk ** Rocky Mountain Elk

Resident Tags, Rifle* 14323 Bow N/A Total 14323

Non-Resident Tags, Rifle* 732 Bow N/A Total 732
(*Incl. muzzleloader)

Grand Total 15055

Comment: 1986 Hunting Season: No special licences for primative weapons, bow and muzzleloader etc.

Take of Bulls, Rifle 2168 Bow N/A Total 2168

Take of Antlerless, Rifle 1356 Bow N/A Total 1356

Grand Total 3524

Comment: 1986 Hunting Season (Resident and Non-resident) Antlerless harvest comprised of 303 cows and 1053 calves

Bull Hunter Success _____ Total Hunter Success 22% (1986)

How is Harvest Data Obtained Resident by Hunter Sample (100% Mail out to Elk Hunters with 78% response rate in 1986) Non-resident by guide declaration.

What Census Methods Used (Sample Size) Primarily aerial surveys. Stratified random block surveys used in the Northeast (presently being tested in the Kootenays), classification surveys used elsewhere.

Percent of Hunting by Drawing 28 % (1986 Residents only)

Contact Person for Mgt./Research Information Dan Blower - Management

Don Eastman - Research

Other Comments: 1988 Provincial Elk Species Management Plan being prepared by Ray Demarchi

Ongoing Research Subjects and Investigations:

Elk-Intensive Forestry Interactions on Vancouver Island

East Kootenay Elk Evaluation Project

East Kootenay Elk Inventory, MU 422 and MU423

Elk-Wolf Interactions in Muskwa and Kechika

Recent Elk Publications:

1. Brunt, K. 1987. Man-made Forests and Elk in Coastal British Columbia. For. Chron. 155-158.

2. Brunt, K., D. Becker, and J. Youds. 1987. Vancouver Island Roosevelt Elk/Intensive Forestry Interactions. Job Completion Report. B.C. Ministry of Environment and Parks and B. C. Ministry of Forests and Lands. IWIFR - 33. Victoria, B. C.

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has yet to be done in that area, of course. Some of the publications that are soon to come out will be a handbook on deer and elk habitats in coastal forests, along the lines of westside Oregon/Washington handbook.

CALIFORNIA STATUS REPORT

Don Koch - California Fish and Game

I am here to talk about the elk management strategies we employed in California. If you look at our harvest data from last year you would notice we took 15 elk. The Forest Service should be up here talking about some of the management strategies - because with a little help from mother nature, their aggressive backfire program improved about 350,000 acres of habitat in northern California last year.

Not to be outdone, we tried to employ some innovative management and strategies in terms of harvesting Tule elk. In 1969 the last Tule elk hunt was held in California. After essentially 14 years of relocation programs we moved about 800 elk and established 58 new herds. We suggested the Fish and Game Commission authorize 105 permits and they did. We were promptly sued. That is still in court right now so I can't talk about it, but I have been involved in another recent court case involving another big game species in California. The best way to describe the process you enter the system as pig and you come out as sausage. Hopefully next year, the 1988 hunting season will have 242 elk permits available on limited entry drawing in California. We expect high hunter success and like I said hopefully things will go smooth in the courts.

In terms of our Tule elk program, we anticipate continued relocation programs. We have a lot of elk that are in situations where they will not be able to be hunted. They are either on national wildlife refuges and enclosures, or in state parks. So, we anticipate relocating more Tule elk. Most of the Tule elk will probably be relocated on private lands and that is just a fraction of the amount of suitable habitat available for them. We have saturated public lands.

The sporting community in the state is a little concerned about that - there are some suggestions that we are getting involved in put and take hunting programs of Tule elk. That is sort of the way it is - there is no available public land for Tule elk. Hopefully, we are here to talk to some other states about the potential to get Roosevelt elk into some of this habitat the Forest Service has improved for us and hopefully we will get some cooperation to get involved in a progressive Roosevelt elk program.

COLORADO STATUS REPORT

Len Carpenter, Colorado Big Game Manager

Colorado has had a series of changes in the past three years relative to elk hunting. When I speak about elk hunting in Colorado, I obviously will have to refer a bit to deer hunting in Colorado because as most of you know, in almost all areas of the state we do hunt deer and elk together and those seasons coincide in almost all cases. As a result, we have to talk

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Donald Koch California
State or Province

No. of Wintering Elk (note species) Tule 2,500
Rocky Mountain 1,500
Roosevelt 3,000 Comment:

Bulls/100 Cows (winter) _____ Range 20 to 58 Comment:

Calves/100 Cows (winter) _____ Range 14 to 60 Comment:

Resident Tags, Rifle* _____ Bow _____ Total 242*

Non-Resident Tags, Rifle* 0 Bow 0 Total 0
(*Incl. muzzleloader)

Grand Total _____

Comment: *Methods of take rifle and/or archery. In 1985, 105 Tule elk permits will be issued for the first time in 19 years.

Take of Bulls, Rifle 8 Bow _____ Total 8*

Take of Antlerless, Rifle 6 Bow 1 Total 7*

Grand Total 15

Comment: *32 either sex permits issued in 1987

Bull Hunter Success _____ Total Hunter Success 47%

How is Harvest Data Obtained Mandatory report card--both successful and unsuccessful hunters return report tag.

What Census Methods Used (Sample Size) Helicopter and fixed wing aircraft (Cessna 185) in selected management areas (N= 1,000)

Percent of Hunting by Drawing 100 %

Contact Person for Mgt./Research Information Donald Koch (916) 324-0769, Wildlife Management Division, 1416 Ninth Street, Sacramento, CA 95814

Other Comments:

Ongoing Research Subjects and Investigations:

Tule elk/mule deer interaction/Owens Valley; Roosevelt elk habitat inventory/Siskiyou County; Tule elk movement, productivity and mortality study/San Benito County.

Recent Elk Publications:

Tule elk management: Problems encountered with a successful wildlife management program. 1987; Transactions at the Western Section of the Wildlife Society.

1987 Report to the Legislature on the status of Tule elk.

about how we are going to distribute elk hunters and deer hunters among the various seasons so we really have to talk about both and can't just concentrate on talking about elk hunters.

Beginning in 1986 we went to a new season structure. In Colorado since about 1976 every time the seasons are established they are established for about a three year period, and then are re-evaluated for change at the end of that period. We made the last change in 1986. Increasing participation by deer and elk hunters over a number of years in the state of Colorado resulted in the real need and demand by the sportsmen, as well as various other land management agencies, and others for change. During the latter years of the 1970's and early 1980's there was an unprecedented growth in elk hunting in Colorado. At the same time, deer hunting maintained a fairly high level. We were having to deal with over 400,000 hunters in the course of a season, so it became important to try to figure out ways hunters could be distributed among seasons so that crowding was not an issue. This was a very big concern because sportsmen would bring it to our attention and then there was also the question of quality that came up yesterday. The unprecedented growth of elk hunting in Colorado resulted in the lower and lower bull/cow ratio and the cry for quality. As a result with the discussions that began in 1986 to talk about what might be done there was considerable clamor for some kind of major changes. In order to reach the main objective of trying to distribute somewhere near 400,000 people among the various seasons, it was decided to go to a basic structure of three combined deer and elk seasons. Those seasons were to begin approximately October 15 and be completed by November 15. So, essentially there is about a month there for regular rifle seasons and try to put three combined deer and elk seasons. Those seasons were to begin approximately October 15 and be completed by November 15. So, essentially there is about a month there for regular rifle seasons and try to put three seasons in that framework with some break between each season to allow for the first group of hunters to be replaced by the second and consequently, by the third. So, as you can imagine, as you start to put all those things together, there were several concerns of how you might structure those types of seasons.

We wanted participation to be somewhat equal among those seasons. Obviously you would think that most people would prefer to hunt the first season, given the grand idea that you better get there before someone else does. So, the basic kind of structure that was put together was go to the three seasons as I mentioned and then put a few bells and whistles on those. Included with those bells and whistles are such things as varying the length of the seasons. The first season is a very short five day season and again remember you are hunting deer and elk. There is also a restriction that if you are going to hunt deer and elk, you have to hunt both in the same season - you can't make a choice of deer in one and elk in another, so right away it makes for hard choices if you do want to hunt both deer and elk in Colorado. The other major thing that was done was to put no cow licenses, or doe licenses in case of deer, in the first season. Antlerless hunts were put only in the second and third season. The final thing and probably the most controversial, or the one that we might spend a little time talking about was the inclusion of antler point regulations with those seasons.

Basically, what was done was antler point regulations were placed on both deer and elk - with elk it was a four point restriction - with deer, a three point restriction. And, in the first season, antler restrictions apply in most areas in the state and in many areas in second season, and fewer areas in the third season. So, what you see happening, by using antler point regulations or restrictions and also by the length of season or the availability of female licenses you see the kinds of choices hunters were offered. The whole idea is trying to equally distribute participation among the seasons.

What kind of results occurred with that type of a structure? Basically, what we found is the choices we forced the hunter to make worked. From a distribution standpoint of hunters, we had very good distribution across the seasons. There are some basic differences between resident and nonresident hunters. We found that the first seasons, especially for elk, are preferred by the nonresident hunter and the third season which is a longer season was preferred by residents. The first season is five days, the second is 12 days, and the third is about nine days. Again, resident hunters preferred to hunt the last season, and I think there are several reasons for that. Obviously, they wanted the longer period of time. They undoubtedly preferred to hunt areas without antler point restrictions. One of the things that happened when we went to that structure was a drop from 400,000 hunters prior to the changes to somewhere below 350,000 hunters for deer and elk combined. So, there was a decrease in hunter participation. We are starting to see hunter numbers grow back again. I am not sure how high they will reach, given the current structures that we have.

What about some of the biological changes that might have occurred? As I mentioned earlier, one of the main concerns was the issue of sex ratios and we talked about that the last couple of days. I am sure we will talk about it more. With unlimited hunting, obviously the bull/cow ratios have been reduced. In fact, in some places across the state, it was as low as 4 and 5 bulls/100 cows. And most of our harvest was coming with yearling animals, as most of us are aware. There was this real concern that we needed more mature or branched antler bulls available for the hunter. Again, that was the main idea behind antler point regulations. Basically, what we have seen is that there has been increase in total bull numbers, up to around 15 or 20 per 100 cows so you see from that standpoint it has worked.

Age ratios show no clear pattern relative to this change in sex ratios. It has been very much as it was before antler point regulations.

The question of hunter satisfaction has to come up and obviously it has been a very popular kind of approach. Many of the hunters have been very happy going with the antler point regulations. I think in some cases they do not fully understand consequences of choices but they are very satisfied. In fact, over 80 percent of the people we surveyed have been very satisfied. From that viewpoint, you would have to say that season structure has worked.

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Len Carpenter — Colorado (State or Province)

No. of Wintering Elk (note species) Rocky Mtn. 174,000 Comment: _____

Bulls/100 Cows (winter) x Range 5 to 40 Comment: _____

Average ≅ 17 varies widely due to observability and sample sizes.

Calves/100 Cows (winter) x Range 29 to 72 Comment: _____

Average ≅ 48

Resident Tags, Rifle* 93,936 Bow 9,017 Total 102,953

Non-Resident Tags, Rifle* 39,112 Bow 5,239 Total 44,351
1987
(*Incl. muzzleloader)

Grand Total 147,304

Comment: Colorado has 3 combined deer and elk seasons (rifle); and a few early and late seasons.

Take of Bulls, Rifle 11,466 Bow 1,123 Total 12,589

Take of Antlerless, Rifle 8,603 Bow 516 Total 9,119

Grand Total 21,708

Comment: No antlerless harvest in first season and most units have 4-pt antler restriction on bulls in first 2 seasons and not in 3rd season

Bull Hunter Success 11% Total Hunter Success 17% (includes al seasons and manner of t

How is Harvest Data Obtained primarily by phone surveys

What Census Methods Used (Sample Size) Similar areas counted yearly from helicopters. Primarily minimum counts. Research Section is experimenting with line transect methodology.

Percent of Hunting by Drawing ≅ 24 % 1987

(All Antlerless Permits, all specified areas)
34,730 Limited Licenses issued in 1987.
41,460 Limited Licenses proposed in 1988.

Contact Person for Mgt./Research Information Len Carpenter (303-484-2836) or Bob Tully (303-291-7345)

Other Comments:

Ongoing Research Subjects and Investigations:

Colorado is conducting a research study on effects of over-wintering elk on livestock forage and livestock performance in NW Colorado. We are also investigating various in vivo methods to detect pregnancy and determine stage of pregnancy. We continue to investigate methodologies for elk census in terms of precision. We are cooperating with Colorado State University and Forbes Ranches, Inc. on a bull elk bugling study in relation to repeated "bugle-ups" by hunters.

Recent Elk Publications:

Freddy, D. J. 1987. The White River Elk Herd: A Perspective, 1960-85. Tech. Publ. 37. Colo. Div. Wildlife. 64pp.

In Colorado, game damage is an issue we always have to deal with. We are dealing with that in a couple of ways. We have a research study now very similar to one in Arizona trying to determine what the elk/livestock impacts are.

In summary, to say from the standpoint of distribution of elk hunters in meeting the interest of the sportsmen of Colorado, the season structure we now have has been fairly successful. From a biological standpoint, I have some concerns about the antler point regulations as they exist, especially in deer. I think in the next season structure we will be evaluating and will make some changes in antler point regulations for deer but I think you will see basically the same structure as we have had the last two years for the next two years.

IDAHO STATUS REPORT

Lloyd Oldenburg, Idaho Fish and Game, Box 25, 600 S. Walnut, Boise, Idaho 83707

This presentation is in line with the request that state reports cover innovative management through special regulations.

I am sure each state has a definition of "innovative and special regulations." We, in Idaho, like to think we have a special definition of "quality elk hunting." This status has been achieved by maintaining general bull hunting in most of the state (48 units) during the past 13 years. In addition, there are limited antlerless permits issued in 36 of these units. In the Panhandle there are ten units with general hunting. A portion of each season in each unit in this area is either sex, and a portion is bulls only.

There are also controlled hunts in 22 units where there is no general season.

Seven units and half of another unit in the roadless backcountry have a general 68-day bull season from September 15 through November 21. This season may be termed as "unique" as I do not think there is any general elk season open that early or that long anywhere else in the country.

From the early 1950s there had been general elk hunting over a large portion of the state, and seasons were traditionally either sex through 1973. In 1953 it was the first time we exceeded 10,000 animals. From 1972 through 1981 our statewide harvest exceeded 10,000 elk only in 1973.

Because of declining elk populations in the early 1970s, bulls-only hunting, in all areas outside the Panhandle, was initiated in 1974.

The total elk harvest in the state bottomed out at 4,135 animals in 1976, two years after initiation of the general bulls-only regulation. Since then there has been a steady population increase through 1987 when 67,400 general elk hunters harvested 11,275 elk (9,810 bulls and 1,465 antlerless) and 9,019 controlled hunt permittees harvested 3,942 elk (1,143 bulls and 2,799 cows). These two harvest methods totaled 15,199 elk (10,953 bulls

and 4,264 cows). The number of cows harvested in 1987 exceeded the total statewide elk harvest in 1976 by 129 animals. An additional 1,700 more elk were taken by archers and muzzleloader hunters. Statewide harvest was about 16,900 animals. The 10,953 bull elk harvested by gun hunters were made up of 51 percent five-point or larger animals. This is our definition of "quality hunting." My personal philosophy is that 1988 is "the good old days."

On a note which is not so glowing, our resident elk tag sales have increased from 68,575 in 1982 and 75,000 in 1987; and total sales has increased from 77,000 to 86,800 during the same five year period. Because of this major increase in elk hunters, we are now evaluating methods to stabilize hunter numbers or distribute hunting pressure and allow us to maintain the quality Idaho elk hunters now enjoy.

Summary of 1988 Elk Seasons

Number Units	Begin	End	Days	Bulls Only	Either Sex
1988 General Elk Seasons					
4	October 1	October 16	16	11	5
5	October 1	October 26	26	11	15
13	October 5	October 30	26	26	None
11	October 5	October 16	12	12	None
1	September 15	October 24	40	40	None
7	September 15	November 21	68	68	None
3	October 5	November 6	33	33	None
16	October 12	October 16	5	5	None
Elk Archery Seasons					
51	September 3	September 30	28	None	28
1	November 19	December 4	16	None	16
1	November 19	December 11	23	None	23
3	December 5	December 31	27	None	27
1	August 1	September 30	61	33	28

Number Units	Begin	End	Days	Bulls Only	Either Sex	Antlerless Only
Elk Muzzleloader Seasons						
1	October 29	November 20	23	None	23	None
1	November 2	November 27	26	26	None	None
1	November 12	November 27	16	16	None	None
1	November 19	December 11	23	None	23	None
1	November 26	December 11	16	None	None	16
1	November 26	December 11	16	16	None	None
1	November 26	December 25	30	None		30

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Lloyd Oldenburg Idaho (State or Province)

No. of Wintering Elk (note species) Est. 120,000 ± Rocky Mtn. Comment: _____

Bulls/100 Cows (winter) 25-35 Range 15 to 45 Comment: Varies from general hunt areas (25-35) to early hunt area (15-25) to controlled hunts (27-45).

Calves/100 Cows (winter) 30-35 Range 20 to 60 Comment: _____

Resident Tags, Rifle* 74,398 Bow same tag Total _____

Non-Resident Tags, Rifle* 12,416 Bow same tag Total _____
(*Incl. muzzleloader)

Grand Total 86,814

Comment: Compares to 70,782 resident and 9,532 nonresident (total 80,314) in 1983.

Take of Bulls, Rifle 10,943 Muzzleloader ? Bow ? Total _____

Take of Antlerless, Rifle 3,975 Muzzleloader ? Bow ? Total _____

Grand Total est. 16,500

Comment: Do not have 1987 data for muzzleloader and archery at this time (estimate 1,500).

Bull Hunter Success 17 Total Hunter Success 20

How is Harvest Data Obtained Telephone survey - 32,000 contacts.

What Census Methods Used (Sample Size) Sightability/herd composition.

Percent of Hunting by Drawing 11 % (9,600 controlled hunt permits)

Contact Person for Mgt./Research Information Lloyd Oldenburg

208-334-2920 Box 25, 600 S. Walnut Boise, ID 83707

Other Comments: For research contact: Lonn Kuck at 208-743-6502,

1540 Warner Avenue Lewiston, ID 83501

Ongoing Research Subjects and Investigations:

Sightability, Bull Habitat Use, Bull Vulnerability to Hunting in Roaded vs Unroaded Areas

Recent Elk Publications:

W-160-R P-R Reports of above projects by James Unsworth and Lonn Kuck.

MONTANA STATUS REPORT

John Firebaugh, Montana Department of Fish Wildlife and Parks, Missoula, Montana

Restrictive Bull Elk Hunting Regulations in Montana

Abstract

Historically, Montana has enjoyed long liberal elk hunting seasons. Since 1981, as a result of reductions in habitat security and increasing hunting pressure, branch antlered bull seasons have been initiated in 25 elk hunting districts. Trade offs are involved in any restrictive bull seasons and positive and negative attributes are discussed. Another type of restrictive bull season, spike only, and branched bull by permit was implemented in the Elkhorn Mountains in 1987. This season has resulted in better bull survival than had been attained with branch antlered or any bull seasons. Trade offs for the spike only-branch antlered bull by permit only season are discussed as well as public perceptions about these type of seasons.

Historical Hunting Seasons

Montana has historically enjoyed long, liberal elk hunting seasons with the objective of providing maximum hunter opportunity consistent with elk population goals while maintaining a diversity of choice for sportsmen with regard to time, weather conditions and hunter density. However, elk hunting has become more restrictive over the past 20 years to protect the resource and prevent overharvest. In 1963, 67 percent of Montana's hunted elk habitat was open to season-long either sex hunting; by 1987 this had dropped to one percent. These restrictions have been necessary not as a result of lower elk numbers, but because of increased vehicle access, reduced habitat security, and more hunters, which have resulted in accelerated harvest rates. Currently, we are witnessing all-time population highs in many areas.

Montana is probably the only state where elk seasons run from September into February. The present general season structure includes a six week archery season for either-sex elk beginning in early September through mid-October and a five week rifle season beginning in late October and continuing through the Thanksgiving weekend. In most hunting districts, the rifle season is for antlered bulls only with limited antlerless permits. Late season permit-only hunts occur from December into the middle of February to capitalize on elk movements from Yellowstone National Park into Montana.

As a result of reductions in habitat security and increasing hunting pressure, department biologists and some sportsmen began to express concern over a lack of bulls observed during post-season surveys, and in a reduction in the average age of bulls in the harvest, especially in low security habitat. Poor calf crops (18-35 calves/100 cows) observed during post-season surveys in the late 1970's in the normally productive (50+ calves/100 cows) Gravelly Mountains of southwestern Montana, combined with

extremely low bull survival (one percent or less), prompted department biologists to begin exploring alternative harvest strategies that would insure adequate survival of older bulls through the breeding season to test the hypothesis that poor calf production/survival was a result of an inadequate number of sexually mature bulls available during the breeding season. As a result, in 1981 the first branch-antlered bull (BAB) season in Montana was implemented in the Gravelly Mountains. Basically, this season protects spike bulls and allows any bull with a visible branching of one or more extensions (at least four inches in length) from the main antler to be harvested.

Branch Antlered Bull Seasons

The intent of this season was to allow spike bulls to survive the hunting season resulting in an increase in the number of branch-antlered bulls available for breeding the following year as more mature 2 1/2 year old bulls. The BAB season was not designed to maintain a wide diversity of age classes within the bull segment of the population, especially in low security habitats.

Since 1981, BAB hunting has been implemented in 25 elk hunting districts, mainly in low security habitats of southwestern Montana. In most of these hunting districts the main objective of the season is to improve the low bull/cow ratios observed during post season surveys and carry over larger numbers of 2 1/2 year old bulls through the breeding season. Some seasons were recommended for biological reasons (poor calf production/ survival) while others were implemented due to social reasons (public demand for more BAB). Calf production/survival in the Gravelly Mountains has increased following several years of BAB hunting and this response is being closely monitored.

Biological and Social Considerations

When pondering the need for restrictive bull hunting regulations, a number of facts need to be considered before making a decision. The problem needs to be defined. Is it a biological problem (poor calf production) or social (public demand for more bulls)? What is the level of habitat security? What are the age-sex ratio objectives of the population for the particular hunting district or group of hunting districts? If the public is demanding more bulls, will they be satisfied with just more BAB or do they want more large, mature bulls? The nature of the demand needs to be assessed. Is the demand for more bulls coming from a vocal minority or from the majority of the hunting public? And, is the public aware of the trade-offs in hunting opportunity that accompany restrictive bull hunting regulations? I'll discuss these trade-offs later.

BAB seasons in Montana are being monitored and evaluated to determine bull recruitment and survival under different habitat security types. The perception that BAB seasons in Montana will provide a large diversity of age classes within the bull segment of the population has not been demonstrated in the low security habitats of southwestern Montana. Harvest rates of bulls marked with radio collars confirm this statement. During 1984 and 1985 in the relatively low security habitat of the Elkhorn

Mountains of southwestern Montana when any antlered bull was legal, 89 percent (31 of 35) of the yearling bulls marked with radio collars were harvested and 100 percent (14 of 14) of the 2 1/2 year old bulls marked with radio collars were harvested. The combined total was 92 percent of the total marked bulls harvested during these two years. No three year olds were marked since none were found on the winter range. From 1983-1985 less than one percent of the 230 bulls examined at check stations were older than 3 1/2 years old. Under the any antlered bull regulation in the Elkhorns, few bulls survived the hunting season.

Table 1. Annual mortality of radio-equipped bull elk under three hunting season types in the Elkhorn Mountains, 1984-1987

Year	Season Type	Yearlings	2-Year-Olds	3 Year-Olds	Combined
1984-85	Antlered Bull	31 of 35* (88.6)**	14 of 14 (100)	---	45 of 49 (91.8)
1986	Branch-Antlered Bull	13 of 25 (52.0)	5 of 6 (83.3)	---	18 of 31 (58.1)
1987	Spikes Legal/BAB Permit	8 of 16 (50.0)	4 of 14 (28.6)	0 of 2 (0)	12 of 32 (37.5)

*Number of radioed bulls
**Percent

BAB hunting was implemented in the Elkhorns in 1986 and 52 percent of (13 of 25) of the marked yearling bulls were harvested and 83 percent (5 of 6) of the marked 2 1/2 year old bulls were harvested, resulting in a combined total of 58 percent of the marked bulls harvested. It should be noted that 38 percent (nine) of the marked yearling bulls were illegally harvested (spike bulls). No bulls older than 2 1/2 years old were checked during the 1986 season. The biologist studying this area concluded if the BAB season continued in the Elkhorns, past harvest information would indicate that the composition of the harvest would be approximately 25 percent branched yearlings, 75 percent 2 1/2 year olds and very few three year old or older bulls. The BAB regulation in the Elkhorns would increase the number of 2 1/2 year old bulls in the harvest but would not result in many bulls older than 2 1/2 years old in the population. Bull/cow ratios from post season surveys in the Elkhorns increased from an average of 2.6 bulls:100 cows (1.9 percent bulls in the population) following any bull seasons to 8.1 bulls:100 cows (5.8 percent bulls in the population) following the BAB season.

In the Gravelly Mountain complex where BAB seasons have been in effect for several years, checking station results indicate few bulls live beyond 4 1/2 years, even after four to five years of a BAB season. Out of 244 BABs checked from 1984-1986, 51 (21 percent) were branched yearlings, 150 (62 percent) were 2 1/2 year olds, and 42 (1 percent) were 3 1/2 years old or

older. The BAB season, like other antler point regulations, causes hunting pressure to be greatest on the segment of the herd that the regulation was designed to produce. Post season bull/cow ratios in the Gravellies during 1986 were nearly 13 bulls:100 cows and 8.3 percent of the total population. Prior to the BAB seasons, less than one percent of the post season population was composed of antlered bulls.

As I mentioned earlier, when dealing with hunting regulation changes regarding restrictive bull seasons, there are various trade-offs involved, and the hunting public needs to be thoroughly informed and understand what they will gain and lose with the regulation change. We have taken considerable effort to inform the public of these trade-offs prior to the implementation of BAB seasons in Montana. The following are trade-offs expected with a BAB harvest regulation. Positive attributes include:

1. Legal protection is provided to the unbranched (yearling) segment of the bull population (spike bulls).

2. The number of BAB increases in the following breeding and fall hunting season (primarily 2 1/2 year old bulls).

3. The harvest of BAB increases as most of the harvest is transferred from yearling bulls to 2 1/2 year old bulls.

4. Present observations indicate high hunter satisfaction with BAB regulations.

Negative attributes include:

1. The older bull population may decrease due to increased hunting pressure on this segment of the population. This is not well documented in Montana, but in Colorado the harvest of 2, 3, and 4 year old bulls more than doubled while those in the 6 and 7 year old class tripled the first year of the BAB season.

2. Larger yearling bulls with branched antlers are not protected - more pressure is directed toward them.

3. Provides a potential for illegal harvest of spikes. This has been a problem in Montana in nearly every hunting district where BAB seasons have been implemented. Even with adequate signing and a considerable public information campaign, the illegal harvest of spikes continues. The first year of BAB hunting in the Elkhorns, 9 of 24 (38 percent) radio-collared yearling bulls were illegally harvested. Estimates in other areas have ranged from 15-40 percent. Some biologists feel after several years of BAB seasons the illegal harvest of yearlings is declining.

4. The total bull harvest is reduced. This has been documented in several areas and has been 30-40 percent for the years following the first BAB season. This could be the result of several factors including illegal harvest not reported, natural mortality, reduction in hunter numbers, emigration of bulls from the area and occupation of

different and less accessible habitats by BAB than spike bulls, resulting in a reduction in the harvest.

5. The opportunity to hunt spike bulls is eliminated.

6. BAB seasons can allow the carry-over of more yearling bulls than necessary for breeding purposes. If range carrying capacity or landowner tolerances have been reached, then an increase in bulls on the winter range will require a corresponding decrease in cows, reducing the net reproductive potential. If calf production is a problem, this reduction may be offset through an increase in more efficient breeders (2 1/2 year old bulls) during the rut.

7. Hunter success decreases due to decreased opportunity and the fact that BAB occupy different and less accessible habitat than yearling bulls.

8. Short-term decrease in hunter numbers - hunting pressure may be transferred to an adjacent area.

9. Provides no opportunity to maintain a wide diversity of age classes within the bull segment of the population except possibly in high security habitat. Regarding this last statement, we are monitoring BAB seasons in two areas where habitat security is much greater than where the remainder of BAB seasons exist. These include two hunting districts in the upper Blackfoot Valley of west-central Montana and six hunting districts in the Gallatin-Madison Mountain Range of southwestern Montana. BAB seasons in these areas have only been in effect for two years, so it is premature to come to any conclusions regarding recruitment rates of bulls. However, through checking station data, harvest surveys and age-sex surveys, we will begin documenting whether or not older bulls are being recruited into the population and providing a wide diversity of age classes within the bull segment of the population in these more secure habitats.

Spike Only General Seasons

One other restrictive bull elk season I would like to briefly discuss is the current season in the Elkhorn Mountains where spikes are legal and BABs are on limited permits. This season type began in 1987 and followed one year of BAB hunting (1986) to allow the carry-over of yearling bulls and provide more BAB for 1987 which are now protected by permit only hunting. The objective of this season is to increase the diversity of ages in the bull population and increase the number of mature bulls in the population while allowing the general elk license holder to hunt spikes. In order to be successful, a portion of the yearlings would need to be recruited each year to assure maintenance of the older bulls in the population. An average of 18 percent of the yearling bulls in the Elkhorns have antlers that branch more than four inches and would be protected through the permit hunting on BAB. In addition, in 1984 and 1985 when all yearling bulls were legal, approximately 10-15 percent survived the hunting season. Based on the fate of radioed yearling bulls, annual recruitment of yearling bulls under this regulation would be approximately 20-30 percent.

From 1984-1986, when all BAB were legal, 95 percent (19 of 20) of the radioed 2 1/2 year old bulls were harvested. During 1987, with BAB legal only by special permit, only 25 percent (4 of 16) radioed 2 1/2 and 3 1/2 year old bulls were harvested. In addition, under the new regulation only 50 percent (8 of 16) radioed yearling bulls were harvested. Overall mortality of all radio-collared bulls was 38 percent in 1987 compared to 58 percent in 1986 under the BAB season and over 90 percent under the any antlered bull season in 1984 and 1985.

Of the 81 bulls checked from the Elkhorns during the 1987 hunting season 70 were yearlings and 11 were 2 1/2 years old. No bulls 3 1/2 years old or older were examined, which is a reflection of the heavy harvest of 2 1/2 year old bulls under the BAB season in 1986.

Table 2. Ages of harvested bull elk from the Elkhorn Mountains under three hunting season types, 1983-1987

Year	Season Type	Number of Harvested Bulls*			Total Examined
		Yearlings	2 Year-Olds	3 Year-Olds+	
1983	Antlered Bull	33	7	2	42
1984	Antlered Bull	78	10	3	91
1985	Antlered Bull	72	14	3	89
1986	Branched-Antlered Bull	20	17	0	37
1987	Spikes Legal/BAB Permit	70	11	0	81

*Bulls actually examined

Although surveys are not complete, it appears there are considerably more yearling and 2 1/2 year old bulls on the winter ranges following the 1987 season compared to past years. We anticipate approximately 10 to 15 antlered bulls per 100 cows on the winter ranges during 1988, which is 8-10 percent of the entire elk population. Following the BAB season in 1986 there were eight bulls per 100 cows on the winter range, although over 90 percent of these bulls were yearlings. As a result of the spikes legal/BAB permit season we are seeing a 40 percent to 50 percent increase in bulls on the winter ranges with a composition of about 60 percent yearlings and 40 percent older bulls.

Table 3. Bull:cow ratios and percent bulls on winter ranges in the Elkhorn Mountains, 1982-1987

Year	Season Type	Number of Elk Classified	Bulls: 100 Cows	Percent Bulls in the Population
1982-83	Antlered Bull	1,656	2.6	1.9
1983-84	Antlered Bull	2,938	4.3	3.1
1984-85	Antlered Bull	4,135	2.1	1.6
1985-86	Antlered Bull	2,641	1.2	0.9
1986-87	Branched-Antlered Bull	3,443	8.1	5.8
1987-88	Spikes Legal/BAB Permits	---	10-15	8-10

To summarize the first year evaluation of the spikes legal/BAB on permits regulation, it appears to be successful in increasing the number of older bulls on the winter range and will subsequently increase the number of older bulls during the rut and in the hunter harvest. Based on the survival of 2 1/2 year old bulls during the 1987 season we can anticipate an increased availability and harvest of older bulls during 1988 and following years, a major change from BAB seasons.

There are some trade-offs to be considered when implementing a season for spikes legal/BAB on permit. The positive attributes include:

1. Provides the opportunity to establish and maintain a diversified age structure within the bull segment of the population regardless of habitat security (more older bulls are carried over).

2. May increase net recruitment of calves.

3. Allows a higher percentage of branched yearlings to survive to older age classes.

4. Eliminates winter carry-over of more yearling bulls than is essential for breeding purposes.

5. Provides the opportunity for all licensed elk hunters to hunt any spike bull.

6. May possibly reduce illegal harvest (by allowing harvest of spikes that are typically the most vulnerable).

Negative attributes include:

1. Decreases the opportunity for any licensed elk hunter to harvest a BAB.

2. Requires a drawing for all BAB hunting opportunities.

3. Increases the potential for illegal harvest of BAB.

4. Concerns from outfitters and archers.

Public Perception of Restrictive Bull Seasons

Responses by sportsmen and outfitters to restrictive bull regulations tend to vary. In general, where BAB seasons have been implemented they are well received by both sportsmen and outfitters and they are quite satisfied with this type of season. In west-central Montana, where habitat security is greater and bull/cow ratios are much higher than most of southwestern Montana, there is little support to change from any bull seasons to BAB seasons in selective areas, particularly when there is no biological reason. A high percentage of the hunters are perfectly happy to be able to harvest any elk, whether it's a spike, a cow, or a branched bull, and they view BAB regulations as further restrictions in their hunting opportunity.

The spikes legal/BABs on permit season in the Elkhorn Mountains has received general support from sportsmen and opposition from most local outfitters. In general, outfitters perceive this type of season as a threat to their ability to provide their clients with an opportunity to harvest a mature bull due to the restriction on the number of permits issued for BABs, even though this type of season appears to be much more successful in recruiting older bulls into the population. However, the one outfitter who remained in the Elkhorns to hunt during 1987 did support this season.

Summary

Although I've concentrated mainly on the specifics of two types of restrictive bull seasons in Montana, I don't want to neglect to mention that department personnel deal almost daily with land management agencies to maintain habitat security through recommendations on road closures, timber harvest, methods and timing of cuts, maintaining roadless areas, etc. This involvement helps maintain a diverse age structure of bulls in the various populations, maintains a better distribution of the bull harvest throughout the hunting season, prevents or at least slows down the need for additional hunting season restrictions and provides the public with good opportunity and freedom of choice to hunt elk in Montana.

While the opportunity to kill a BAB is still good over much of Montana's elk range, restrictions will be necessary if the number of older bulls is to be increased, or in some instances, maintained. We have the choice of a relatively unrestricted harvest with reduced odds of taking an older bull, versus a more restricted harvest with better odds of harvesting an older bull. Hunter preferences as well as biological considerations will guide future management decisions.

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name John Firebaugh Montana (State or Province)

No. of Wintering
Elk (note species) Rocky Mtn. Elk 100,000± Comment: Montana does not make a statewide population estimate for elk. In general, the population trend has been up.

Bulls/100 Cows (winter) 5-15 Range 2 to 30 Comment: Varies considerabl across the state depending upon habitat security and management goals.

Calves/100 Cows (winter) 35-45 Range 20 to 60 Comment: Varies considerabl depending upon winter range habitats, snow depths, etc. Typically, N.W. Montana has the lowest ratios while S.W. and central Montana have higher ratios.

Resident Tags, Rifle* 84,355 Bow 12,679 Total 97,034

Non-Resident Tags, Rifle* 17,000 Bow * Total 17,000
(*Incl. muzzleloader)

Grand Total 114,034

Comment: *Nonresident archery tags are not broken out but are included in the resident total. A maximum of 17,000 nonresident elk licenses can be sold due to legislation.

Take of Bulls, Rifle 10,633 Bow 557 Total 11,190

Take of Antlerless, Rifle 8,522 Bow 181 Total 8,703

Grand Total 19,893

Comment: The 1986 harvest was the highest elk harvest on record. Antlerless permits issued are increasing in many areas to stabiliz and in some cases reduce the population.

Bull Hunter Success 12% Total Hunter Success 21%

How is Harvest Data Obtained Resident elk hunters are randomly sampled through a phone survey. Nonresidents are randomly sampled through a mail survey.

What Census Methods Used (Sample Size) Approximately 40% of the elk license buyers are sampled. When 100 or less antlerless permits are issued in a hunting district, 100% are sampled. When over 100 are issued, a smaller percentage is sampled.

Percent of Hunting by Drawing 20 %

Contact Person for Mgt./Research Information Terry Lonner, Montana Dept. of Fish, Wildlife & Parks, Research Bureau, MSU Campus, Bozeman, MT 59717-001.

Other Comments:

Ongoing Research Subjects and Investigations:

Elk Population Dynamics and Breeding Biology

Elkhorn Mountains Wildlife Monitoring Program

Monitoring of Elk Response to the BPA 500KV Garrison-Taft Transmission Line

Monitoring of distribution, turnover rates, and habitat use of bulls in several habitat types

Recent Elk Publications:

Impact Mitigation and Monitoring of the BPA 500 KV Garrison-Taft Transmission Line - Effects on Elk Security and Hunter Opportunity, 1986. Thompson

Lower Clark Fork Elk Study - Biennial Progress Report - 1985-1987

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name None — New Mexico (State or Province)

No. of Wintering
Elk (note species) Rocky Mt. _____ Comment: Winter migrations from other states makes estimation of population nearly impossible, since movements change with yearly weather changes.

Bulls/100 Cows (winter) 21 Range 9 to 31 Comment: Includes only units where at least 100 cows were counted.

Calves/100 Cows (winter) 46 Range 19 to 63 Comment: Includes only units where at least 100 cows were counted.

Resident Tags, Rifle* 9302 Bow 3144 Total 12,446

Non-Resident Tags, Rifle* 2169 Bow 796 Total 2,965
(*incl. muzzleloader)

Grand Total 15,411

Comment: All data (harvest, sex and age ratios and license information) are from the 1986-87 hunting season.

Take of Bulls, Rifle 2056 Bow 335 Total 2,391

Take of Antlerless, Rifle 638 Bow 156 Total 794

Grand Total 3,185

Comment: Harvest is projected from returned card surveys.

Bull Hunter Success _____ Total Hunter Success 22.4%

How is Harvest Data Obtained Card surveys (mail) and field checks.

What Census Methods Used (Sample Size) Aerial surveys are conducted randomly in areas of known occupied elk habitat. Counts of at least 100 cows are made to determine age and sex ratios. Indices from these surveys are then used to determine population trends.

Percent of Hunting by Drawing 89.5 %

Contact Person for Mgt./Research Information Robert Jenks, New Mexico Department of Game and Fish, Villagra Bldg., Santa Fe, New Mexico 87503

Other Comments:

Ongoing Research Subjects and Investigations:

Valle Vidal Elk Study - Objectives: 1. Investigate methods of improving current survey techniques. 2. To estimate numbers, productivity and sex and age classifications. 3. To monitor seasonal use and movements.

Tentative plans to investigate use of a computer model for elk.

Recent Elk Publications:

History of Elk Transplants in New Mexico - Expected publication by Santiago Gonzales in "Pinon Review".

OREGON STATUS REPORT

Al Polenz, Big Game Manager

We have followed along a lot like it has been reported here. In Oregon, we have been using what we have called the creep method. Our district biologists creep up on the staff with some recommendations for new regulations. We have taken that a step further and have gone to the public with it. We have a mixture of regulations in effect in the state right now. We have tried to maintain general hunting where anybody can buy a tag and hunt elk. In 1986, we ended up with over 140,000 elk hunters which was a record for us, we dropped about 10 or 12,000 this past year (in 1987). We are still in the neighborhood of around 130 to 135,000 hunters which we feel is too much considering the access that we have.

Access is one of the problems we feel we have been fighting for many years. We are still in that process. Back in 1970 we finally recognized and instituted the beginnings of our road management programs to the point that right now we have about 50 areas, with over 2 million acres involved in some type of road closure or road management programs. Mostly in our Rocky Mountain areas in eastern Oregon. We have a much smaller road management program in our Roosevelt areas in the western part of the state.

We do have some point regulations that are in effect. These were not recommended by the Department. They were instituted as a result of Commission wishes in the late 1970's. We have one three point area, one in eastern Oregon for Rocky Mountain elk and four 3-point areas in western Oregon for Roosevelt elk. As was reported earlier, the people are very happy with it. They think it's a good regulation. We are not quite so enamored with it. We have found through some rather sad experiences that when we go into a point regulation we immediately recommend limited entry along with it; and this is what we have.

We do have a limit on the number of tags that we will make available on any one of our point regulation areas. Because of bad hunter behavior and what we figured was an unacceptable level of illegal harvest, limited entry was enacted along with point regulations. We are trying to get out of point regulations. Our tendency in Oregon is to go to limited entry rather than point regulation or something else that might forestall complete limited entry. It's our feeling, that limited entry is inevitable. We don't see postponing it forever.

The single weapon concept has been around in the state for over ten years. You have to hunt with either a bow or firearm. We include muzzleloaders in our firearm seasons. We do not have, with one exception, any muzzleloader seasons where they are out by themselves. We have attracted between 15 and 20 thousand archery hunters annually on elk.

Archery seasons have removed some people from the firearms ranks; which was the intent of going to hunting method selection regulations. Our seasons are bull only, by and large, we have a few areas where we do get into either sex elk hunting. This is primarily for population control. We had a section of the south-central part of the state that was either sex for

many years. Our policy was to favor mule deer over elk in those particular areas. We decided to change that and increase the number of elk and went to a bull only regulation. Since then we have seen a dramatic increase in elk in those areas. It is still that part of the state where you can take a large trophy bull (i.e., six point or better).

Although we don't have nearly as many elk as we have further north in the northeast corner, we do produce some good bulls and we're maintaining bull ratios in those areas. Right now it is all under limited entry. This is a big block of country that runs from the central part of the state over to the Idaho line and includes about eight or ten units. We are maintaining 15-20 bulls per 100 cows. We upset the local people somewhat - they do not care for applying to hunt in their own backyard and not getting a tag each year. Up until this year we always had surplus tags available after the drawing. There was really no reason the locals could not hunt, but it's another step they don't really care for.

All of our antlerless hunting is for population control or damage control and it is all on permit or limited entry basis. We instituted what we call a pool hunt, for lack of a better term a few years ago. The biologists recommend a damage hunt for either county or a unit or group of units. Biologists ask for a number of tags to issue as damage occurs. Commission action will provide him that number of tags and then he is given a time period in the regulations to alert people to the time that they may be hunting if they get that particular tag. Then the biologist has the flexibility to use those tags as he wishes. He is not confined to putting all of the hunters in that particular hunt out there at any one time. He can issue two or three or a half dozen tags for a particular problem that happens to come along. It has worked very well for us. It has given our biologists the flexibility that they want and the hunters seem to be quite satisfied. We guarantee all of them a seven day hunt which is the same type of hunt that every other antlerless hunter in Oregon gets, so it has worked quite well.

The hunt periods may run from November to December; some even later until the end of March in some instances. So, there is a long period of time during which the successful applicant has to stand by and wait for a call from our biologists.

We tried to implement a five year plan a few years ago and passed a few pieces of it through the Commission. Some of the plan involved limited entry and we did not get that adopted. A major reason was the fact that we do have some fee hunting operations going on in some of our more popular northwest Oregon areas. The Commission did not want to impose a limited entry on these people, since it would certainly affect their operations. That situation has been at a standstill to date.

We tried to get a calf or spike only hunt in some areas of western Oregon but that didn't go through. We have been involved in a number of activities in western Oregon to enhance Roosevelt elk. There is a lot of unfilled habitat as a result of timber management activities.

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Al Polenz Oregon (State or Province)

No. of Wintering
Elk (note species) Rocky Mtn. 55,000 Comment:

Roosevelt 51,000

Bulls/100 Cows (winter) Rocky Mtn. 7 Range 3 to 20 Comment:

Roosevelt 12 7 to 12

Calves/100 Cows (winter) Rocky Mtn. 39 Range 21 to 67 Comment:

Roosevelt 34 Range 21 to 57

Resident Tags, Rifle* 107,741 Bow 16,832 Total 124,573

Non-Resident Tags, Rifle* 4,265 Bow 1,148 Total 5,413
(*Incl. muzzleloader)

Grand Total 129,986

Comment: 66% Rocky Mtn. (62,206 hunters - 61%)

34% Roosevelt (39,043 hunters - 39%)

Take of Bulls, Rifle 8,107 Bow 573 Total 8,680

Take of Antlerless, Rifle 5,023 Bow 724 Total 5,747

Grand Total 14.427

Comment: 73% Rocky Mtn. (eastern Oregon)

27% Roosevelt (22% Coast & 5% Cascades)

Bull Hunter Success 10%* Total Hunter Success 14%

How is Harvest Data Obtained Telephone survey (10% sample)

* Does not include either-sex rifle or the bow take

What Census Methods Used (Sample Size) Spring (Feb.-Apr.) herd composition and annual trend; primarily aerial.

Percent of Hunting by Drawing 31 %

Page 2

Contact Person for Mgt./Research Information Al Polenz - Management

Larry Bright - Research

Other Comments: Starkey study just starting

Habitat mapping & modeling now into application phase

Ongoing Research Subjects and Investigations:

Elk/Deer/Cattle Equivalency Study - Starkey

Roosevelt Elk Habitat Mapping & Modeling

Wildlife Investigations Lab - Reproductive, Aging, Physical Condition

Heppner Unit Summer Range Telemetry Study

Cascades and Blue Mtns. Telemetry

Recent Elk Publications:

None since last workshop

We have a fairly active transplant program going on where we move a hundred or more animals a year.

Another program, even though we say we do not pay damages, is what we call a green forage program. This is an attempt to provide forage on private lands. In my mind, this is compensation for use of those range lands. Elk may be on a particular landowners property for months. It has been received very well by the landowners. It is attracting, in some cases, animals off damage issue situations onto places where either the landowners are tolerable of the animals or else onto some public lands. It is not confined strictly to private land.

We do some work on public lands. It has been a very positive step. We spend over a million dollars a biennium - statewide on the green forage program. It does take a lot of money to administer but we are getting a lot of good, positive relations with landowners. We have been doing a lot of telemetry work - we probably have on the order of 250 radio transmitters around the state primarily in the Cascades and northeastern Oregon. We are defining seasonal ranges and identifying a lot of movement across unit boundaries. We are also finding out how these elk are reacting to major timber management activities going on throughout the state.

We are just starting the Starkey project out of La Grande in northeast Oregon, in cooperation with the Forest Service. Our Department's part of it is a livestock, deer, and elk equivalence test and we are also trying to get a breeding bull experiment started.

UTAH STATUS REPORT

Grant Jense, 1596 West North Temple, Salt Lake City, Utah 84116

Elk were prevalent throughout the mountainous areas of northern and central Utah prior to settlement by European man. Unrestricted hunting following settlement eliminated most of the elk from Utah by the turn of the century. Only a remnant population remained in the Uinta Mountains.

To reestablish elk in the state, interstate elk transplants were initiated. Between 1912 and 1925, 200 elk were brought into the state, mostly from Yellowstone National Park and Jackson, Wyoming and released in ten areas around the state. Between 1929 and 1950 an additional 165 head were relocated within the state on twelve areas.

Elk hunting opportunity prior to 1967 was very limited. In 1966, 2,302 elk permits were issued and 910 elk were harvested. Permits were issued under a quota system on a unit basis. A permittee had to draw for the opportunity to hunt and a five year waiting period was imposed on all elk permittees. There were relatively few elk hunters in Utah and therefore, not a lot of support for an aggressive elk management program.

In 1967, part of the elk management units were put into a general season bull permit hunting strategy (open area) and by 1970 the majority of units were being hunted under this system. At the inception of general season

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Grant K. Jense — Utah (State or Province)

No. of Wintering Elk (note species) 35,000 R.M. _____ Comment: Elk are still increasing on most management units.

Bulls/100 Cows (preseason winter) 21 Range 12 to 65 Comment: We do not collect post season Bull/cow ratio data.

Calves/100 Cows (winter) 52 Range 47 to 61 Comment: _____

Resident Tags, Rifle* 29,457 Bow 2,523 Total 31,980

Non-Resident Tags, Rifle* 1,037 Bow 120 Total 1,157
(*Incl. muzzleloader)

Grand Total 33,137

Comment: _____

Take of Bulls, Rifle 4,342 Bow 287 Total 4,629

Take of Antlerless, Rifle 962 Bow 20 Total 982

Grand Total 5,611

Comment: _____

unlimited permits - 15%; muzzleloader 28%
Bull Hunter Success limited permits 83% Total Hunter Success 17%*
*Includes archery

How is Harvest Data Obtained unlimted permits - telephone limited permits - questionnaires cards

What Census Methods Used (Sample Size) Fixed wing airplane - most winter ranges are censused after a good snow cover.

Percent of Hunting by Drawing 9% of permits%

Contact Person for Mgt./Research Information Grant K. Jense

1596 West North Temple, Salt Lake City, UT 84116

Other Comments:

Ongoing Research Subjects and Investigations:

Hardware Ranch Studies: 1) Testing of various drugs for tranquilizing and immobilizing elk; 2) Pregancy rates and clving dates for Cache Elk Unit. Seasonal range and movement patterns of elk on the La Sal Mountains and Cedar Mountain.

Recent Elk Publications:

1) Habitat Selection, Foraging Behavior, and Dietary Nutrition of Elk in Burned Aspen Forest, Journal of Range management Vol. 40, No. 5., Sept., 19

2) Pregancy rate and conception season in the Cache Elk herd, Utah, 1987. Final project report by Ronald C. Squibb, ph.D., Utah State University Logan, Utah.

bull permit hunting, the states elk population was estimated at about 6,000. Under the permit quota system, sufficient antlerless permits were issued each year to keep elk herds suppressed from 1925 to 1966.

During the past 22 years, substantial progress has been made. Elk numbers have increased from about 6,000 in 13 management units to approximately 40,000 head on 34 management units. Hunter numbers have also increased to about 33,000. By putting most of the hunting pressure on the bull segment, the herds were released and started to expand. With increases in elk numbers and hunting pressure, elk moved into adjacent areas. Due to a combination of natural movement and transplants of more than 1,000 animals since 1973, elk now inhabit the majority of suitable range in the state. We are presently working on four agreements for reintroducing elk into former habitats. If this trend continues for the next five to ten years, the majority of habitat should be filled with a total population of 60,000-70,000 elk.

At least part of the success for increased elk numbers in the state can be attributed to a change in attitude for elk. Utah has traditionally been a mule deer state. There has been some resistance to increasing elk numbers by past Division of Wildlife Resources employees and there has been a substantial amount of resistance from the livestock community and land managing agencies. Many landowners now perceive elk as an asset instead of a liability. Personnel in land managing agencies now come from a diverse background, not strictly from agriculture. Also, elk hunting is becoming very popular in Utah. Hunters are demanding more opportunity and are supportive of programs to increase elk numbers.

General season bull permit hunting has been good for increasing Utah's elk herds, however, it does have some drawbacks. With most of the hunting pressure on bulls, this segment of the herd is turned over rapidly with 66 percent of the 1987 open area harvest being yearling bulls. Most elk hunters in Utah are happy with being able to kill an elk. However, there is an increasing demand for more mature bulls and the opportunity to hunt under less crowded conditions.

Utah is presently developing management plans for each of its elk units. Various methods are being used to get public input and an attempt will be made to provide a diversity in hunting opportunity to try to satisfy the desires of the various publics.

WASHINGTON STATUS REPORT

Rolf Johnson, Big Game Program Manager

Elk Management in Washington

In the last few years, the Washington Department of Wildlife has made major changes in hunting seasons to provide quality hunting opportunities. The Department solicited hunter desires from sportsmen through monthly meetings and public opinion surveys. Some hunters wanted bigger bulls, others wanted less crowded hunting and others wanted more meat in the freezer. It became evident that sportsmen have a variety of options about quality. The

perception of quality differs widely from one person to another. The Department and Wildlife Commission responded to these quality desires by providing a variety of opportunities so the hunter could choose the type of hunting experience desired.

Weapon Selection

In 1983, the Wildlife Commission directed the Department to draft major changes in hunting seasons for their consideration in 1984. These changes initiated in 1984 became known as "Resource Allocation". The cornerstone of Resource Allocation is weapon selection. A hunter has to choose one hunting method (modern firearm, archery, or muzzleloader) and cannot buy an additional tag for another hunting method. The weapon selection concept has been very controversial and initially resulted in reduced elk tag sales. Since 1984, however, elk tag sales have stabilized and the weapon selection concept has gained in popularity.

Limited Entry

One aspect of quality management in Washington is limited entry hunts. The eruption of Mt. St. Helens in 1980 led to the closure of one of the most popular elk hunting areas in the state. The Mt. St. Helens area was closed to hunting during the mountain's unstable two years following eruption. [The eruption created a blast zone of 150,000 acres. In addition, a debris slide of pumice and ash was seeded and fertilized to prevent erosion and provide forage for wildlife. This area, devoid of forest cover, attracted over a hundred elk from surrounding areas.]

Because of the extreme visibility in the blast zone, very conservative seasons were implemented when hunting was resumed in 1982. While some elk were killed in the 1980 eruption, recovery was rapid with excellent productivity. The two year closure protected bulls for the two years and dramatically changed the age composition of bull elk. Prior to 1980, fall post season surveys revealed one to two bulls per 100 cows and very few branch antlered bulls. In 1983, bull ratios increased to 60 per 100 cows and 53 percent of the bulls were branched antlered. A limited entry season was initiated in two units in the Mt. St. Helens area to retain the diverse age structure and provide quality hunting opportunity. Public response to these seasons has been favorable.

In the last few years other areas where hunting pressure was excessive have been restricted to permit only hunting. Some areas have limited opportunity for large branched antler bulls during the rut. This past year six units with a total of 60 permits were open in early October for five point or larger bulls. In some cases, units adjacent to national park reserves were open to early permit only hunts to provide an opportunity not previously available. In addition, a couple of watersheds that were previously off limits to hunting have been opened to hunting on a limited permit basis.

The limited entry seasons adopted in Washington will provide a genuine trophy hunting opportunity. Unlike the branched antler only restrictions, which tend to crop bulls a year or two older, limiting hunter numbers allowed for a mixed age distribution and enables some bulls to reach trophy size.

The disadvantage of limited entry programs is that hunters are further constricted on the remaining elk range. If excessive limited entry units are added, either hunting quality deteriorates beyond acceptable limits in the remainder of the state or all units will have to be restricted to permit only hunting as well. We believe we have the right number of limited entry units at the present time.

Branched Antler Seasons

The most popular management change to provide quality hunting is branched antler seasons. The Department has implemented branched antler hunts in some situations to satisfy hunter desires for branched antler hunts but in other areas branched antler seasons have been initiated to improve herd productivity.

Historically, elk hunting regulations in Washington have been any bull seasons. The high hunter pressure has resulted in heavy cropping of bulls and resultant low bull escapement. In the 1970's and early 1980's, post season elk surveys revealed only about five or six bulls per 100 cows. Some of the branched antler hunts have resulted in better bull escapement and accommodated this hunter desire.

In western Washington, vegetation has poorer nutritional content than in the eastern part of the state. Research studies indicate that nutrition affects yearling bull maturity and in areas of poor nutrition, yearling males do not reach sexual maturity until the cow's second or third heat cycle. Cows that are bred late produce late calves that have a poorer chance for survival in their first winter. In areas where elk security is good and sufficient mature bulls are available to breed the cows, this is not a problem. In many areas of western Washington, however, security is not adequate and insufficient mature bulls are available to breed all the cows in their first heat cycle. The protection of yearling bulls in some areas appears to improve herd productivity.

The first branch antlered bull units were initiated in 1982. Since that time, additional branched antler units have been identified and in 1987 we had 29 units. All but two branched antler units are in western Washington.

Road Management (Limited Vehicle Access)

Over the last couple of decades, there has been a several hundred-fold increase in public road access on federal, state, and industrial forest lands. More hunters can get more place every year, leaving animals with less escape cover -- where the animals have an edge on the hunters. A whole generation of hunters has grown up with this option and many have come to believe that better opportunity is the end result of additional road access. The result, however, has been more restrictive hunting

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Rolf Johnson — Washington (State or Province)

No. of Wintering
Elk (note species) Rocky Mt. 28,000 Comment: _____

Roosevelt 29,000

Bulls/100 Cows (winter) Rocky Mt. 10 Range 3 to 14 Comment: _____

Roosevelt 10 7 14

Calves/100 Cows (winter) Rocky Mt. 40 Range 33 to 60 Comment: _____

Roosevelt 34 35 44

Resident Tags, Rifle* 67,106 Bow 11,299 Total 78,405

Non-Resident Tags, Rifle* 622 Bow 97 Total 719
(*Incl. muzzleloader)

Grand Total 79,124

Comment: _____

Take of Bulls, Rifle 4065 Bow 369 Total 4434

Take of Antlerless, Rifle 2154 Bow 602 Total 2756

Grand Total 7190

Comment: _____

Bull Hunter Success 6% Total Hunter Success 10%

How is Harvest Data Obtained 3 wave questionnaire and game harvest report cards.

What Census Methods Used (Sample Size) Fixed wing and helicopter, 6913 elk surveyed during winter of 1986-87

Percent of Hunting by Drawing 8 %

Contact Person for Mgt./Research Information Rolf Johnson, Management

Ken Dixon, Research

Other Comments:

Ongoing Research Subjects and Investigations:

Habitat Development Impact Study - Colockum

Forage Seeding - Western Washington

Survey - Sightability Model

Recent Elk Publications:

regulations, less hunting freedom and opportunity, fewer mature bulls and bucks, and an adversely affected recreation industry. As road densities increase, hunter opportunity actually decreases due to the need for additional and more restrictive hunting regulations.

Vehicle access programs are designed to satisfy a number of objectives but the most common objective is simply to reduce disturbance. Some road management programs are designed to provide quality recreation but others are to improve herd structure, reduce poaching and/or reduce landowner/sportsmen conflicts.

About half of the road management programs are road closures during hunting season. These closures reduce hunter crowding and enhance bull escapement. This in turn leads to increased trophy animals and quality hunting opportunity. Many of the remaining vehicle access programs are year round but some vehicle access areas are closed only during critical seasons.

The Department has a goal of implementing some type of road management program in 10-15 percent of the commercial forest land base in Washington. So far, about eight percent of commercial forests or 900,000 acres of land are in a vehicular access program. Road management programs are producing quality hunting opportunities and public opinion surveys show they are popular with most hunters.

WYOMING STATUS REPORT

Vern Stelter, Wyoming Game and Fish Department

When I found out I was going to be giving this presentation, the first thing I did was call Rolf Johnson and ask him what he wanted me to talk about - he said, bless his heart, I want you to summarize statewide elk management in Wyoming. I want you to interject humor into this because these things get a little dry - asking someone to summarize elk hunting programs into ten minutes is kinda like asking him to describe the Rise and Fall of the Third Reich in three sentences. You can do it, by saying something like - they rose, they lost, and went away. This is very concise, precise, accurate, just not very informative. So, I think like the rest of the people that preceded me, I am going to select a couple of things that are of specific interest that are going on today in Wyoming.

The demand for elk continues to be high in Wyoming as in most other states. Last year we sold about 50,000 licenses. Based on the number of unsuccessful applicants, we could have sold nearly 80,000 if we had half the elk population to support that number of hunters. Our statewide hunter success rate last year was over 27 percent and our harvest was over 12,000. This probably goes a long in explaining why the elk hunting demand exists particularly among the nonresident hunters.

The economy of the state of Wyoming benefits a great deal from the elk hunter like it does in every state. Last year it benefited to the tune of about 25 million dollars in hunter expenditures. The flip side of this is that the Game and Fish Department went into the red by about $800,000 in

the elk program. We took in about 2.7 million dollars in license revenues, but we spend about 3.5 million in our elk management program. This is due in large part to the cost of running about two dozen feed grounds throughout the northwest part of the state in order to make up for losses of winter habitat there. Without the feed grounds, we couldn't maintain the elk population that we currently have there.

Fortunately, we have very successful mule deer and antelope programs that run into the black and those programs carry the elk program as well. One of the bright spots in elk management in Wyoming is archery hunting. It is gaining in popularity as it is, I suppose, almost everywhere else. This is good in several ways. It is good for the hunters who are unsuccessful in drawing rifle licenses, because it offers an alternative to not hunting at all, and it is considered by our bow hunters to be a good quality hunt. It is good for the economy because bow hunters spend quite a few days in the field - everyday they spend in the field costs money which benefits the local economy. It is good for the elk populations because bow hunters, at least in Wyoming have maintained notoriously low success rates. Bow hunters do have a rather low success rate and you can get a lot of recreation without much cost to the resource.

In politics, the Department is continuing to successfully elude efforts to bring us under the control of the legislature. Legislative control, as some of you in other states know, can be a double edge sword and we continue, so far, to be financially independent from state general fund monies and from the political strings that are always attached. With any kind of luck we will remain financially independent throughout eternity.

In Wyoming as in other states we have spent a lot of time in the last few years impressing upon our citizens the economic value of wildlife. We have given presentations to ranching seminars, and numerous economic development symposiums that spring up in most states when you have a bust economy like ours. We have spent time emphasizing that wildlife is more than a pest to ranchers and something neat for tourists to look at. We encourage the idea of wildlife being a economic force for many people, both in nonconsumptive and consumptive matters. We may have overemphasized this to some of the wrong people probably in Wyoming as evidenced by a couple of the bills that were introduced in the recent legislative season.

First, there was privatization bill which would have in effect given ownership and all management options to the landowners for all wildlife that exists on his land, including the selling of licenses, etc. Secondly, there was an outfitters sponsored bill that would have required that a certain percentage of hunters would be only allowed to buy license and hunt on public land if they first hired an outfitter. I think the folks from Montana, Idaho, and Nevada, maybe some other states, have had these experiences. The privatization bill said essentially I want to own the state's wildlife. The outfitter bill said I want the people who own it and its habitat to pay me before they can use it. Both of these, of course, carried the idea of economic gains much too far. Both bills failed, due in large part to a loud public outcry against it. They will return, I am sure and their message is pretty clear. If wildlife is valuable, I want all I can get from it and I really don't care much if the public likes this or

not. I guess in retrospect this reaction was as inevitable as undesirable. It undercuts the basic idea of wildlife being publicly owned as well as managed for the good of the general public.

Our department is trying to maintain a good balance between proper management for the good of the general public on one hand and the maximization of economic gains on the other. As you all well know, this is a tricky business - it is especially tricky in Wyoming where the most valuable resource has always been publicly owned. There is a constant maneuvering to see who is going to get the biggest piece of the pie. The pressures that this brings to bear is inevitably going to be political. And they will influence elk management at all levels. Juggling these pressures will be one of the bigger challenges many of us will face in the near future. Successful maneuvering in dealing with this problem will require that we have a strong public involvement. Any major change in management direction that favors a few commercial interests will always be at the expense of the general public and of course the general public owns the animals and their habitat and pays for their upkeep. I think, as resource managers, we owe the owners and landowners of our resource as much effort as we can to prevent this sort of thing from happening.

ELK STATUS for
1988 Western States & Provinces Elk Workshop

Attending Representative's Name Vern Stelter Wyoming
State or Province

No. of Wintering
Elk (note species) 67,897 _____ Comment: For post-season 1986-87.

Bulls/100 Cows (winter) 16.4 Range 4 to 50 Comment: For post-season 1986-87.

Calves/100 Cows (winter) 38.5 Range 15 to 73 Comment: For post-season 1986-87.

Resident Tags, Rifle* 35,155 Bow 4,877 Total 40,032

Non-Resident Tags, Rifle* 7,172 Bow 667 Total 7,839
(*Incl. muzzleloader)

Grand Total 47,871

Comment: Number of licenses sold for 1987 hunting season.

Take of Bulls, Rifle 6612 Bow Total Bow = Total _____

Take of Antlerless, Rifle 4995 Bow 443 Total _____

Grand Total 12,050

Comment: Harvest for 1987 hunting season, archery harvest not separated by antlered and antlerless.

Bull Hunter Success _____ Total Hunter Success 27.4%

How is Harvest Data Obtained Questionnaire, Field Checks and Check Stations

What Census Methods Used (Sample Size) Helicopter and fixed-wing surveys.

Percent of Hunting by Drawing 50 %

Contact Person for Mgt./Research Information Harry Harju, Biological Services Supervisor, Wyoming Game and Fish Department, Cheyenne, Wyoming, 82001, 307-777-6942

Other Comments:

Ongoing Research Subjects and Investigations:

Elk responses to habitat alterations.

Elk disturbances to seismic activities.

Elk and brucellosis

Recent Elk Publications:

ELK HABITAT IMPROVEMENT THROUGH TIMBER HARVESTING IN WEST CENTRAL ALBERTA

Luigi E. Morgantini, Forest Science, University of Alberta
Edmonton, AB, Canada, T6G 2H1

Dale Eslinger, Alberta Fish and Wildlife Division
Rocky Mountain House, AB, Canada, T0M 1T0

Paul M. Woodard, Forest Science, University of Alberta
Edmonton, AB, Canada, T6G 2H1

Abstract

Approximately 355 hectares (877 acres) of forest are being harvested in a valley adjacent to one of the most important elk winter ranges in Alberta. The main objective of the logging operation is to create additional winter range. Timber harvesting will create 18 openings of irregular shape, 360 m (1200 ft) maximum width, in forest habitats traditionally used by elk for resting and escape. At the present time, forage production in these habitats ranges between 45 and 145 kg/ha (40-139 lb/acre), whereas forage production from the natural winter range varies between 620 and 1677 kg/ha (552- 1494 lb/acre). The openings will not be reforested, but will be fertilized and seeded with grasses. Access roads will be reclaimed. Logging is being conducted in winter. During the first year, the distribution of elk did not appear to be directly affected.

Introduction

The value of timber harvest operations in creating elk habitats is still a subject for controversy. There is significant evidence that suggests logging can be beneficial by increasing vegetation heterogenetity and forage availability in otherwise uniform forest stands (Irwin 1976, Ward 1976). But other reports suggest harvesting is bad for elk because of major habitat losses due to disturbance (Beall 1974), increased vehicular traffic (Leege 1976), and changes in site-specific habitat requirements (Lyon and Ward 1982). The size of cutblocks appears to be an important variable in determining the magnitude and type of effect. Some studies have shown that cutblocks should not be larger than 16 hectares 39.5 acres) (Lyon 1976). However, others have reported heavier elk use of cutblocks of considerable larger size (Hershey and Leege 1975).

The variety of responses by elk to timber harvesting operations reflects the wide range of environmental conditions in which elk-timber harvest studies have been conducted. Attempts have been made to develop guidelines to enhance elk habitats through logging (Black et al. 1976, Thomas et al. 1976, Thomas 1979). Still, the response of elk populations to timber harvest appears to be largely determined by site- specific environmental conditions and the animals previous exposure to human activities. Direct and indirect cause and effect relationships are often site-specific. Consequently, wildlife managers often lack the information needed for carrying out cost effective and efficient management programs.

The Ya Ha Tinda Region

Along the Eastern Slopes of the Rocky Mountains in west- central Alberta, there are grass-shrubland ranges that have been historically used by elk as winter habitats. Presently, in spite of elk hunting restrictions, most of these ranges support fewer animals than in the past. It is not known whether this is due to changes in the structure and composition of the vegetation, thus lower carrying capacity, or to a delay in the recovery of the local elk population, which was liberally hunted in the 1960's.

The 10,880 acre (4,533 ha) Ya Ha Tinda Ranch is one of the most important elk winter ranges in Alberta. Situated along the Red Deer River valley, approximately 10 km (7 miles) from the eastern boundary of Banff National Park, the area is characterized by an extensive rough fescue (Festuca scabrella Torr.) grassland surrounded by shrublands and coniferous forests. The federally owned horse ranch, which is situated on this rolling grassland is used as winter range by a large number of elk that migrate out of Banff National Park every fall (Morgantini and Hudson 1988). During average weather conditions, 350-500 animals winter in the area. However, as many as 800-900 have wintered on the fescue prairie. Rough fescue is the dominant component of the elk winter diet (80- 90%; Morgantini and Hudson 1985, 1989). The Ya Ha Tinda Ranch also supports an average of 180 horses over the winter months.

Range conditions and forage production vary depending on species composition and grazing conditions. As determined on similar adjacent winter ranges in 1982 (Morgantini and Russel 1983), grassland communities associated with well drained, gravelly soils have low forage production (e.g. rough fescue- bearberry (Arctostaphylos uva ursi [L.] Spreng.) or rough fescue-hooker's oat grass (Helictotrichon hookeri [Scribr.] Henr.) communities: 348-410 kg/ha; 310-365 lbs/acre). The forage production of other commonly used plant communities such as shrubby cinquefoil (Potentilla fruticosa L.) -rough fescue or rough fescue-wheat grass (Agropyron spp.), ranges between 1313 and 1654 kg/ha (1169-1473 lbs/acre).

Forage production may also vary depending on the amount of spring-summer precipitation and grazing pressure. In 1962 and 1973, forage production averaged 466-1358 kg/ha (415-2100 lbs/acre) and 122-1134 kg/ha (109-1010 lbs/acre), respectively (McGillis 1977). Due to human activities and hunting by native people, elk tend to over-use remote portions of the ranch and under use others (Morgantini and Hudson 1979). Therefore, there are portions of the winter range that have been heavily overgrazed.

The Ya Ha Tinda Ranch grassland is surrounded by extensive lodgepole pine (Pinus contorta var. latifolia Engelm.), white spruce (Picea glauca (Moench) Voss) and Engelmann spruce (Picea engelmannii Parry ex Engelm.) forests. The understory is mostly represented by buffalo berry (Sheperdia canadensis (L.) Nutt.) in pine forests, and by willow species (Salix spp.) in the wetter spruce forests. Hairy wild rye (Elymus innovatus Beal) is the dominant grass species. The forests are generally dense and large amounts of deadfall are common. These

conditions provide excellent hiding and resting cover, but palatable forage is limited. Rough fescue is not well represented. The total herbaceous production of these forests ranges between 45 and 156 kg/ha (40-139 lbs/acre).

Timber Harvest in the Bighorn Creek Valley

In an attempt to expand the winter range available to the elk population and to encourage animals to remain in the region year-round, the Alberta Fish and Wildlife Division, in conjunction with the Alberta Forest Service, has developed an extensive timber harvesting program in the Bighorn Creek drainage (Burrington et al. 1986). The area is immediately adjacent to the Ya Ha Tinda Ranch grassland and, as such, it offers an unique opportunity for habitat management. Timber harvesting in the area will be a one pass operation that will be completed over two winters (1987/88 and 1988/89). A major consideration in developing the harvesting system was to minimize the impact of cutting and extraction. The cutblock layout plan was developed with the input from wildlife biologists, landscape foresters and silviculturalists. It consists of eighteen, well spaced and visually pleasing cutblocks, with irregular shapes to maximize forest-edge effect. Wherever possible, the width of the cutblocks will not exceed 360 m (1200 ft). In total, some 355 hectares (844 acres) of forest cover will be harvested for approximately 103,000 cubic meters of timber. Cutting will affect about 6% of the watershed and 12% of the forested area of the drainage. The cutblocks will not be reforested, but will be fertilized and seeded with an appropriate grass mixture. Logging roads will be reclaimed to the original contour. No motorized access will be permitted. Hunting will continue, with horses being the primary mode of travel. Due to the recreational value of the area, reclamation and seeding will be financed through a special habitat fund entitled "Buck for Wildlife Trust Fund". This fund is accrued mainly through part of the proceeds from the sale of hunting and fishing licences (approximately 2.3 million Canadian dollars per annum).

The Elk-Logging Study

The presence of a major elk winter range in the immediate vicinity of a logging area offers a unique opportunity to test the response of the animals to logging and to evaluate the effectiveness of logging as a technique to create elk habitats along the eastern slopes of Alberta. A study funded by the Alberta Recreation, Parks and Wildlife Foundation, the Alberta Fish and Wildlife Division, and the University of Alberta has been initiated. Changes in elk movements and distribution, food habits, forage quality and production, vegetational changes and the use of cutblocks will be monitored over several years. These results will be compared to those from Morgantini (1988).

Initial Results

Logging operations began on December 1, 1987 and continued until March 15, 1988. During the first winter, the access road system was built. In addition, four cutblocks on the west side of the valley and one on the east side, immediately adjacent to the Ya Ha Tinda Ranch grassland, were cleared.

It is too early to assess the value of timber harvest to the elk population in the area. However, some initial observations on the impact of logging activities can be made.

During the winter of 1987/88, logging was mostly restricted to a small section of the valley. The impact of logging activities on the traditional movements and distribution of elk appears to be limited and fairly insignificant. Despite the presence of newly constructed roads, and active logging in the area, elk followed the same well worn trails to and from the open grassland that they have been known to use in past years (Morgantini 1988). No large herd was detected in the vicinity of cutblocks. However, small groups of animals (30-40) were repeatedly observed resting in full sight of one cutblock, 200 m distant. Initial data from two forest transects perpendicular to the cutblock adjacent to the Ya Ha Tinda Ranch grassland further indicate that elk were not affected by active logging (Table 1). During a five day period when the cutblock was being cleared, a cumulative total of 151 beds and 225 fecal groups were counted, an average density of 1900 beds and 2800 fecal groups per hectare. The forest intersected by the transects is traditionally used for cover during daylight hours (Morgantini and Hudson 1979, Morgantini 1988).

TABLE 1.

Elk fecal groups and beds over two 200m long by 2m wide belt transects in forest adjacent to a cutblock. (The numbers represent five days accumulation during the active logging period.)

Distance from Cutblock	0-50 m	51-100 m	101-150 m	151-200m
Transect #1				
Fecal groups	15	41	36	54
Beds	15	26	26	30
Transect #2				
Fecal groups	11	38	19	11
Beds	8	31	10	5

The limited impact of logging activities on elk use patterns is particularly interesting considering this species is known to be wary of human activities (Ward 1976). In addition, this herd is actively hunted by native people during winter and, hence, it tends to avoid man during this season. The impact of

logging on elk distribution may have been mitigated by the physiography of the area, the location of the initial cutblocks, and the overall low level of logging activities.

Conclusions

Timber harvest in the Bighorn Creek valley has the potential to benefit the elk population in the region by creating additional range. The disturbance associated with logging may have a limited impact. But the success of the project will ultimately depend on the vegetation that will establish in the cutblocks. Elk in the region forage on the highly palatable rough fescue. It is possible that the animals can be forced by human activities away from the open grassland into the cutblocks. However, in the absence of highly palatable forage in the cutblocks, elk will be continuously drawn back to the native grassland. Therefore, when logging is completed, habitat management will have to address and compensate for any differential in forage quality and availability between the cutblocks and the native winter range.

Literature Cited

Beall, R.C. 1974. Winter habitat selection and use by a western Montana elk herd. Ph.D. Thesis. Univ. Montana. Missoula. 199pp.

Black, H.R., R.J. Scherzinger, and J.W.Thomas. 1976. Relationships of Rocky Mountain Elk and Rocky Mountain mule deer habitat to timber management in the Blue Mountains of Oregon and Washington. Pages 11-31. In: S.R. Hieb, (ed.) Proc. Elk-Logging-road Sump. Univ. Idaho, Moscow. 142 pp.

Burrington, B., D. Eslinger, W. Gladstone, and M. Swan. 1986. Wildlife habitat improvement in the Bighorn Creek watershed. AENR tech. rep. # T/118, Edmonton.

Hershey, T.G.,and T.A. Leege. 1976. Influences of logging on elk summer range in north central Idaho. Pages 73-80. In: S.R. Hieb, (Ed.). Proc. Elk-Logging-Road Sump. Univ. Idaho, Moscow.

Irwin, L.L. 1976. Effects of intensive silviculture on big game forage sources in northern Idaho. Pages 135-142. In: S.R. Hieb, (Ed.). Proc. Elk-Logging-Road Sump. Univ. Idaho, Moscow.

Lyon, L.J. 1976. Elk use as related to characteristics of clearcuts in western Montana. Pages 69-72. In: S.R. Hieb, (Ed.). Proc. Elk-Logging-Road Sump. Univ. Idaho, Moscow.

Leege, T.A. 1976. Relationship of logging to decline of Pete King elk herd. Pages 6-10. In: S.R. Hieb, (Ed.). Proc. Elk-Logging-Road Sump. Univ. Idaho, Moscow.

Morgantini, L.E. 1988. Behavioural adaptive strategies of wapiti (Cervus elaphus) in the Canadian Rocky Mountains. Ph.D. Thesis. Univ. Alberta. Edmonton. 215pp.

Morgantini, L.E. and R.J. Hudson. 1979. Human disturbance and habitat selection in elk. Pages 132-139. In: M.S. Boyce and L.D. Hayden-Wing, (Eds.). North American Elk: Ecology, Behavior and Management. Univ. Wyoming, Laramie.

Morgantini, L.E. and R.J. Hudson. 1985. Changes in diet of wapiti during hunting seasons. J. Range Manage. 38:77-79

Morgantini, L.E. and R.J. Hudson. 1988. Migratory patterns of the Wapiti (Cervus elaphus) in Banff National Park, Alberta. Can. Field Nat. 102:12-19.

Morgantini, L.E. and R.J. Hudson. 1989. Nutritional significance of wapiti migrations to alpine ranges in western Alberta. Arct. and Alp. Res. 21(3): (in press).

Morgantini, L.E. and W.B. Russel. 1983. An assessment of three selected elk winter ranges in the Rocky Mountain Region. Alberta Fish and Wildlife Division. Edmonton. 265 pp.

Thomas, J.W., R.J. Miller, H. Black, J.E. Rodiek, and C. Maser. 1976. Guidelines for maintaining and enhancing wildlife habitat in forest management in the Blue Mountains of Oregon and Washington. Trans. N. Amer. Wildl. and NAt. Resour. Conf. 41:452-476.

Thomas, J.W. Ed. 1979. Wildlife habitats in managed forests - the Blue Mountains of Oregon and Washington. Handbook No. 533. Washington, D.C.: U.S. Dept. Agric. 512 pp.

Ward, A.L. 1976. Elk behavior in relation to timber harvest operations and traffic on the Medicine Bow Range in south-central Wyoming. Pages 11-31. In: S.R. Hieb, (Ed.). Proc. Elk-Logging-Road Sump. Univ. Idaho, Moscow.

Panel Discussion

"Human Development Conflicts and User Demands on Elk Populations"

Speakers: Larry Temple, New Mexico
John Woods, British Columbia
Paul Moruz, U.S.F.S., Idaho
Jerry Hickman, Washington
Marty Chaney, Soil Conservation Service, Washington
J. Michael Hillis, U.S.F.S., Montana
Evelyn Merril, University of Wyoming

MEETING THE DEMANDS OF ELK POPULATIONS AND RECREATIONAL USERS ON THE VALLE VIDAL UNIT

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Abstract

In 1982 the Pennzoil Corporation of Houston, Texas, which owns the half million acre Vermejo Park Ranch located in northeastern New Mexico, donated 100,000 acres of this ranch to the U.S. Forest Service. This land donation was annexed to the Carson National Forest and became known as the Valle Vidal Unit.

The high mountain terrain of the Valle Vidal Unit is home to an estimated 1,500 to 2,000 elk. The U.S. Forest Service and the New Mexico Department of Game and Fish entered into a memorandum of understanding to manage the Valle Vidal Unit in a manner which will maintain, protect, and enhance the habitat for elk and provide for quality wildlife oriented recreation opportunities. In order to meet the goals of the memorandum of understanding, the Forest Service and the Department of Game and Fish initiated the following management objectives with the intent of minimizing conflicts between human activities and wildlife needs.

1. Closed the majority of the existing roads on the Unit to vehicular travel.

2. Established regulations prohibiting all off road vehicular travel.

3. Restricted vehicular camping to designated campgrounds.

4. Established designated snowmobile use areas open only when elk have migrated out of the area.

5. Establishment of seasonal closure areas designed to protect elk on their calving grounds and wintering grounds.

6. Allowing elk hunting on a limited permit system.

7. Initiated an elk population monitoring program to provide data on population numbers, productivity, sex and age classification, seasonal use areas, movement patterns, and harvest data.

Introduction

In early 1982 the Pennzoil Corporation of Houston, Texas, donated 100,000 acres of their 492,560 acre Vermejo Ranch to the U. S. Forest Service. This donation was annexed to the Carson National Forest and was named the Valle Vidal Unit.

Located in Colfax and Taos Counties in northeastern New Mexico, the Valle Vidal Unit became a scenic addition to the Carson National Forest. The Unit lies on the eastern slopes of the Sangre de Cristo Mountains. Elevations range from 12,585 - 7,837 feet and topography varies from steep mountains to flat terrain. Diversity of vegetation types are: grama-buffalo grass prairie; pinyon-juniper woodland; ponderosa pine-Douglas fir forest; southwestern spruce-fir forest; and alpine tundra (Kuchler 1964).

The Unit is home for a diversity of wildlife including elk (Cervus elaphus nelsoni), mule deer (Odocoileus hemionus), mountain lion (Felis concolor), black bear (Ursus americanus), coyote (Canis latrans), and bobcat (Lynx rufus); numerous species of birds including the bald eagle (Haliaeetus leucocephalus), golden eagle (Aquila chrysaetos), Merriam's Turkey (Melagris gallopavo merriami), and blue grouse (Dendragapus obscurus); numerous species of reptiles and amphibians and numerous species of fish including cutthroat trout (Salmo clarki virginalis).

The Valle Vidal elk herd is estimated at 1,500 - 2,000 elk and is characterized by an average winter calf:cow ratio of 37 calves per hundred cows (Table 1). During the five hunting seasons since the donation, 1983-1987, 951 sportsmen harvested 496 elk for a success rate of 52.2 percent (Table 2).

Table 1. Winter Calf:Cow ratios, 1984-88.

Year	Calves:100 Cows	Number Classified	Total Number Observed
1984	37.8	313	1,102
1985	32.3	497	1,385
1986	34.7	448	2,016
1987	43.4	585	1,441
1988	36.7	454	1,919

Table 2. Valle Vidal Elk Hunter Success, 1983-87.

Year	Number Bow Either Sex Hunters	Percent Hunter Success	Number Muzzleloader Either Sex Hunters	Percent Hunter Success
1983	0	--	0	--
1984	10	0	9	22.2
1985	10	10.0	10	50.0
1986	8	0	8	50.0
1987	10	10.0	10	40.0

Year	Number Rifle Bull Hunters	Percent Hunter Success	Number Rifle Cow Hunters	Percent Hunter Success
1983	97	51.5	94	58.5
1984	89	69.7	84	44.0
1985	87	49.4	87	44.8
1986	87	55.2	76	69.7
1987	92	63.0	83	41.0

Valle Vidal Elk Studies

Beginning in June of 1985 a Federal Aid project titled Valle Vidal Elk Studies was initiated on the Valle Vidal Unit. The main objective of the study is to collect management data from elk herds on the Valle Vidal Unit to assist the New Mexico Department of Game and Fish and the U.S. Forest Service in determining elk harvest and management recommendations.

Job objectives and procedures of the study include:

1. To estimate numbers, productivity and sex and age classification of elk.

   a. Numbers, productivity and sex and age classification data will be collected from elk live-trapped in an elk corral trap.

   b. Numbers, productivity and sex and age classification data will also be collected from calf:cow ratio surveys conducted from horseback in late July, Bull:cow ratio surveys will be conducted from horseback during the rutting season and winter elk population surveys conducted from helicopters each winter.

2. To monitor elk populations to determine intensive seasonal use areas and movement patterns.

   a. Monitoring of elk populations will be accomplished by scheduled and incidental observations of elk and from scheduled tracking sessions of radio collared elk.

   b. All observations will be recorded utilizing standardized aerial and ground observation forms.

   c. Maps will be generated from observation data in order to identify seasonal use areas.

3. To collect hunter harvest data from elk hunters.

   a. Hunter harvest data will be collected by requiring each elk hunter to complete an elk hunter survey form.

Management Goals and Objectives

In recognition of the significance that this donation provides the public, the New Mexico Department of Game and Fish, the U.S. Forest Service and the Vermejo Park Corporation entered into a memorandum of understanding. This became a cooperative management effort with the primary goal of maintaining, protecting and enhancing the habitat for all naturally occurring and other desirable wildlife species. Along with the memorandum of understanding the Valle Vidal Unit is managed under the direction of the multiple-use guide and specific environmental assessments. This guide provides management under the multiple-use concept and will provide direction until the Unit can be amended into the Carson Forest Plan.

Management on the Valle Vidal Unit as directed in the memorandum of understanding and the multiple-use guide has resulted in a series of management objectives designed to minimize human and wildlife conflicts.

Management Objectives Implemented

1. Closed the majority of the existing roads on the Unit to vehicular travel. These are approximately 360 miles of roads existing on the Unit. All of these roads, with the exception of 41 miles of improved public access roads, have been closed to the public.

2. Established regulations prohibiting all off road vehicular travel.

3. Restricted overnight vehicular camping to two designated campgrounds.

4. Established designated snowmobile use areas on the west side open only when elk have migrated out of the area.

5. Established an elk calving closure area from May 1 to June 30. This closes the entire west side of the Valle Vidal Unit to human entry with the exception of designated access roads remaining open for travel to the east side. Established a winter elk habitat closure from January 1 to March 31. This closes the entire east side of the unit to human entry, with the exception of designated access roads remaining open for travel to the west side.

6. Allowing elk hunting on a limited permit system. During the past five seasons 200 permits have been offered each year. Elk permits are a once in a lifetime opportunity and once an elk hunter is issued an elk permit for the Valle Vidal Unit, he can never hunt elk on the Unit again.

7. Initiated an elk population monitoring program to provide data on population numbers, productivity, sex and age classification, seasonal use areas, movement patterns and harvest data.

Literature Cited

Kuchler, A. W. 1964. Potential Natural Vegetation of the Conterminous United States. Amer. Geo. Soc. Spec. Pub. 36.

INITIAL EFFECTS OF HIGHWAY EXPANSION AND FENCING ON ELK MORTALITIES AND MOVEMENTS IN BANFF NATIONAL PARK, ALBERTA

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Abstract

A 26.1 km segment of the Trans-Canada Highway (TCH) in Banff National Park, Alta. was expanded from a two-lane undivided highway to a four-lane divided highway. Before reconstruction, the highway had a history of ungulate-vehicle collisions. Elk was the most frequent species killed along with fewer mule deer, bighorn sheep, moose, and white-tailed deer. To mitigate a projected increase in vehicle-animal collisions, the expanded highway was isolated with a 2.4 m high woven-wire fence. Eight wildlife underpasses were installed to facilitate ungulate movement across the fenced corridor. In addition, ungulates could cross the highway under three watercourse bridges and on a single railway overpass. Most elk intrusions into the fenced corridor were associated with open ends of the fence. The pre-construction road-kill pattern was altered by highway expansion and fencing. Elk-vehicle collisions increased on an expanded highway segment before fencing. Collisions decreased after fencing. Elk utilized all underpasses and the overpass. Although elk crossed the highway corridor less frequently after fencing, migration routes and seasonal home ranges did not appear to be affected.

Introduction

The construction and operation of highways across ungulate ranges is a growing concern of wildlife managers (Kelsall and Simpson 1987). Problems associated with highways include landscape alienation, wildlife disturbance, hunter access, poaching, and vehicle-wildlife collisions. Collisions with large mammals are sources of wildlife mortality, human injury, and economic loss (Feldhamer et al. 1986). Deer-vehicle collisions have received considerable attention (Puglisi et al 1974, Bashore et al. 1985, Feldhamer et al. 1986) and there have been attempts to reduce deer (Odocoileus hemionus) collisions with highway fencing (Falk et al. 1978, Feldhamer et al. 1986), one-way gates (Reed et al. 1974), and wildlife underpasses (Reed 1981). By comparison, there are few examples of elk road-kill problems (Singer 1975, Ward et al. 1980) and the impact of highway expansion, fencing, and wildlife underpasses on elk (Cervus elaphus) is largely unknown.

Our objectives were to determine: (1) if fencing would reduce elk-vehicle collisions, (2) if highway expansion in the absence of fencing would change the elk-vehicle collision rate and, (3) if elk would use man-made structures to cross a fenced highway corridor. In this paper we present preliminary results based on the first four years of a six year study.

Acknowledgements

We would like to thank M. Bottini, C. Eleverum, H. Flygare, M. Gebauer, P. Harris, G. Harrison, R. Kunelius, B. Leeson, D. Mann, and the Warden Service, Banff National Park for their assistance in the field. This research was supported by funding from the Canadian Parks Service, Public Works Canada, and the Natural Science and Engineering Research Council (Ottawa).

Study Area

Biophysical Resources

The study area was a segment of the Bow River valley in Banff National Park, Alberta between the park's eastern boundary and the Continental Divide. In this area, the Bow River valley is 2-5 km wide and penetrates the eastern side of the Southern Rocky Mountains from southeast (km 0) to northwest (km 80.2). The valley floor elevation increases from 1,341 m in the southeast to 1,646 at the Divide and the mountains rise to elevations of 3,000+ m on either side. Mean annual snowfall increases to the northwest from 251 cm at the townsite of Banff (km 14) to 418 cm at Lake Louise (km 70). The valley is subject to frequent chinooks during the winter and the southeastern third (km 0-27) is frequently snow free.

Holland and Coen (1983) described the biophysical resources of the area. The lower section of the valley (km 0-47) is within the montane ecoregion with an open forest of Douglas-fir (Pseudotsuga menziesii), lodgepole pine (Pinus contorta), white spruce (Picea glauca), and trembling aspen (Populus tremuloides) interspersed with natural grasslands. The remainder of the valley floor (km 47-80.2) is within the subalpine ecoregion with a closed coniferous forest of Engelmann spruce (Picea engelmannii), alpine fir (Abies lasiocarpa) and serial stands of lodgepole pine.

Holroyd and Van Tighem (1983) reviewed the large mammal resources and identified populations of elk, mule deer, white-tailed deer (Odocoileus virginianus), moose (Alces alces), bighorn sheep (Ovis canadensis), grizzly bear (Ursus arctos) , black bear (Ursus americanus), cougar (Felis concolor), timber wolf (Canis lupus), and coyote (Canis latrans).

Elk are currently the most abundant cervid in the valley. Late winter counts during the years 1985 to 1988 estimate 900 to 1000 animals. (R. Kunelius, Can. Parks Serv., unpubl. data). The montane segment of the valley has the largest concentration of wintering elk in the park. Although elk utilize the valley on a year-round basis, the greatest numbers are present from September through May when migratory individuals have returned (J. Woods, Can. Parks Serv., unpubl. data). The majority of elk in this area are partially habituated to human presence because of national park protection.

Human Developments

The Trans Canada Highway (TCH) and the Canadian Pacific Railway (CPR) roughly parallel the Bow River through the study area. At three locations the CPR crosses the TCH and has a maximum separation from the highway of 1 km. The TCH and CPR are major transcontinental transportation routes with large traffic volumes. The entire area is heavily visited by tourists and contains an extensive network of public trails, campgrounds, picnic facilities, and secondary roads. Approximately 15 km west of the park's eastern boundary, a portion of the valley is occupied by a

townsite (Banff) with a population of approximately 6,000.

For construction purposes, the TCH was considered in three zones: TCH I from km 0 to km 11, TCH II from km 11 to km 26.1, and TCH III from km 26.1 to km 80.2. In 1982, the road through entire TCH was a two-lane undivided highway with an average speed limit of 90 km/hour and a maximum average traffic volume of 10,540 vehicles per day (M. Brunell, Can. Parks. Serv., unpubl. data). During the years 1983 to 1985, TCH I and TCH II were expanded to a four-lane divided highway with varying speeds up to 90 km/hour and a maximum average daily vehicle volume of 10,802. TCH III was not substantially altered during this period. Projected increases of an existing ungulate-vehicle collision problem in TCH I and TCH II were considered significant from public safety and wildlife population points of view and lead to the implementation of several mitigation measures (Klenavic 1979, Paradine 1982).

A 2.4 m high woven-wire fence with 15 cm square 9-gauge mesh was installed along both sides of the reconstructed highway. The bottom wire of the fence followed landscape irregularities within 15 cm. Pipe-style cattleguards 5 m wide were installed at all intersections. In one location the fence crossed the CPR and plastic sheeting placed between and adjacent to the rails formed a cattleguard. Although both ends of fence were terminated as close as possible to the road, there were no barriers on the highway surface to prevent animals walking into the fenced zone. In TCH I, the fence was in place by January 1985 but was not completely installed in TCH II until September 1987.

Twelve structures of varying design were potentially usable by elk to cross the fence barrier. These included eight wildlife crossing underpasses built specifically to allow animal crossings, three routes beneath watercourse bridges, and a railway overpass.

Seven wildlife crossings were created by spanning depressions with concrete and steel bridges. Although the openings beneath these bridges were approximately 15 m wide, the side slopes reduced potential level tread width to 4-5 m. Each had a clearance of approximately 4 m from the center tread to the bottom of the bridge. One wildlife crossing was through a 4.27 m diameter metal culvert with similar tread clearances to the open span bridge.

Watercourse bridges on the TCH opportunistically created elk crossings including a 1.5 m wide pathway beside a creek, a 38 m wide dry spillway, and a 86 m wide riverside area. Animals using crossings passed under the highway for a distance of at least 30 m.

At a major fenced intersection, a CPR bridge created an opportunistic overpass crossing. The bridge paralleled the highway and spanned fence segments around the intersection by passing 7 m above a secondary road. The 115 m by 15 m deck included an active railway line and a 3.5 m gravel tread installed for future twin-tracking.

A number of swing gates were included in the fence to allow access to restricted roads and to facilitate active animal removal by park staff. Several one-way gates similar to those described by Reed et al. (1974) were included in the fence to allow trapped animals to exit the fenced corridor without human intervention. Complete details on project construction are available from Public Works Canada, Trans-Canada Highway Project, Box 1355, Banff, Alta., TOL OCO.

Methods

During the years 1983-87, park wardens patrolled the entire TCH numerous times per day. When ungulates were observed within the fenced highway corridor, an active effort was made to remove them by herding through gates. Animals found dead on or adjacent to the highway surface were removed. Proximity to the highway and evidence of trauma was used to assign road-kill as cause of death. Several elk road-kills were located with the aid of radio telemetry.

Data on highway kills from 1970 to 1984 were available in park files (R. Kunelius Can. Parks Serv., unpubl. data). The elk road-kill pattern before reconstruction was used as a model to compare changes in road-kill patterns after expansion and fencing. Road-kill patterns after treatments to TCH I and TCH II were individually compared to the historic relationship with TCH III.

Between January 1986 and December 1987, 64 free ranging elk including 38 adult females, 18 adult males, and 8 young of the year were fitted with radio transmitters. Two cow elk radio collared in a previous study (P. Jacobson, Can. Parks Serv., unpubl. data) were included within this sample. All radios contained mortality sensors and radios heard on mortality mode were immediately investigated.

Elk were relocated at intervals of 7 days or less during daylight hours. Multiple bearings (3 or more) were taken from mobile ground receivers to obtain locations with an accuracy of +/- 200 m as determined by field tests. In all cases, the side of the highway corridor occupied by the animal was determined. A highway crossing index (HCI) was calculated for each animal by dividing the animal's observed corridor crossings by its total number of relocations. The minimum concave polygon method (Cederlund 1987 et al.) was used to determine home range configurations for animals with >10 relocations.

Sand traps located within 3 wildlife underpasses and one watercourse crossing within TCH I were examined at 2 day intervals between 1985 and 1987. At each observation, the total number of elk completely crossing the highway corridor was determined and the sand was raked smooth. The position of most underpasses relative to the highway made direct undetected observation difficult although the railway overpass could be readily observed.

Results

Road-kills --
Reported ungulate mortalities on the TCH during preconstruction years (1970-1984) included 531 elk, 410 mule deer, 140 bighorn sheep, 62 moose, and 59 white-tailed deer. The historic pattern of elk road-kills was 48% TCH I, 22% TCH II, and 30% TCH III (H. Flygare, Can. Parks Serv., unpublished data).

During 1985 and 1986, when highway expansion was complete but TCH II unfenced, therewere 172 road-killed elk including 12 in TCH I, 90 in TCH II, and 70 in TCH III. In 1987, when the expanded highway was completely fenced, 44 elk were killed including 1 in TCH I, 5 in TCH II, and 38 in TCH III. In TCH I after fencing, there was a significant reduction in elk-vehicle collisions during 1985-86 (Chi square = 78.9, df = 1, $P < 0.001$) and in 1987 (Chi square = 57.3, df = 1, $P < 0.001$). In TCH II, there was a significant increase in collisions on the

expanded highway before fencing (Chi square = 13.6, df = 1, $P < 0.001$) and a significant decrease after fencing (Chi square = 16.2, df = 1, $P < 0.001$).

From June 1983 to December 1987, 90% of the elk observed within the fenced zone (n = 818) gained entry via open ends of the fence. Other means of entry included the CPR cattleguard, TCH cattleguards, open gates, and damaged fences. Only 2 elk were known to have crossed TCH cattleguards and none to have jumped the fence. In contrast to elk outside the fence, elk trapped within the corridor were typically highly excited and crisscrossed the highway in apparent attempts to escape.

A total of 370 elk were observed exiting the fenced corridor through one-way gates. Some of these animals were herded through the gates by park wardens. At the southeastern fence end, several elk learned to enter the fenced corridor by walking on the highway pavement and to leave via a nearby one-way gate. Although elk of all ages and both sexes used one-way gates, some elk refused to use them, even if harassed. In these cases, the nearest swing gate was opened and the animals gently herded out. Wardens spent 232 person-hours removing elk from the fenced project during these years.

Few deer were seen within the expanded highway after fencing. From 1985 through 1987, 3 mule deer and 2 white-tailed deer were killed within the fenced corridor.

Elk movements --
During the period 1985-1987, elk tracks beneath man-made structures indicated at least 1,717 successful crossings of the fenced corridor in TCH I. Subsequent to complete fencing in TCH I and TCH II, elk were observed to utilize all potential underpass routes and the CPR overpass.

Radio tagged elk were relocated on 9,036 occasions during 1986 and 1987. All but 1 elk had home ranges either overlapping or closely approaching (< 1 km) the TCH. The HCI for elk in the TCH I area after fencing was 0.02 (9 elk, 1,1571 locations). In the absence of fencing, the HCI for TCH II was 0.08 (45 elk, 6,735 locations) and for TCH III was 0.17 (10 elk, 730 locations).

The two adult female elk with known home ranges in 1981 occupied nearly identical ranges in 1986 and 1987. One utilized both sides of TCH I before and after fencing. Her HCI was 0.24 in 1981, 0.02 in 1986, and 0.03 in 1987. The other elk's home range did not overlap the TCH before or after fencing.

Five radio-collared elk (2 adult males, 3 adult females) were killed crossing the TCH in unfenced areas.

Discussion

While Feldhamer et al. (1986) recommended fencing as a potentially effective way to reduce road-kills, they described an "ungulate-proof" fence system which did not decrease white-tailed deer road-kills. Deer continued to gain access to the fenced corridor at unprotected intersections, under the fence at terrain irregularities, through the wire mesh, and through man-made holes in the fence. In comparison, the TCH fence formed a nearly complete barrier for elk and deer. The reduction in road-kills on fenced sections of the TCH was probably a function of adequate design, good upkeep, prompt removal of intruding animals by the park warden staff, and availability of one-way gates.

Termination of fence ends is an unsolved problem. While cattleguards are effective on secondary roads, they may not be suitable for use on a highway surface. The eastern fence end in this project was located at a level site frequented by elk. Animals could easily gain access to the fenced corridor by walking a short distance on the pavement. In the absence of alternative methods, we suggest that fence ends should be located in areas unattractive to ungulates (bridge structures, cliffs etc.). Open ends are a particular problem during fence construction and for that reason fence installation should be progressive.

Singer (1975) predicted no increase in elk mortality after expansion of a highway in Glacier National Park, Mont. He noted that most elk crossings were at night (when traffic would be reduced) and that the expansion of the highway to four lanes might create a barrier to elk movement. Falk et al. (1978) suggested that increased traffic volume on a highway frequented by white-tailed deer might deter deer from crossing and reduce the need for fencing. In Banff, elk-vehicle collisions increased in the TCH II zone after expansion but before fencing. During this period there was little change in traffic volume. While reasons for this increase are currently unclear, candidate causes include increased traffic speed, increased animal crossing time, and the presence of concrete and grassed medians. The radio telemetry data and the road-kill distribution did not suggest that the increased kill rate was the result of animals being deflected by the fence.

While fence/cattleguard systems may solve cervid road-kill problems, they also may create significant obstacles to animal movement. Animals constrained by fences may be more vulnerable to predation or be denied access to seasonal ranges. Although elk studied by Ward et al. (1980) in an ungulate-proof fence situation did not utilize an underpass, the degree of underpass use observed in this study is consistent behavioral adaptability of elk suggested by Geist (1982).

As Feldhamer et al. (1986) noted, noncontinuous radio tracking data can underestimate animal crossings. However, we feel that the index (HCI) used in this study provided insight into relative crossing frequencies in adjacent highway zones. The highest indices were obtained from unfenced areas and the lowest from the fenced area. In the one case where we had crossing data for an elk before and after fencing, its HCI was reduced.

Reed (1981) observed continued reluctant crossing behavior for mule deer using an underpass over a 6 year period. Although our data demonstrates that elk will utilize underpass and overpass structures, these animals do not appear to be crossing the corridor as frequently after fencing.

Elk behavior within national parks (Schultz and Bailey 1978) may be quite different from hunted areas (Rost and Bailey 1979). While the ungulate-vehicle mitigation system in place in Banff National Park appears to be working well, managers dealing with elk less tolerant of humans may find it difficult to duplicate these results.

Literature Cited

Bashore, T. L., W. M. Tzilkowski, E. D. Bellis. 1985. Analysis of deer-vehicle collision sites in Pennsylvania. J. Wildl. Manage. 49:769-774.

Cederlund, G., F. Sandegren, K. Larsson. 1987. Summer movements of female moose and dispersal of their offspring. J. Wildl. Mange. 51:342-352.

Falk, N. W., H. B. Graves, and E. D. Bellis. 1978. Highway right-of-way fences as deer deterrents. J. Wildl. Manage. 42:646-650.

Feldhamer, G. A., J. E. Gates, D. M. Harman, A. J. Loranger, and K. R. Dixon. 1986. Effects of interstate highway fencing on white-tailed deer activity. J. Wildl. Manage. 50:497-503.

Geist, V. 1982. Adaptive behavioral strategies. Pages 219-277. in Thomas, J. W. and D. E. Toweill, eds. Elk of North America, ecology and management. Stackpole Books, Pa.

Holland, W. D., and G. M. Coen, eds. 1983. Ecological (biophysical) land classification of Banff and Jasper national parks. Vol. I: Summary. Alta. Inst. Pedology Pub. M-83-2. 193pp.

Holroyd, G. L. and K. J. Van Tighem. 1983. Ecological (biophysical) land classification of Banff and Jasper national parks. Vol. III: The wildlife inventory. Can. Wildl. Serv., Edmonton. 691pp.

Kelsall, J. P. and K. Simpson. 1987. The impacts of highways on ungulates, a review and selected bibliography. Min. Environ. and Parks, B.C. 105pp.

Klenavic, J. S. 1979. Banff highway project, East Gate to km 13. Report of the Environmental Assessment Panel 11. Ottawa. 85pp.

Paradine, P. J. 1982. Banff highway project, km 13 to 27. Report of the Environmental Assessment Panel 18. Ottawa. 64pp.

Puglisi, M. J., J. S. Lindzey, and E. D. Bellis. 1974. Factors associated with highway mortality of white-tailed deer. J. Wildl. Manage. 38:799-807.

Reed, D. F. 1981. Mule deer behavior at a highway underpass exit. J. Wildl. Manage. 45:542-543.

------, D. F., T. M. Pojar, and T. N. Woodard. 1974. Use of one-way gates by mule deer. J. Wildl. Manage. 38:9-15.

Rost, G. R. and J. A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. J. Wildl. Manage. 43:634-641.

Schultz, R. D. and J. A. Bailey. 1978. Responses of national park elk to human activity. J. Wildl. Manage. 42:91-100.

Singer, F. J. 1975. Behavior of mountain goats, elk and other wildlife in relation to U.S. Highway 2, Glacier National Park, Fed. Highway Admin. and Glacier Nat. Park, West Glacier, Mont. 96pp.

Ward, A. L., N. E. Fornwalt, S. E. Henry and R. A. Hodorff. 1980. Effects of highway operation practices and facilities on elk, mule deer, and pronghorn antelope. Rocky Mtn. Forest and Range Exp. Stn. Publ. FHWA-RD-79-143. 48pp.

MANAGING ELK HUNTING OPPORTUNITY

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Abstract

Elk population management and elk habitat management are primary goals of the Idaho Department of Fish and Game and the Forest Service respectively. In the past, coordination between these agencies has been focused on achieving elk population levels that are compatible with habitat carrying capacities on each National Forest in Idaho. In 1986, a Memorandum of Understanding was signed between these agencies to incorporate elk hunter opportunities as part of their mutual goals.

This paper describes the concept of managing elk hunting opportunities using specific examples found within National Forests in Idaho. Distinctions are drawn between managing for elk habitat effectiveness and hunting season vulnerability. Elk hunting opportunities are illustrated as part of the recreation opportunity spectrum upon Forest Service lands. Implications of managing for specific hunting opportunities over time are discussed in terms of road densities, road and trail uses, vegetation manipulation, elk population levels, herd structure, trophy status and hunting restrictions.

Introduction

Most of the habitat used by elk in Idaho is found within the ten National Forests located in the state. The Forest Service has had the responsibility to manage wildlife habitat on these federal lands since the agency was established in 1905. In the past, the focus of elk habitat management has been to provide adequate food in balance between summer and winter ranges interspersed among both hiding and thermal cover. More recently, the management of roads open to vehicular access has been highlighted as an essential part of managing elk habitat.

The Idaho Department of Fish and Game has the responsibility for the management of elk populations in the state. This agency has fostered an increase in elk numbers following near extirpation in Idaho brought on by market hunting in the late 1800's. In the early part of this century the focus was on building populations. Seasons were closed and elk were transplanted into formerly occupied range. In Idaho, populations increased dramatically after several large wildfires improved winter range forage conditions for elk. During this period, vehicular access was limited and elk vulnerability to harvest was low. Consequently, elk hunting seasons were long and included either sex of elk. Hunters had little impact on elk herds despite these liberal hunting opportunities.

Improved access and increasing numbers of hunters began to change this situation through the mid-1950's and 1960's. By the early 1970's, it became apparent that Idaho's elk population had been reduced by excessive harvest of cow elk. A major season change was needed to address this problem. In the mid-1970's "antlered-only" elk seasons were implemented. This program was effective in increasing elk populations. By the mid-1980's, elk populations in Idaho were higher than they had been since the "good old days" of the 1940's and 1950's.

Despite a growing elk population overall, antlered-only harvest has changed the sex and age structure of the herd in some parts of the state. Access, which continued to increase in the last twenty years, has also increased the vulnerability of bull elk to harvest. This contributed to a higher bull harvest as did the increasing number of hunters afield. The ratio of bulls to cows decreased in many units and old bulls became scarce. This problem continues to the present. The most common problem facing elk managers in Idaho today is preventing the overharvest of bull elk.

In 1986 a memorandum of understanding was signed between the Idaho Department of Fish and Game and Regions 1, 4, and 6 of the Forest Service that set a new course for the managment of elk in Idaho. This memorandum did not suggest that each agency disregard the past accomplishments made in elk habitat and elk population management. Instead, the agreement commits the agencies to incorporate what has been learned about elk in the past into development of specific hunting opportunities for the future. The memorandum intends to put into practice on Idaho Forests what is becoming an important concept in modern elk management.

The Concept of Managing Elk Hunting Opportunity

The concept of managing elk hunting opportunity is based upon two main points. First is the recognition that elk are inherently a highly adaptive species capable of prospering in a variety of developed and undeveloped habitats. The term adaptive in this case does not imply that elk modify their needs of food, cover, and water as conditions change around them. Rather, adaptive is used to convey the fact that elk are accommodated by a wide variety of habitat conditions, i.e., food types, cover ratios, and sources of water. This trait has allowed the species to occupy many of the wstern states despite the wide variety in elevations, climate, and moisture.

The second point is that elk vulnerability to harvest is determined by road density, hiding cover, season timing, season length and number of hunters. Management of elk harvest is achieved by manipulating the factors influencing vulnerability. While elk can adapt to a variety of habitats, the species has a limited ability to withstand hunting effects. The size and composition of the harvest is the single most important factor influencing herd size and structure.

The concept of managing elk hunting opportunity suggests that elk can be managed across a wide variety of habitats if the vulnerability to harvest is controlled in a manner fitting each habitat condition. An elk population could be maintained within an open grassland area as long as vulnerability is controlled to prevent overharvest. A densely forested area can more easily support an elk herd under heavy hunting pressure because hiding cover itself can contribute to preventing overharvest. Relatively speaking, the more dense the vegetation and inaccessible the area, the less vulnerable elk will be to hunting. Therefore, the more dense the vegetation and remote the area, the more liberal the hunting opportunities can be. The concept is culminated by the notion that the density of the vegetation (hiding cover) and the human access (road densities) can be managed toward achieving specific sport hunting opportunities for elk.

Putting the Concept into Practice

Habitat and population managers have several means to manipulate the factors influencing elk vulnerability to harvest. In theory, a nearly infinite variety of seasons and regulations are possible. In practice, the wildlife manager has much

more limited options. The length and timing of hunting seasons is one obvious way to control vulnerability and therefore harvest. However, hunting seasons are heavily influenced by traditions which can be difficult to change.

Changes in elk seasons can also impact the management of other big game species and create more problems than are solved. Opening dates must be uniform over relatively large areas in order to disperse hunters and minimize hunter density. Season lengths have been adjusted most commonly resulting in some short seasons currently in place.

Forest cover can be manipulated to change vulnerability. Timber harvest can increase the density of hiding cover over the long run in many habitat types. In the short term, however, a reduction in hiding cover is usually the cost. The clearcuts that were once hailed as new forage openings for elk are now evaluated for their effect on elk vulnerability to hunting as well. In areas with high inherent vulnerability, little if anything can be done to reduce vulnerability through changes in vegetation.

Access management provides an opportunity to control the vulnerability of elk to harvest and therefore the age structure of the bulls. In addition, we believe that access management provides the greatest ability to achieve specific hunting opportunities. A fully roaded area open to all motorized vehicles is well suited to "road hunting" opportunities for elk. However, such conditions are likely to bring on relatively short hunting seasons to off-set the easy access and high vulnerability of elk to hunters. Providing exclusive access to specific types of motorized vehicles on designated routes can widen the array of hunting experiences further. This approach will provide a variety of motorized opportunities to satisfy different user groups while minimizing the vulnerability of elk to harvest. A remote area having few open roads will better satisfy the hunter seeking more primitive experiences on foot or horseback. Fewer roads, if coupled with dense vegetation, can support relatively long hunting seasons.

Though the Forest Service can largely effect vegetative cover and open road densities within National Forest lands, this agency cannot determine the most appropriate hunting opportunity. The Idaho Department of Fish and Game has a greater knowledge of hunter preferences and elk herd capabilities across Idaho. The Department can advise the Forest Service on which hunting opportunities are most appropriate for an area, but the Department has little ability to directly effect vegetation or open road densities. Only through the coordination and commitment of both agencies can the concept of managing for specific elk hunting opportunities be realized in practice.

Summary

The practice of managing for specific elk hunting opportunities will have little success in Idaho unless it reflects the preferences of the hunting public. Both the Forest Service and the Idaho Department of Fish and Game are keenly aware of this fact. The difficulty comes with the realization that hunter preferences are diverse. The matter is further complicated by the controversial nature of access management upon public lands today. The memorandum of understanding agreed to by these agencies brings experienced habitat and population managers together to design hunting opportunities appropriate for Idaho in the twenty-first century. The success of their efforts will be enhanced through broad involvement and education of the people who value hunting elk in Idaho.

SPOKANE COUNTY ELK HERD AND HUMAN HABITAT CONFLICTS

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Abstract:

From 1975 to present, a naturally immigrating/expanding population of Rocky Mountain elk has occupied various habitat types in Spokane County, Washington State. The population has grown to approximately 150 to 200 animals. Crop depredation, damage to fences and fruit trees are some negative aspects of the expansion of this herd. Positive benefits of this population's growth include recreational hunting and viewing of the animals. Various seasonal manipulations have been used by Washington Department of Wildlife to control elk damage and regulate harvest. These methods include season length, control of hunter access and use of special permits.

Introduction

Several small populations of elk have established themselves in rural areas of Spokane County. These areas include the Spangle-Cheney area (especially Turnbull National Wildlife Refuge), the Blanchard-Scotia area north of Mount Spokane, and the Newman Lake area between the south slopes of Mount Spokane and the Spokane River.

Most of the increasing interest is the largest group of elk occupying the habitat south and east of metropolitan Spokane in the area of Mica Peak around Rockford to as far south as Tekoa. One important management consideration for these elk is that the vast majority of the habitat is on private property. Federal and state lands are a very minor portion of the elk habitat in this area.

One purpose for presenting this paper is to document the positive and negative aspects of elk near a human population center of 350,000 persons in eastern Washington.

Archeological evidence and records show that elk inhabited and were consumed by prehistoric hunters in eastern Washington and northern Idaho. And historically, elk were native to northeastern Washington and northern Idaho forests and plains at the end of the last ice age. White settlement of this area reduced the elk population to a low level by the 1860's. Native remnant elk herds plus Rocky Mountain elk transplanted from Yellowstone National Park in the 1920's and 1930's repopulated northern Idaho's elk range.

It seems reasonable the elk currently in Spokane County immigrated from elk range near the state line in Idaho. The Idaho Department of Fish and Game concurs with this opinion. Elk movement across this state line if documented regularly at this time.

It appears from landowner reports that an elk would occasionally be seen in parts of Spokane County since about 1930. From 1970 until the present time, a number of small herds of elk have immigrated into parts of Spokane County. Currently, these herds are stable or continuing to expand.

During the 1980's elk-human conflicts have caused conflicts and specific management actions were initiated to control damage.

The area north of the Spokane River, which includes the Blanchard-Scotia and Newman Lake herds, are in Game Management Unit (GMU) 124 (100-150 elk); GMU 130 correponds with the Cheney-Spangle herd of elk (50-75 elk); and GMU 127 includes the Mica Peak elk which range seasonally from Rockford into Idaho, into the Rock Creek drainage and as far south as Tekoa (175-220 elk).

The habitat utilized by these elk are the timbered areas near agricultural and suburban housing developments. Common timber species in the area are Ponderosa pine and Douglas fir. Agricultural crops are primarily grain crops and alfalfa or grass hay fields. Though commercial orchards are not common the Mica Peak area, there have been reports of elk damage to fruit trees.

Besides crop damage, an additional negative aspect of an expanding elk population in Mica Peak is the chance of vehicle collision. During the winter of 1987-88 we had three elk killed by vehicles in the Mica Peak unit alone. Collisions with vehicles on secondary roads in the area are a reasonable probability as well.

The initial and seemingly universal reaction of the public and the property owner to an expanding/immigrating population of elk is enthusiastic acceptance. The landowners and the public enjoy the novelty of a "new" species of wildlife in the area. Aesthetic viewing is an excellent method of enjoying the resource for the public. However, the private landowner will find the novelty wears thin when elk damage crops and/or fences; then, it becomes necessary to utilize recreational harvest as a management tool.

Through the efforts of various biologists, wildlife control agents and wildlife agents, the Washington Department of Wildlife has worked to stabilize the elk herd, especially in the Mica Peak area and to protect agricultural and recreational interest in the elk herd's range.

Department personnel work with landowners to help prevent elk damage. Timber harvest prescriptions are designed to benefit wildlife values in the areas frequented by elk.

A great deal of effort is being expended by the Washington Department of Wildlife to gain access for hunters on private property by contacting individual landowners. Coordinating efforts of hunters and landowners is complicated by the size of land holdings and the proximity to suburban housing development.

Extended seasons, antlerless permits and primitive weapons (i.e. archery) have been used to harass the elk out of certain agricultural areas to reduce damage. With the Mica Peak (GMU 127) herd, it is necessary to harvest antlerless animals to maintain the elk herd below a level at which their presence becomes an unreasonable burden on the private property owner. For example, in 1988 two seasons for Mica Peak will offer 50 permits each hunting period. One season is set for early November during general elk season and the second is scheduled for January/February 1989. The smaller herd in the Cheney area will have ten permits for general elk season in November, 1988.

Summary

Rocky Mountain elk have re-established themselves naturally in parts of rural Spokane County. One herd in the Mica Peak area is existing close to the metropolitan area of the Spokane Valley. The Washington Department of Wildlife has worked closely with the private landowners of this area to prevent crop damage and to help manage the herd numbers with various hunting season manipulations. With conscientious effort on the part of wildlife managers, recreational hunting is a valuable tool even on private property near cosmopolitan areas.

TITLE: Coordinated Resource Management Planning
Peola - Lick Fork Coordinated Plan

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ABSTRACT: Critical elk winter range on the eastern slopes of the Blue Mountains in southeastern Washington is located on intermingled ownerships of public and private land. The purchase of the Hedt Ranch on Lick Fork in Asotin County by the Washington Department of Wildlife sparked interest in developing a new Coordinated Plan with the major private landowners in the area, Schlee Farms and Bill Weatherly. The government agencies involved include the U.S. Forest Service, the Washington Department of Natural Resources, the Washington Department of Wildlife and the Soil Conservation Service. The Hedt Ranch adjoins lands already managed by the Department of Wildlife, the Asotin Creek Wildlife Area. The Department of Wildlife is interested in shifting cattle use on lands in the area both to leave the necessary amount of forage for the elk on their critical winter range and to leave major elk calving areas undisturbed during late spring and early summer. The ranchers want to sustain or improve their forage resources while still maintaining their current ranching operations. The Forest Service and Department of Natural Resources are interested in developing a well-balanced multiple use of the resources that they manage. The Soil Conservation Service is coordinating development of the plan.

LOLO CREEK TIMBER HARVEST MORATORIUM: WHAT RESPONSIBILITY DO NATIONAL FORESTS HAVE FOR BUFFERING ELK IMPACTS FROM TIMBER HARVESTING ON PRIVATE LANDS

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Abstract

Most Western National Forests have Forest Plan strategies for maintaining established elk population levels, and in some cases, for providing certain types of elk hunting opportunities. In order to meet these objectives, timber harvest activities are often designed to minimize unit size, maintain adequate amounts of adjacent cover, and minimize open road density. Private industry lands generally do not have the same elk management strategies. Corporate land management generally involves a more rapid liquidation of marketable timber with a higher economic return. Harvest units tend to be large with rapid re-entry into adjacent uncut stands. These factors generally result in less cover and poorer spatial arrangement than National Forest lands. When National Forest lands and Corporate lands are intermingled, such as in checkerboard patterns common in the west, National Forests may be called upon by the public to buffer the impacts of corporate landowners. In 1987, a cumulative effects analysis of the 57,000 acre upper Lolo Creek drainage in western Montana was done to evaluate the widespread impacts of timber harvest on elk productivity and hunting opportunities. Cover percentages, road densities, and spatial arrangement were used to calculate elk productivity. The arrangement and patch size of security cover, and its association with roads and topographical factors were used to assess impacts on elk harvest rates, bull carryover, and subsequent losses in elk hunting opportunities. This analysis revealed that the combined impacts of National Forest and private industry timber harvest had pushed elk productivity and hunting opportunities to a level significantly below minimum Forest Plan standards. A ten year timber harvesting moratorium was declared by the Forest Supervisor in order to allow for cover recovery. Analysis methods is discussed in detail and include somewhat controversial methods of calculating the effects of timber harvest on elk hunting opportunities.

Introduction

Many National Forests within the Northern Rockies are interspersed with corporate timber lands. There are two general categories of mixed ownership lands including: 1) large blocks of industry lands within or adjacent to National Forests, or 2) a "checkerboard" pattern where the ownership alternates between public and private from one section to the next. Both situations often encompass large drainages. On the Lolo National Forest in western Montana, mixed ownership affects about 30% of the Forest, or about 600,000 acres. The National Forest Management Act of 1976 directs all forests to consider in their forest planning process: 1) the effects of National Forest activities on adjacent landowners, and 2) the effects other landowner's activities have on meeting National Forest outputs.

Mixed ownership land management situations create interesting problems for elk management. In 1987, after a detailed cumulative effects analysis in the 57,000 acre upper Lolo Creek drainage, the Lolo National Forest established a ten year moratorium on all timber harvest activities. The moratorium was established because the combined effects of National Forest and private industry timber harvesting had exceeded the Lolo Forest Plan standards for elk productivity and elk hunting recreational opportunities. In subsequent dealings with industry representatives and state and federal wildlife specialists, the elk cumulative effects analysis process and the coordination process were refined.

Timber Harvest Strategies

National Forest versus Industry Lands - There are some significant differences between National Forest and private industry timber harvest and land management strategies. On National Forests, lands determined to be suitable for timber harvest are constrained by a number of congressional acts. These acts typically limit harvest unit size to under 40 acres, mandate an even flow of timber (which equates with more consistent long-term cover/forage conditions), and prohibit removal of leave strips until adjoining units are producing hiding cover. Additionally, many National Forest Plans emphasize wildlife to some degree which often results in the protection of riparian zones and the closure of sensitive roads. Unlike the situation on public lands, the management of private industry lands is driven more by demands for economic efficiency. Unit size is often determined by the size of the stand available. In western Montana, units often encompass an entire 640 acre Section. Industry lands are not managed under an even flow concept and are typically managed to liquidate harvestable stands within 20 years. This generally results in cover shortages in the short run and a surplus of cover in the long run. While private industry managers generally protect large streams, they often ignore smaller moist draws or wet microsites which do not have clearly defined channels.

In areas of checkerboard land ownership, wildlife managers are often faced with managing National Forest sections that may be heavily harvested and are surrounded by private sections devoid or nearly devoid of cover. This type of habitat arrangement creates further elk management challenges. It become difficult to maintain both the productivity of the summer elk range and opportunities for quality elk hunting.

Analysis Parameters - On the Lolo National Forest, cumulative effects on elk productivity are calculated using recognized methods. Cover/forage models (Thomas et al., 1976) and open road models (Lyon, 1979) are used to calculate habitat effectiveness. The Lolo also developed a nontraditional method for assessing habitat productivity by quantitatively evaluating the spatial arrangement of cover and forage (Hillis, 1987). Based on numerous studies, this method assumes that elk use on summer range declines when forage areas are separated by increasingly long distances from cover. Relying on interpretations of earlier research, it was assumed that any point in an opening over 600 feet from cover suffered a decline in elk use. This meant that as harvest units increased to sizes over 40 acres, they developed an increasingly large "donut hole" of reduced elk productivity. By calculating the acres that this occurs on in checkerboard ownership lands where private industry is harvesting 640 acre clearcuts, it is easy to reach levels where 30-40% of the area is suffering reduced productivity. When such situations were identified, it was determined that Forest Plan standards for elk productivity were exceeded and some change in the total harvest strategy, National Forest or private, was required.

The impacts of timber harvest on hunting recreation in mixed ownership areas is difficult to assess. Western Montana is unique in that it has a five week general bull season, no limits on resident bull tags, and a significant percentage of branched antler bulls in the harvest. There are several possible reasons for this phenomenon: 1) hunting pressure is significantly less in western Montana than areas such as Oregon's Blue Mountains, 2) cover is extensive and thick, especially compared with the "stringers" of cover in eastern Oregon or Washington, and 3) the topography of western Montana is rugged. Nonetheless, there are indications that continued roading and logging in western Montana have compromised the security cover values to the point that they are resulting in an accelerated elk harvest and a decrease in the branched-antler harvest component. The Montana Department of Fish, Wildlife, and Parks (FWP) has adopted an elk management objective that includes maintaining a branched-antler component in the harvest, long seasons, and a minimum of restrictions. These objectives may appear mutually exclusive since it is easy to grow big bulls by limiting hunters, or season length, or establishing a 5-point

minimum for harvestable animals. Without such additional restrictions, the only tool left is to restrict access and maintain large amounts of security cover. In western Montana, that is not an illogical management tool since the country is inherently rugged and heavily forested. Recognizing that, the Forest Service Regional Forester signed an agreement with the Director of the FWP to use cover and road management to assist the FWP in meeting those hunting recreation objectives. The Lolo Forest Plan has a standard that restates that commitment to hunting recreation quality (Anon 1986).

In cooperation with state biologists, the following assumptions were made. Productive elk habitats can be maintained with fairly low cover-forage ratios (perhaps as low as 40/60) and high road densities, as long as the spatial arrangement is adequate and most roads are closed. If, however, long unregulated seasons and mature bull harvest is also desired, then it appears logical that some of that cover must be arranged in larger blocks with more difficult access. Looner and Cada (1982) attempted to quantify this relationship using road densities and cover as the two variables explaining harvest rate. Since their model was developed east of the Rockies, it was not used extensively in the Lolo's analyses. Instead, the Lolo developed a system which assessed individual drainages to determine the percentage available in cover blocks greater than 250 acres. The assumption was that a 250 acre block is big enough to hide an elk even during extensive hunting pressure and thus provide security cover. Conversely, the assumption was made that small leave strips of cover bissected by multiple midslope roads are not capable of providing that critical hunting season cover. Drainages where the percentage of cover blocks greater than 250 acres equalled 40% or 50% were assumed to have good security cover values. Drainages where those larger blocks comprised only 10-20% of the areas were assumed to have poor security cover values. When situations in the latter category were identified, it was determined that the drainage in question was exceeding the Lolo Forest Plan Standard for maintaining recreational opportunities.

This raises the question of, what options are available once Forest Plan Standards are exceeded? There are really only three choices. National Forests can work with private industry to try and achieve a mutually acceptable solution. When that fails, they can buffer private industry activities. Ignoring cumulative effects should not be considered as a viable option. Ideally, National Forests and private industry can cooperate to reach a mutually acceptable solution. There are some examples of that occurring. The Lolo completed another cumulative effects analysis in the Boles Creek drainage, where the analysis determined that elk summer range values were at risk. During coordination efforts with the adjacent landowner, Plum Creek Timber Company, Plum Creek agreed to defer their remaining harvest options for 15 years which allowed the Lolo to not only meet their Forest Plan elk standards, but allowed the forest to harvest two pending timber sales. Realistically, since corporate and National Forest management strategies are so far apart, there will be times when the National Forests should expect to have to buffer private land activities as in the case of the Lolo Creek decision.

Discussion

The concept of doing cumulative effects analyses across ownership boundaries is nothing new. For wide-ranging species like elk, it is something that should be considered on all projects where mixed ownerships are involved. The concept of measuring impacts on habitat productivity, measurable by cover/forage ratios and open road densities, should be a standard, widely accepted practice. An aspect of elk cumulative effects analysis that is admittingly risky is trying to quantify the relationship between cover and hunting recreation. At this time, there are some gaps in the research literature. Typically, corporate representatives, when asked to modify their harvest practices to accommodate such things as bull carryover, respond with, "Show me in the elk guidelines where the size of cover blocks is critical," or "Can't we just close more roads?", etc. Some attempts have been made

in western Montana to test this relationship by comparing prehunting season habitat selection data against habitat selection data collected after opening day of the hunting season. These data were further compared against elk survivability. While results are promising they are inconclusive so far. Hopefully, research will tackle this problem in the near future.

Literature Cited

Anonymous, 1986. Lolo National Forest Plan, USDA, Forest Service, Lolo National Forest.

Hillis, J.M. 1987. Inservice working report, in Lolo Creek Cumulative Effects Environmental Analysis, USDA, Forest Service, Lolo National Forest.

Lonner, T.N., and J.D. Cada. 1982. Some Effects of Forest Management on Elk Hunting Opportunity. Pages 119-128 in Proc. West. States Elk Workshop, Flagstaff, AZ.

Lyon, L.J. 1979. Habitat Effectiveness for Elk as Influenced by Roads and Cover. J. For. 77(10):658:660.

Thomas, J.W., R.J. Miller, H. Black, J.E. Rodiek, and C. Maser. 1976. Guidelines for maintaining and enhancing wildlife habitat in forest management in the Blue Mountains of Oregon and Washington. Trans. North Am. Wildl. Nat. Res. Conf. 41:452-476.

FOREST SUCCESSION AND ELK HARVEST STRATEGIES AT MOUNT ST. HELENS

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Abstract

The eruption of Mount St. Helens devastated an an area of over 60,000 ha. In the initial 5 years after the eruption, population growth and characteristics of the elk inhabiting the northwest portion of the blast zone were indicative of an irruptive population, however, future population trends will depend on forest succession and harvest management. Simulations based on a 60-year timber harvest rotation indicated that the elk population would initially decrease but remain fairly high until a large proportion of the area was comprised of forest stands greater than 30 years. A large initial elk harvest, followed by an increase in elk harvest as the area matured to second growth, and a reduction in elk harvest at the end of the rotation period is required to maximize sustained yield of elk. A constant elk harvest which initially can be sustained may overharvest the population as the elk population responds to changes in forest sucession.

Introduction

The eruption of Mount St. Helens on 18 May 1980 killed the above ground flora and fauna (over 60,000 ha) primarily north of the mountain. Although widespread losses of wildlife habitat were thought to have occurred, regrowth of natural vegetation as well as seedings and tree plantings led to the rapid recovery of habitat. One of the first wildlife species to reinvade the Mount St. Helens "blast zone" was the Roosevelt elk (Cervus elaphus roosevelti).

In the initial 5 years after the eruption, population growth, decreased age of maturity, and high survival of elk inhabiting the northwest portion of the blast zone were indicative of an irruptive population (Merrill 1987). A combination of rapid vegetation regrowth, mild winters, limited human access and low harvests contributed to the rapid recovery of this elk population.

However, long-term population trends of elk within the Mount St. Helens blast zone will be determined, in large part, by patterns of forest succession and management. As forest canopy closure occurs over a large portion of the blast zone, forage availability will diminish and carrying capacity will decline rapidly. The purpose of this paper is to illustrate possible trends in the carrying capacity of elk associated with forest succession using a simplified forest succession model and describe the effects of harvest strategies on elk population trends.

We thank Dr. Mark Boyce for his insight and assistance with the population growth and maximum yield models.

Study Area

The study area lies northwest of Mount St. Helens and includes a 225 km2 area within portions of the Green River and North Fork of the Toutle River drainages. Approximately 90% of the area lies within the northwest portion of the Mount St. Helens blast zone. The area includes high elevation areas that received heavy ash deposits (>12 cm) (approximately 19% of the study area), areas of low or medium ash (65%), the debris avalanche in the North Fork of the Toutle River (6%) and peripheral, undamaged forests (10%) (Merrill 1987). Primary landowners are the Weyerhaeuser Company and Department of Natural Resources. The study area falls primarily within the Margaret and Loo-wit Game Managment Units.

Elevations range from 240 m to over 1200 m. Climate is maritime with wet, mild winters and cool dry summers. Franklin and Dryness (1973) include the Mount St. Helens area in the Southern Washington Cascades Province and describe soils and vegetation found in forest zones adjacent to the blast zone.

Initial plant recovery within the blast zone has been described by Means et al. (1982) and Adams and Adams (1982). In general, there has been a rapid recovery of native vegetation in areas where ash depths were less than 12 cm. Dominant species include fireweed (Epilobium angustifolium), pearly everlasting (Anaphilis margaritacea), cat's ear (Hypochaeris radicata) and thistle (Circium arvense). In areas of high ash accumulation, plant species composition is similar but has not recovered as rapidly as in low ash areas. The debris avalanche of the North Fork of the Toutle River was fertilized and seeded in 1980 and has grass-clover (Trifolium spp.) plant cover.

Methods

Potential carrying capacity (PCC) of elk through time was simulated using a forest succession matrix model similar to that described by Raedeke and Lehmkuhl (1986). Successional stages included four forest stand ages and two unique vegetation communities (Table 1).

Table 1. Estimated potential carrying capcacities (PCC) of elk (elk/km2) within different forest stands at Mount St. Helens.

Vegetation Community	Potential Winter Carrying Capacity (Elk/km2)	Initial Portion of Study Area (km2)
Debris slide	19.0	13
High Ash	0.1	43
0 - 5	2.9	150
6 - 10	2.0	6
11- 30	2.9	8
31- 60	0.8	5
		225

Because these lands are primarily commercial forests, mature trees (60-150 years) and virgin timber (150+ years) timber was harvested prior to this stand age. The amount of area in each successional stage was based on a study area size of 2252 km and on the proportion of 950 random points which fell within each vegetation type (Merrill 1987).

Winter PCC values for the three of the forest stand ages were similar to those used by Raedeke and Lehmkuhl (1986) and were based on the work of Taber and Raedeke (1980) and Hett et al. (1978). We lowered the PCC value for 0-5 year successional stage to fit the observed population counts for 1985 (Merrill 1987).

The winter PCC of the debris avalanche was based on the observed number of elk using the area in 1985 (Merrill 1987). For the years of simulation, we assumed the PCC of the debris avalanche remained stable due to the fertilization and reseeding efforts being conducted cooperatively by the Weyerhaeuser Company, Washington Department of Wildlife, and the Rocky Mountain Elk Foundation. Forest succession in the high ash areas was assumed to be delayed relative to other stand ages. Since most of the area designated as high ash area was at high elevation, we used a low winter PCC value to reflect the accumulation of snow in this area during most winters.

Projected population growth was derived using a nonlinear extension of the logistic model (Gilpin and Ayala 1973):

$$dN/dt = r\,N\,[1 - (N/K)^{\theta}] \qquad \text{(Eq. 1)}$$

In discrete time, this model is approximated by:

$$N(t+1) = N(t)\,\exp\{r\,[1 - (N(t)/K(t)^{\theta}]\} \qquad \text{(Eq. 2)}$$

where N is the population at t, K is the PCC value for time t, r is 0.34 (Merrill 1987), and θ is 3.0 (Boyce in press). The maximum sustained yield (MSY) for this model occurs at the population size (N') where the second derivative of equation 1 equals 0. MSY was estimated to be N(t+1) - N'(t).

Results

Simulations based on a 60-year rotation in timber harvest indicate that the potential winter carrying capacity (PCC) for elk in the Mount St. Helens area will decrease from the number of elk observed the last few years, but remain fairly high for the next 20 years (Figure 1). As a large percentage of the study area becomes closed-canopied second growth, the PCC for elk will decrease and remain low until the second growth forests are harvested. The same general pattern occurs with a 40-year rotation, but PCC remains low for about half as long as under a 60-year rotation. Both analyses assume that the mature second growth timber is harvested by the end of the rotation period.

If the elk population were not harvested, it would be expected to track forest succession, lagging somewhat behind changes in PCC (Figure 1). However, if the management goal for elk were to maintain a maximum sustained yield (MSY), it would be necessary to reduce and maintain the population at about 2/3 the PCC. Maintaining the elk population at a level which could sustain a maximum yield would require a large initial elk harvest, followed by an increase in harvest as the area matured to second growth, and a reduction in harvest at the end of the rotation

period to allow the population to grow to the new POC level (Figure 2). The initial large harvests would eventually overharvest the population as the number of elk decrease in response to changes in POC (Figure 3).

Discussion

Our results indicate a decrease in the winter carrying capacity for elk in the Mount St. Helens blast zone which seems intuitive based on our current understanding elk-forest relationships in the Pacific Northwest. However, the extent to which a "boom-bust" pattern in elk carrying capacity occurs over the long-term will depend on the amount of variation in stand age and spatial distribution created by site potential and forest management practices. Our simulations assumed uniform effects of forest succession on POC and disregarded spatial considerations. Variable rotation length, pre-commercial thinning and fertilization can be used to improve range conditions and stand age diversity. Habitat improvements on the seeded debris avalanche may be particularly appropriate to maintain wintering elk numbers. A reduction in POC for elk on summer range in the next 20 years may not be as great as on winter range because of the delayed succession on severely disturbed sites at high elevations which are availble in the summer but generally not in the winter.

Despite this variation, we suspect that there will be a rather dramatic decline in the elk population in response to forest succession under the 40 to 60-year timber harvest rotation. The extent to which recreational opportunities and associated disturbance excelerate the population decline in the area remains unknown, since our model assumed constant effects of road density, recreational use, weather, and other factors that might reduce the availability of resources.

Our long-term concern for the elk at Mount St. Helens is the possible overharvest of elk which could occur if a rapid decline in elk numbers were to occur and go undetected. Unfortunately, our current knowledge of elk carrying capacities for different stand ages and the importance of spatial relationships among stand ages is known in only general terms that do not yet allow integration into harvest models. Nonetheless, in the western Cascades where plant succession is rapid, further attention must be given to the dynamic interactions between forest succession and management, and elk harvest strategies. The Mount St Helens area continues to provide an excellent opportunity to evaluate these relationships.

Literature Cited

Boyce, M. S. in press. The Jackson elk herd: intensive wildlife management in North America. Cambridge Univ. Press, Cambridge.

Franklin, J. F. and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. U.S.D.A. Pacific Northwest Forest and Range Experiment Station. Gen. Tech. Rep. PNW-8.

Gilpin, M. E. and F. J. Ayala. 1973. Global models of growth and competition. Proc. Nat. Acad. Sci. U.S.A 70:3590-3593.

Hett, J., R. D. Taber and J. Schoen 1978. Forest management policies and elk summer range carrying capacity in the Abies amabilis forest, western Washington. Environ. Manage. 2:56-66.

Means, J. E., W. A. Mckee, W. H. Moir, and J. F. Franklin. 1982. Natural vegetation of the northeastern portion of the devastated area. Pages 93-103 in S. A. E. Keller, ed. Mount St. Helens: One year later. Eastern Washington University Press, Cheny.

Merrill, E. H. 1987. Habitat ecology and population dynamics of elk at Mount St. Helens. Ph. D. Thesis. Univ. Washington, Seattle. 242 pp.

Raedeke, K. J., and J. F. Lehmkuhl. 1986. A simulation procedure for modeling the relationships between wildlife and forest management. Pages 377-381 In J. Verner, M. Morrison and C. J. Ralph (eds.). Wildlife 2000: modeling habitat relationships of terrestrial vertebrates. Univ. of Wisconsin Press. Madison, WI.

Taber, R. D., and K. J. Raedeke. 1980. Environmental assessment report: the Roosevelt elk of the Olympic National Forest. College of Forest Resources, Univ. Washington, Seattle. 109 pp.

CHALLENGE COST-SHARE AND THE FUTURE OF PRIVATE PARTICIPATION IN ELK MANAGEMENT ON PUBLIC LANDS

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Abstract

Beginning in 1986, the Congress allocated funds to the Forest Service to conduct fish and wildlife habitat enhancement activities in cooperation with private and other public organizations. The program, entitled Challenge Cost Share, has captured the attention and support of many groups and the allocations have doubled in just three years.

One of the first applications of Challenge Cost Share funds in the Northern Region was a prescribed burn for the elk winter range on the Nez Perce National Forest. Since the initial application, the program has expanded and elk habitat projects have been completed on six forests within the region.

Challenge Cost Share and the partnerships formed with private organizations offer tremendous potential for elk management on public lands in the Northern Region and elsewhere. However, the role of private organizations in funding habitat management on public lands creates some unusual situations and their participation in such programs must be objectively focused on achieving benefits to the elk resource and long-term maintenance of elk habitat.

Introduction

Beginning with FY 1986, Congress provided funding for a Forest Service "Challenge Grant" program. The basic premise behind the program is that money would be made available to the Forest Service to match private donations for the purpose of conducting fish and wildlife improvement projects on National Forest System lands. The program was an outgrowth of emphasis given to the "user pay" concept by the Reagan administration, essentially creating an opportunity for private citizens to directly affect fish and wildlife habitat through their participation in the program.

The funding provided by Congress is "outside" of the normal budget in the sense that it is available to use if matched by private funds. It was not intended to replace regular budgets, but to be additive to them. The Congress sent a clear message regarding the use of Challenge Grant funds, specifying that they be used to accomplish on-the-ground projects that improved conditions for fish and wildlife.

Much of the credit for initiating the program is due to Lonnie Williamson of the Wildlife Management Institute. It was his suggestion about the basic concept of the program, made to the Senate Appropriations Committee, that triggered the Congress into action.

The program, changed to "Challenge Cost Share" (CCS) in FY 1988, is now in its third year and has been a remarkable success story in accomplishing improvements in fish and wildlife habitat. One of the key points in that success is that private involvement is the catalyst that makes the program work. It has provided a chance for private citizens and groups to directly influence management on public lands.

Current Status

As the program has been implemented, the match provided by the private sector has taken the form of money, labor, special skills or knowledge and special equipment. Generally, the match has taken the form of funds, and routinely in the ratio of 1:1. In the two fiscal years that have been completed in the Northern Region of the Forest

Service (FYs 1986 and 1987), the CCS funding of $260,000 was matched by private donations with a value of $523,000, resulting in a total of $783,000 available for projects. Table 1 lists the growth of the CCS program in Region 1 (Montana, northern Idaho, and western Dakotas):

Table 1. Challenge Cost Share and Cooperator Contributions for Region 1, USFS

Source	Wildlife	Fish	Threatened and Endangered Species	Total
FY 86 Region 1 Allocation	$20,900	$55,100	$15,200	$ 91,200
FY 86 Cooperator Contributions				$244,000
FY 87 Region 1 Allocation	$58,000	$56,000	$55,000	$169,000
FY 87 Cooperator Contributions				$279,000
FY 88 Region 1 Allocation	$40,000	$59,000	$57,000	$176,000

Based on the record in Region 1 to date, private contributions have more than matched available CCS funds, actually achieving a ratio closer to 1:2. Nationally, the program has grown at a rapid rate as depicted in Table 2:

Table 2. National Challenge Cost Share Allocations for FY 86-89

FY 86 National Allocation	$ 800,000
FY 87 National Allocation	$ 2,000,000
FY 88 National Allocation	$ 3,000,000
FY 89 National Allocation	Projected $ 5,000,000
	Total FY 86-89 $10,800,000

The CCS funds, unlike regular budget funds for habitat improvement, do not have "hard" targets attached. This increases the flexibility of the funds and promotes a diversity of projects by allowing field units to match with local interests and needs.

Looking specifically at elk, there are seven Forest Service Regions that can utilize the CCS program to improve elk habitat. They are:

Table 3. USFS Regions and Administrative Areas

Region	Headquarters	Area
1	Missoula, MT	MT, N. Idaho, W. Dakotas
2	Denver, CO	CO, KS, E. Wyoming, NE, SD
3	Albuquerque, NM	AZ, NM
4	Ogden, UT	S. Idaho, NV, UT, W. Wyoming
5	San Francisco, CA	CA
6	Portland, OR	OR, WA
10	Juneau, AK	AK

The area administered by these regions include the range of Roosevelt elk, Rocky Mountain elk, and Tule elk. At present, five of these seven regions have completed elk projects under the CCS program which benefit Roosevelt elk and Rocky Mountain elk. Three of the regions have had elk projects every year the CCS program has been in existence.

The significance of the CCS program for fish and wildlife habitat improvement cannot be overemphasized. Historically, Forest Service budgets for fish and wildlife habitat improvement have been very small while the recognized backlog of needs has grown. Many forests have "shelf stock," projects identified as a need but historically lacking the funding for accomplishment. The CCS program has enabled the Forest Service to address some of these needs as well as adding a great deal of diversity to fish and wildlife programs by providing funds for projects that have not historically been a part of Forest and District efforts. Prime examples include projects for sensitive species, projects aimed at nongame species and nonconsumptive wildlife activities, and projects aimed at raptors. The CCS program has been very successful at supplementing, complimenting and diversifying historical Forest Service fish and wildlife habitat improvement programs.

Projects which benefit elk specifically often provide benefits for other big game species such as bighorn sheep, mule deer and black bear. Therefore, it is difficult to precisely identify projects which specifically benefit elk alone. However, figures projected through the end of FY 88, indicate that approximately $260,000 of CCS funds will support projects that benefit elk either directly or indirectly.

With just a match of 1:1, a very conservative estimate, a total of over $500,000 will have been expended on projects which benefit elk. The types of projects vary depending on the features of the area and the management opportunities identified. Table 4 lists the types of projects conducted to date:

Table 4. Examples of Challenge Cost Share Projects Which Benefit Elk

*Seeding of Forage Sites
*Water Hole Development
*Elk Transplants/Relocations
*Management Related Studies on Habitat Use, Survey Techniques, Seasonal Ranges
*Prescribed Burning of Winter Ranges
*Access Control
*Fencing to Exclude Livestock from Key Sites

Nationwide, cooperators in the CCS program number in the hundreds and range from small, local sportsmen's groups to national conservation groups. Typical of the cooperators which fund elk related projects are: state universities, state fish and game departments, national hunting and conservation groups, private ranches, family trusts, local and regional sportsmen's clubs, and single individuals. The program has become a catalyst for change and stimulated cooperation and creativity. A specific example was a project on the Caribou National Forest in Idaho where the Rocky Mountain Elk Foundation donated $8,000 for CCS elk projects. The amount was matched by the Idaho Fish and Game Department and that total matched with Forest Service CCS funds for a grand total of $32,000 project dollars. Through cooperation and enthusiasm, the initial $8,000 donation was leveraged to $32,000 and focused on projects supported by three organizations. The potential for this effort was created by the availability of CCS funds.

Summary

Aside from creating change on the ground, where it counts, the CCS program has had many positive side effects including:

1. the CCS program has created an air of optimism and a recognition that projects can be accomplished;

2. the CCS program has breathed new life into old partnerships and generated a spirit of cooperation and creativity;

3. the CCS program has empowered the average sportsman by giving them an avenue to affect public land management through individual or group action;

4. the CCS program has caused an increased sense of ownership among cooperators and generated a stronger constituency for fish and wildlife on public lands;

5. the CCS program has been a success for Congress, resulting in benefits to the resource and the general public through the efficient use of CCS funds.

The Challenge Cost Share program is a proven success and should remain a vital part of public land management. The concept is sound and future adaptations to other resources are certain. It has given new recognition and provided a key role for private individuals and groups in the management of fish and wildlife on public lands and, thus, is a healthy continuation of the traditional ethic of democratic management of a public resource for the benefit of all people.

NEW MEXICO'S HABITAT IMPROVEMENT STAMP PROGRAM

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Abstract

The New Mexico Department of Game and Fish has started a pilot program that requires an access fee for hunting, fishing, and trapping on certain public lands. A cooperative agreement between the Department, Region 3 of the United States Forest Service, and the New Mexico State Office of Bureau of Land Management was signed under the authority of Public Law 93-492, commonly referred to as the "Sikes Act." Areas that require this "user fee" were picked because of an opportunity to raise significant funds for projects and/or because of a chance to benefit wildlife populations quickly. Although the Sikes Act allows expenditures for a variety of purposes, we have chosen to utilize the funds for habitat improvement projects. The three areas where the stamp is required receive an estimated 40% of the hunting pressure in the state. The revenues for the first year of full implementation in all three areas was approximately $184,000. These funds will be increased by the addition of federal aid for some projects, Forest Service and Bureau of Land Management Challenge Cost/Share funds, and volunteer labor from conservation organizations. Projects are developed by an Interagency Coordination Committee after input from the professionals of all agencies and a series of public meetings to obtain input from the sporting public. A Citizens Advisory Committee reviews proposed projects and prioritizes them. The State Game Commission is the final authority that controls the release of funds for expenditure on projects. Approved projects for 1988 include wildlife trick tanks, water storage tank covers, prescribed fires, spring developments, stream structures, riparian enhancement, dam stabilization, road management, browse development, and a turkey transplant. This pilot project will be evaluated in 1991 to determine its success and public acceptance. After this evaluation process is completed, recommendations will be made to the State Game Commission as to the continuation, expansion, or discontinuation of the program.

Introduction

Every wildlife biologist has been faced with a shortage of funds to conduct much needed habitat improvement work. This is true no matter what agency we work for. The development of habitat on public lands has always been conducted with very little money and the many projects we want to do cannot be completed with our limited financial resources. When budgets get cut, the wildlife dollars are usually the first to go. Various nonprofit private organizations have helped out where they can. Ducks Unlimited has provided dollars for waterfowl work but the dollars are not in great amounts unless you live in a state that has millions of people. The Rocky Mountain Elk Foundation is coming on strong, but they only provide funds for projects that benefit elk (Cervus elaphus). I predict that in the next ten years there will be more species oriented groups formed, but we need the dollars now. With the ever increasing demand on public lands for recreation and wildlife oriented activities, we must continue to provide the much needed habitat for the wildlife populations. We must do this while knowing full well that the states will not see

significant budget increases nor will the U. S. Forest Service or the Bureau of Land Management. To provide the public with what they demand, and to be true to our profession, we must find the dollars for our work. The vehicle for us to do this has been in place since 1974, but until 1985, nobody wanted to use it. This vehicle is Public Law 93-492, better known as the Sikes Act. This act allows the state wildlife agency, under agreement with the Forest Service and/or Bureau of Land Management, to charge a user fee for hunting, fishing, and/or trapping on public lands. With this act, we as wildlife professionals, have the opportunity to raise millions of dollars for wildlife projects.

The Act

A brief review of the Sikes Act will allow us to understand the opportunities that await us. The Act was passed in 1960 and addressed conservation on military reservations and the development of cooperative management plans between the states and the Department of Defense. In 1974, the Act was amended to allow for funding of comprehensive wildlife management plans for the states. The second thing the 1974 amendment provided for was a user fee, by the means of a stamp sale, for hunting, fishing, and/or trapping on lands administered by the U. S. Forest Service, the Bureau of Land Management, and/or the Atomic Energy Commission. Any of these agencies could enter into an agreement with the state wildlife agency to charge this fee and the money collected must be spent on wildlife projects in the area where it was collected. The projects that could be conducted include, but is not limited to; protection, research, census, law enforcement, habitat management, propagation, live trapping and transplantation, and regulated taking. The fee is to be collected by the state wildlife agency by stamp sales that are to be conducted at the places where licenses are sold. The amount of the fee is to be determined by agreement of all agencies involved. The state will collect the money and disburse it to the federal agencies for approved projects. In some states, the Game Commission will have the authority to approve the agreement while in other states, it will require legislative action.

The New Mexico Experience

In 1985, the State Game Commission of New Mexico passed a regulation that required a $10.00 stamp to hunt, fish, and/or trap on the Valle Vidal Unit of the Carson National Forest. This was the first user fee imposed under authority of the Sikes Act in the United States. In 1986, the Commission imposed a $5.00 fee on the Lincoln National Forest and surrounding Bureau of Land Management land in southeastern New Mexico as well as the Jicarilla Division of the Carson National Forest in the northwestern part of our state. An additional 83,000 acres of Bureau of Land Management land adjacent to the Jicarilla Division was added to the stamp requirement in 1988. These areas receive an estimated 40% of our deer hunting pressure annually. There are numerous other areas in the state that receive tremendous fishing pressure that have the potential of raising thousands of dollars yearly for wildlife work.

Revenue collected during the 1986-87 license year, the first year that the stamp requirement was in place on all three areas, were approximately $184,000 ($12,000 on the Valle Vidal, $34,400 on the Jicarilla, and $137,600 on the southeast area). The Forest Service has obligated an additional $131,000 from their challenge cost/share program and the Bureau of Land Management has kicked in $6,000 from their challenge program to combine with the Sikes funds for habitat work in New Mexico. This brings

our total for one year to approximately $321,000. Since we were not expecting this much money, we had not developed enough projects to spend all of it. We will be utilizing the Sikes funds and some of the federal agency dollars for approved projects and will conduct similar projects in the area with the remaining agency funds. The Sikes Act funds may be carried over if they are not all spent in one year. We have also utilized federal aid dollars on the Valle Vidal to increase our funding level.

The projects that have been approved for Sikes funding in New Mexico include; 36 water unit installations, 39,178 acres of prescribed burns, 50 miles of reseeding and obliteration of unneeded roads, 2 wetland enhancement projects that include pothole blasting and waterfowl nesting habitat development, 25 miles of riparian habitat enhancement, 19 projects to develop or protect naturally occurring springs to provide wildlife water, 1 Merriams turkey (Meleagris gallopavo merriami) transplant, and the establishment of a $10,000 habitat improvement maintenance fund. This is the type of work that can be done with a user fee in place on public lands. As you can tell, we have concentrated our efforts on habitat improvement although the money may be spent on other types of wildlife projects. We keyed on habitat improvements because we felt that we could show results more quickly, we could provide the greatest benefit to wildlife in the area, and the public expressed a desire for habitat improvements to be a priority for the funds.

When New Mexico started the Sikes Act fee, we went through a series of efforts that covered some, but not all, of the bases that should be covered for a new idea in wildlife funding. I will not go into great detail but rather briefly mention the processes we did and, hopefully, alert those wishing to start a fee in their state of some of the pitfalls we did not foresee. We first started considering the fee in 1983. At that time, we discussed it with the State Game Commission and held a series of public meetings throughout the state. After these public meetings, we recommended the fee be charged in southeast New Mexico on a trial basis. The Commission discussed the fee at numerous Commission meetings and approved the Valle Vidal fee in 1984, to go into effect in 1985. The Commission continued to discuss the southeast recommendation at numerous meetings and in December of 1985, approved a regulation that required the fee starting in April of 1986. April was chosen as a starting date as that coincided with our license year. In February, the U. S. Forest Service requested the Commission to add the Jicarilla Division to the fee requirement and they added this area to our Sikes areas. The Jicarilla requirement was passed after our big game proclamation was printed so we did not get the information out in this media. In 1988 the sporting public and the Cattle Growers Association in the Jicarilla area approached the Bureau of Land Management and requested that additional land, administered by the Bureau of Land Management, be added to the Sikes Act area. The Commission approved this request, but made the stamp requirement effective April 1, 1989. This will allow the Department to provide the proper notification to the public of the stamp requirement. The Commission also instructed the Department to withhold any additional recommendations for expansion until the entire program is evaluated in 1991.

The above paragraph will give you a quick idea of what we did. What we didn't do, but should have is equally as important. Our most critical mistake was not keeping the local and state politicians involved or at least informed. We spent a lot of time, after the fee was in place, justifying our actions to legislators that heard from those who opposed the fee. If the politicians are kept fully informed from the start, you will then be conducting the program instead of trying to justify it. Do not forget your congressional delegation and governor when you are briefing

politicians. Another mistake was the long time frame between the public meetings and the passage of a regulation requiring the fee. Our Commission discussed the Sikes Act for two years before taking action. If you have to wait this long, hold another round of public meetings to have fresh input into the program. If you get a new Commission during this time, be sure to fully brief them on the program. We did not do this in New Mexico and they were briefed by a group opposed to the program. It was only after a large outpouring of public support, expressed to the Governor, that the program saved in New Mexico. A last recommendation on Commission action when authorizing the program is to hold the meeting where it will be authorized in a large population center. We did not do this and got accused of trying to sneak the fee in on an unsuspecting public. Although we had thought that we had covered all the bases, one organized group that opposed the idea gave us a lot of headaches because we did not follow the recommendations given above. A nice sidenote is that after all of the battles, that group has seen the massive public support for the program and now has publicly stated that "we are 100% behind the Sikes Act." When I heard them say that, I knew that we had won the war.

Once the program is in place, you must determine how to spend the money collected. In New Mexico we have a system that seems complicated, but we feel that most steps are necessary to maintain public support for the program. Our first step is to conduct a series of public meetings each year to obtain project recommendations from the sporting public. These projects, as well as ones recommended by the agencies involved, are reviewed by a committee called the Inter-Agency Coordination Committee. This committee is made up of the professionals of the agencies involved and is responsible for selecting projects that adhere to the spirit and law of the Sikes Act. This committee also insures that the proper land use plans are in place by federal agencies that allow the projects to be carried out on public land. It is essential that the district rangers and/or the area managers be involved at this level. Once the Inter-Agency Coordination Committee compiles a list of projects, they are presented to a second committee, called the Citizen's Review Committee. This committee has the charge of placing priorities on the projects and suggesting projects for consideration by the Inter-Agency Coordination Committee. The next step is the presentation of the projects to the State Game Commission for approval. Of course the final step is the construction of the projects. Throughout this whole process we keep the public fully informed by regular and special news releases, TV spots for the local stations, and any other media outlet available to us. We are in the process of developing a semi-annual Sike's Act newsletter for free distribution and are checking into a possible prime-time half hour special on habitat improvement in New Mexico. Never get complacent about your support, continually inundate the public with favorable publicity about the program.

Conclusions

Although our program in New Mexico is a pilot program and will have to be evaluated in 1991, we feel that we are well on the way to success as evidenced by the public demand for continuation of the program in late 1987 when some nonsupporters got the ear of our new Commission. We also see evidence of our success in the fact that the newest Sikes area in New Mexico is there because the public requested the agencies charge the fee. We have received requests from the public to include all Bureau of Land Management land in the northern half of the state in the program as well as recommendations to go statewide with the program as soon as possible. When the evaluation is completed in 1991, I am confident that the program will be expanded in

New Mexico with a set timetable for a statewide stamp requirement. We know we are on the right track when the public asks for the fee before we even tell them that we are thinking of expanding it.

New Mexico is well on the way to raising hundreds of thousands of dollars a year for wildlife work on our public lands. We estimate that we will be able to conduct the habitat work that has been planned for the next fifty years in as few as fifteen years, thirty-five years ahead of schedule. You will see a Sikes Act fee in Texas before the end of this year and Oklahoma may well be there also. By the end of this century the state that does not have a stamp requirement in place will be an endangered species.

The opponents of the fee say that we are just charging the user again, as we have with license fees. The states must be the leaders in charging this fee or will loose control of hunting, fishing, and/or trapping on public lands when Congress passes a federal user fee that includes all uses. If a Sikes Act fee is already in place, then those users that require our fee can be exempted from the federal fee. Another reason I am confident that the program will be adopted by state after state is simple economics. In these days of restricted budgets, the Sikes Act can raise millions of dollars for wildlife. A conservative estimate is that if all national forests in the United States required a $5.00 fee, stamp sales alone would exceed $30,000,000. This does not include Bureau of Land Management lands or any matching funds made available because of the seed money generated by the Sike's Act.

New Mexico has started the user fee idea, it is our hope that our fellow professionals will be able to see the benefits that we are obtaining and will join us in this exciting new program for wildlife management on our public lands.

Questions from the Audience:

Q - Do all users have to purchase the stamp to use the national forest?

A - The act is very specific that hunters, fishers, and trappers are the only people you can require to purchase the stamp. If you had a good public relations department, you can convince people they ought to purchase it anyway. The state sells the stamp - the money comes into the state, and then the projects are agreed on by interagency committees, and the state disperses the money to whichever federal agency is using it for the project or the state does some of the project.

ELK HIDING COVER AS INFLUENCED BY TIMBER STAND THINNING

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Abstract

A personal computer program is used to estimate elk hiding cover on control, treatment, and pretreatment stands on five thinning demonstration areas in western Montana. Hiding cover for entire stands required from 1,486 to approximately 2,000 trees/acre, depending on dbh. Stands with tall shrubs in the understory produced hiding cover at lower tree stem densities. Hiding cover values declined significantly from a range of 44-100% on control areas, to a range of 16-17% on stands thinned to approximately 400 trees/acre. Forage production, however, increased. It is proposed that management of thinned areas can be controlled to prevent major losses of habitat effectiveness for elk.

Introduction

The Mission-Oriented Research Program (MORP) of the University of Montana, School of Forestry, was established to work on second growth management problems in the northern Rocky Mountain forests (Pfister and Fiedler 1986). MORP emphasizes studies of the multiple effects of alternative silvicultural treatments. A substantial research effort is being conducted regarding whole-tree thinning of second-growth timber stands. In addition to determining silvicultural responses, research program managers desire information concerning the influence of these treatments on other forest resources. In Montana, the elk (Cervus elaphus) herds are an extremely important non-commodity resource, and the management of second-growth timber to provide elk habitat is an important consideration.

The objective of this project was to estimate changes in hiding cover for elk using MORP timber stand data and the HIDE2 personal computer (PC) program (Lyon 1987). Hiding cover is defined (Thomas et al. 1979) as vegetation capable of hiding 90% of a standing adult elk from view at a distance of 200 ft. or less. This definition is currently accepted and widely used by both wildlife biologists and land managers. The PC program allows rapid and precise computation of hiding cover values, using tree and shrub density by diameter class.

Hiding cover is only one component of the habitat required by elk, but it was judged to be the component most drastically modified by thinning. The abundance and distribution of hiding cover may strongly influence habitat effectiveness for elk, and a better understanding of modifications will allow the forest manager to provide appropriate distribution patterns.

We gratefully acknowledge the help of Michael Sweet and Carl Fiedler of the Mission-Oriented Research Program, and the University of Montana, Advanced Wildlife Conservation classes of 1986 and 1987.

Study Areas

Data from four thinning demonstrations areas (Coyote Park, Shoestring, Section 12, Section 16) on the Lubrecht Experimental Forest of the University of Montana, and one TDA on the Swan River State Forest (Swan Valley) were used for this project. Lubrecht Experimental Forest is 30 miles east of Missoula, Montana. The Swan Valley demonstration area is approximately 9 miles southeast of Swan Lake, Montana. Each area contained at least one control stand, and some pretreatment data were available. Treatment stand thinnings were planned at mean stem densities of 440, 220, or 110 trees/acre on the Lubrecht TDAs; and to 300, 220, and 150 trees/acre on the Swan Valley TDA. Spacing of the leave trees was more or less random, not highly regular or clumped. There were no shrubs in the Lubrecht Forest TDAs, and understory shrubs in the Swan Valley TDA were cut during thinning. General characteristics of thinning demonstration areas are presented in Table 1. More detailed descriptions of the TDAs are available from MORP.

Table 1. Characteristics of thinning demonstration areas.

Area	Habitat Type[1]	Total Size (ac)	Elev. (ft.)	Aspect	Slope (%)	Overstory Dominant(s)
Coyote Park	PSME/LIBO/VAGL eastern 1/3 (ABLA/MEFE)	14.2	5,200	North	10-40	Larix occidentalis
Shoestring	PSME/SYAL/CARU	13.9	3,900	North	<15	Pseudotsuga menziesii Pinus ponderosa Larix occidentalis
Section 12	PSME/VACA	7.6	4,100	North	mostly <10	Pinus contorta
Section 16	PSME/SYAL/CARU	13.4	4,200	South	mostly <15	Pinus ponderosa
Swan Valley	ABGR/CLUN/CLUN	33	3,800	South	10	Pinus ponderosa

[1]Pfister et al. (1977)

Methods

The HIDE2 PC program (Lyon 1987) accepts data as tree stems per acre by diameter (dbh) class up to 30 in. and shrubs per acre by foliage diameter from 31 to 90 in. Trees with stem diameters < 6 in. can be entered as either stems or as open-grown trees if there are live crowns below 4.5 ft. As data entries are made, random locations for individual plants are generated and plotted to scale as a 1-acre representative stand on the video screen. The program uses an arcsin projection to calculate the percentage visual obstruction in the display stand at a distance of 200 ft. This "visual blockage" is identical to values produced with the cover model proposed by Smith and Long (1987). HIDE2, however, evaluates "hiding cover" in units 65 inches wide so that an entire forest stand provides hiding cover for elk only when > 90% of the elk-width units provide hiding cover. In a previous study (Lyon and Marcum 1986) we compared the HIDE2 program with two field techniques and found that, where timber inventory information was already available, results were more accurate and faster than the field methods.

Timber stand data were supplied by MORP for the five thinning demonstration areas. Standard mensurational data were obtained by sampling three 0.1 ac plots per stand (treatment) on the Lubrecht TDAs. Data from the Swan Valley TDA were obtained from measurements of entire stands in a randomized block design. Control, thinned and two pretreatment stands on these areas were evaluated as elk hiding cover using the HIDE2 program. Ten simulations of each stand were completed. Trees on the TDA's had self-pruned to a height of > 4.5 ft, so no trees were entered as open-grown. Means and standard errors were calculated, and significant differences were assumed with more than two standard errors difference between the means.

Results

Actual tree densities on control plots (Table 2) ranged from 400 to 1,486 stems/acre. Visual blockage on these plots ranged from 84-100% and hiding cover from 44-100%. Only the Shoestring and Swan Valley TDAs had control area hiding cover values > 90% for the entire stand. On the former area, tree stems provided all of the hiding cover, while shrubs provided most of the hiding cover on the Swan Valley plots. The pretreatment hiding cover value for the Section 16 area was 92%, but the hiding cover value for the adjacent control was only 67%. Hiding cover for the entire stand was produced on control plots of the Shoestring TDA by a tree density of 1,486 stems/acre. There was a mix of stem size classes in this stand, and many were > 6 in dbh. In the Section 16 pretreatment area, where stems were more uniform and smaller in average diameter, approximately 2,000 stems/acre were required to produce hiding cover for the entire stand.

Thinning of the demonstration area stands to an approximate mean density of 400 trees/acre resulted in significant declines in both visual blockage and hiding cover for elk. Visual blockage ranged from 84-100% on control plots with tree densities of 700-2000 stems/acre; but dropped to 65-66% after thinning. Hiding cover for elk ranged from 44-100% on controls but declined to 16-17% after thinning. Thinning to even lower densities consistently produced significant reductions in visual blockage, but hiding cover was already so low the

additional losses were not statistically significant. Tree removal accounted for the reduction in visual blockage and hiding cover on the Lubrecht areas whereas elimination of most tall shrubs caused the reductions in the Swan Valley.

Table 2. Tree stem and tall shrub densities and mean diameters (inches); and percent visual blockage and hiding cover means (n=10) with standard errors, for control and thinned plots.

		Thinned Plot Densities		
Area	Control	≥ 300	200-299	100-199
Coyote Park				
Trees ($\bar{x}$ diam.)	1,329 (3.6)	424 (6.0)	228 (6.0)	124 (6.6)
Visual Blockage (SE)	87 (0.6)	66 (0.6)	44 (0.9)	29 (0.5)
Hiding Cover (SE)	49 (2.0)	17 (1.6)	4 (1.2)	2 (0.4)
Shoestring				
Trees ($\bar{x}$ diam.)	1,486 (7.0)	202[1] (8.1)	212 (10.3)	114 (9.9)
Visual Blockage (SE)	99 (0.1)	51 (1.8)	61 (2.1)	41 (1.7)
Hiding Cover (SE)	95 (0.9)	10 (2.5)	18 (3.2)	11 (2.7)
Area	Control	> 300	200-299	100-199
Section 12				
Trees ($\bar{x}$ diam.)	714 (5.4)	434[2] (5.5)	219 (7.1)	152 (7.1)
Visual Blockage (SE)	84 (1.1)	66 (1.0)	49 (1.1)	37 (1.1)
Hiding Cover (SE)	44 (2.7)	16 (2.2)	8 (1.4)	5 (1.1)
Section 16				
Trees ($\bar{x}$ diam.)	990 (5.4)	384[3] (6.4)	223 (8.8)	116 (9.9)
Visual Blockage (SE)	92 (0.8)	65 (0.8)	56 (0.9)	37 (0.8)
Hiding Cover (SE)	67 (2.8)	16 (1.8)	14 (2.2)	5 (1.0)
Swan Valley				
Trees ($\bar{x}$ diam.)	400 (4.6)	300 (5.3)	225 (5.5)	150 (5.5)
Shrubs ($\bar{x}$ diam.)	812 (48.0)	-	-	-
Visual Blockage (SE)	100 (0.0)	49 (1.0)	43 (1.1)	31 (1.0)
Hiding Cover (SE)	100 (0.0)	6 (1.5)	5 (1.2)	4 (1.1)

[1]This stand was thinned to an "acceptable" level that was much less than the planned density of 440 stems/ac.

[2]Pretreatment plots had T/ac = 1,517 (x diam. = 3.8), VB = 93 (SE = 0.6); HC = 72 (SE = 2.6).

[3]Pretreatment plots had T/ac = 2,044 (x diam. = 3.9), VB = 97 (SE = 0.3), HC = 92 (SE = 1.1).

Discussion

Silvicultural thinnings of conifer stands have a significant influence on habitat components for elk. Some hiding cover was retained at the thinning densities examined in this study. However, even the highest densities of leave trees (> 400 stems/acre at Coyote Park and Section 12) provided less than 20% elk hiding cover for entire stands. These values are clearly inadequate to meet the hiding cover needs of elk. In situations where topography changes the viewing angle, such as looking from a hillside into a drainage, hiding cover losses may be even greater (Canfield et al. 1986).

At the same time, forage production increased on the 220 and 110 trees/acre thinnings on the Lubrecht Experimental Forest (Bedunah et al. 1986). Numerous studies elsewhere in the Rocky Mountain west have produced similar results (Reynolds 1964, 1969a, McConnell and Smith 1965, Clary and Folliott 1966, Pearson 1968, Conway 1982, and Crouch 1986). Forage quality (moisture, protein, and digestibility) may also increase in stands thinned to relatively wide spacing (Crouch 1986).

Where elk habitat is an important consideration, silvicultural thinnings have both positive and negative potential. In areas of extensive, dense, second growth forest at lower elevations where forage conditions are poor, forest and wildlife managers can probably improve winter range conditions for elk through carefully planned forest thinning. In second-growth areas where forage is not limiting, thinning probably will not benefit elk. However, intermediate cuttings can be designed to maintain habitat effectiveness.

Present evidence suggests that for optimum elk use, thinned areas should not exceed 200 yards in width and should be interspersed with unthinned cover areas 200-400 yards wide (Leckenby 1984, and Thomas et al. 1988). Thinning should be avoided in stands adjacent to clearcuts and natural openings where the loss of escape cover will reduce elk use (Lyon 1976). Thomas et al. (1979) proposed that cover should occupy at least 40% of optimal elk habitat, but Peek et al. (1982) have pointed out that larger areas of hiding cover become extremely important during the hunting season.

In the second growth stands of this study, the Shoestring and Swan Valley controls and the pretreatment areas of Section 16 exhibited 90% hiding cover for entire stands before thinning. Such stands provide an opportunity to leave areas with higher stem densities as cover for elk when selecting stands for thinning. Tall shrubs should be retained in thinned stands because of the cover they provide. As stands mature, self-pruning and self-thinning will reduce elk hiding cover. Eventual conversion of older stands to young stands with low crowns, and thinning of stands to maintain low crowns may also help provide hiding cover (Smith and Long 1987).

Correct sizing and spacing of unthinned areas would also provide for the preference shown by elk for thermal cover (Beall 1974, Leckenby 1984, Zahn 1985). Thermal cover was defined by Thomas et al. (1979) as any stand of coniferous trees > 40 ft tall, with an average canopy closure > 70%. The physiological need for thermal cover by elk has been questioned (Geist 1982, Peek et al. 1982), but not their preference for it. It seems best to assume that use of preferred habitats by elk is advantageous to them (Thomas et al. 1988), and, to manage their habitat so we do not push them to the physiological,

behavioral or ecological margins of their adaptations for production and survival. Thomas et al. (1988) have now dropped the term "thermal" to avoid arguments over semantics, and have adopted the terms "satisfactory" and "marginal" cover. Satisfactory cover satisfies the previous definition for thermal cover, while marginal cover is a conifer stand > 10 ft tall with an average canopy closure of 40-69%. Because Leckenby (1984) found that use of hiding cover by elk was less than availability when satisfactory or marginal cover was available, Thomas et al. (1988) have dropped the term "hiding cover." However, we think this term should be retained when and where horizontal screening is important in elk security, such as thinned areas and during hunting seasons.

Management Implications

The major effect of forest thinning on elk habitat is a potential loss of hiding cover and concurrent reductions in security. However, security for elk is not entirely a matter of vegetative cover. Loss of security can also result from restrictions of elk movement and disturbances by humans. Precommercial thinnings, especially if delayed until trees are fairly large, often produce heavy amounts of slash, leading to reductions in elk use of an area (Reynolds 1969b, Beall 1974, and Lyon 1976). Thinnings on both summer and winter ranges will be detrimental unless they are done at an early stage in the growth of the stand or unless the slash is cleaned up.

The most important single consideration in elk habitat management, however, is the decline in elk use near open roads. Declines have been recorded near the TDAs at Lubrecht Experimental Forest (Edge 1982, Marcum et al. 1984), and many other places (Marcum 1976, Hershey and Leege 1976, Perry and Overly 1976, Ward 1976, Lyon 1979, Rost and Bailey 1979). Models predicting the influence of road densities up to 6 mi./section (Thomas et al. 1979, Lyon 1983) indicate losses in habitat effectiveness as great as 90%. Road closures in intensively managed areas can be a powerful tool in retaining elk security.

Literature Cited

Beall, R.C. 1974. Winter habitat selection and use by a western Montana elk herd. Ph.D. diss., Univ. Montana, Missoula. 197p.

Bedunah, D., W. Pfingston, G. Kennett, and E.E. Willard. 1986. Relationship of stand canopy density to forage production. IN PRESS in Future forests of the mountain west: a stand culture symposium. Missoula, Mont.

Canfield, J.E., L.J. Lyon, and J.M. Hillis. 1986. The influence of viewing angle on elk hiding cover in young timber stands. USDA For. Serv. Res. Pap. INT-371. 5p.

Clary, W.P., and P.F. Ffolliott. 1966. Differences in herbage-timber relationships between thinned and unthinned ponderosa pine stands. USDA For. Serv. Res. Note RM-74. 4p.

Conway, T.M. 1982. Understory herbage response to varied lodgepole pine spacing intervals in western Montana. M.S. Thesis. Montana State Univ., Bozeman. 84p.

Crouch, G.L. 1986. Effects of thinning pole-sized lodgepole pine on understory vegetation and large herbivore activity in central Colorado. USDA For. Serv. Res. Pap. RM-268. 10p.

Edge, W.D. 1982. Distribution, habitat use and movements of elk in relation to roads and human disturbances in western Montana. M.S. Thesis. Univ. Montana, Missoula. 98p.

Geist, V. 1982. Adaptive behavioral strategies. Pages 219-277 in Thomas, J.W., Toweill, D.E., eds. Elk of North America--ecology and management. Stackpole Books, Harrisburg, Penn.

Hershey, T.J. and T.A. Leege. 1976. Influences of logging on elk summer range in north-central Idaho. Pages 73-80 in S.R. Hieb ed. Proc. Elk-logging-roads Symp., Univ. Idaho, Moscow.

Leckenby, D.A. 1984. Elk use and availability of cover and forage components in the Blue Mountains, northeast Oregon 1976-1982. Wildl. Res. Rep. 14. Oregon Dept. of Fish and Wildl., Portland, OR. 40p.

Lyon, L.J. 1976. Elk use as related to characteristics of clearcuts in western Montana. Pages 69-72 in S.R. Hieb, ed. Proc. Elk-logging-roads Symp. Univ. Idaho, Moscow.

Lyon, L.J. 1979. Habitat effectiveness for elk as influenced by roads and cover. J. For. 77:658-660.

Lyon, L.J. 1983. Road density models describing habitat effectiveness for elk. J. For. 81:592-595.

Lyon, L.J. 1987. Hide2: Evaluation of elk hiding cover using a personal computer. USDA For. Serv. Res. Note INT-365. 2p.

Lyon, L.J. and C.L. Marcum. 1986. Field test of a PC program to evaluate hiding cover for elk. Pages 271-274 in Proceedings, 1986 western states and provinces elk workshop; 1986 March 17-19; Coos Bay, OR. Oregon Dept. of Fish and Wildl., Portland, OR.

Marcum, C.L. 1976. Habitat selection and use during summer and fall months by a western Montana elk herd. Pages 91-96 in S.R. Hieb, ed. Proc. Elk-logging-roads Symp., Univ. Idaho, Moscow.

Marcum, C.L., W.D. Edge, M.D. Scott, J.F. Lehmkuhl, and S.L. Olson. 1984. Final report of the Chamberlain Creek elk study, 1975-1984. Sch. of For., Univ. Montana, Missoula. 257p.

McConnell, B.R., and J.G. Smith. 1965. Understory response three years after thinning pine. J. Range Manage. 18(3):129-132.

Pearson, H.A. 1968. Thinning, clearcutting, and reseeding affect deer and elk use of ponderosa pine forests in Arizona. USDA For. Serv. Res. Note RM-119. 4p.

Peek, J.M., M.D. Scott, L.J. Nelson, D.J. Pierce, and L.L. Irwin. 1982. The role of cover in habitat management in Northwestern United States. Trans. N. Am. Wildl and Nat. Res. Conf. 47:363-373.

Perry, C., and R. Overly. 1976. Impact of roads on big game distribution in portions of the Blue Mountains of Washington. Pages 62-68 in S.R. Hieb, ed. Proc. Elk-logging-roads Symp., Univ. Idaho, Moscow.

Pfister, R.D., B.L. Kovalchik, S.F. Arno, and R.C. Presby. 1977. Forest habitat types of Montana. USDA For. Serv. Tech. Rep. INT-34. 174p.

Pfister, R.D., and C.E. Fiedler. 1986. Montana's mission-oriented research program. West. Jour. App. For. 1(1):11-12.

Reynolds, H.G. 1964. Elk and deer use of a pinyon-juniper woodland in southern New Mexico. Trans. N. Amer. Wildl. and Natur. Resour. Conf. 29:438-444.

Reynolds, H.G. 1969a. Improvement of deer habitat in southwestern forest lands. J. For. 67(11):803-805.

Reynolds, H.G. 1969b. Aspen grove use by deer, elk, and cattle in southwestern coniferous forests. USDA For. Serv. Res. Note RM-138. 4p.

Rost, G.R. and J.A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. J. Wildl. Manage. 43:634-641.

Smith, F.W. and J.N. Long. 1987. Elk hiding and thermal cover guidelines in the context of lodgepole pine stand density. West. Jour. App. For. 2(1):6-10.

Thomas, J.W., H. Black, Jr., R.J. Scherzinger, and R.J. Pedersen. 1979. Deer and elk. Pages 104-127 in J.W. Thomas, ed. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. USDA For. Serv., Agric. Handb. 553. Wash., D.C.

Thomas, J.W., D.A. Leckenby, M. Henjum, R.J. Pedersen, and L.D. Bryant. 1988. Habitat-effectiveness index for elk on Blue Mountain winter ranges. Gen. Tech. Rep. PNW-GTR-218. Portland, OR: U.S. Department of Agr., Forest Service, Pacific Northwest Research Station, 28 pp.

Ward, A.L. 1976. Elk behavior in relation to timber harvest operations and traffic on the Medicine Bow Range in south-central Wyoming. Pages 32-43 in S.R. Hieb ed. Proc. Elk-logging-roads Symp., Univ. Idaho, Moscow.

Zahn, H.M. 1985. Use of thermal cover by elk (Cervus elaphus) on a western Washington summer range. Ph.D. diss. Univ. Washington, Seattle. 175p.

ELK: THE WILDERNESS CONNECTION

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Abstract

North Central Idaho wilderness contains substantial elk (wapiti) range. Forest Service fire management policy on these lands has altered considerably in the past half century. The evolution of this philosophy is the dominant factor in effecting positive habitat changes, on wilderness ranges, for elk and seral associates. The driving force in this philosophical change is the Wilderness Act. Wildlife Management is possible under the auspices of the Wilderness Act, but not within the traditional mold. A history of fire management in the Selway-Bitterroot Wilderness is an example. Included is a cost analysis, on a per acre basis, for prescription fire both within and outside of designated wilderness. The future for quality elk habitat under current direction is discussed. Forces working against current policy are explored as well as potential ramifications.

Background

On a summer morning in early July 1940 two Forest Service Smokejumpers dropped from an airplane to suppress a fire in the Marten Creek drainage, a tributary of the Selway River in North Central Idaho on the Moose Creek Ranger District of the Nez Perce National Forest. With this event the Moose Creek Ranger District and the U.S. Forest Service entered the 20th century from a wilderness fire suppression standpoint. A policy had been forged which was to have profound effects on the flora and fauna of what was to become the only entirely Wilderness designated Ranger District in the U.S. Forest Service. Today it encompasses the largest part of Idaho's Selway-Bitterroot Wilderness, one of America's largest designated Wilderness areas. As such it serves as an excellent barometer to observe the changing weather of fire policy towards wilderness nationwide. Not until the passage of the 1964 Wilderness Act (Public Law 88-577) was there another law/policy event which was to have such an impact on the history of this area.

This first effort at aerial fire suppression resulted in the widespread adoption of this methodology. The ramifications of implementing twentieth century fire suppression in a Wilderness setting are still being brought into focus (Christensen, 1986). In wilderness, the repercussions to other components of the ecosystem may be seen more clearly than on non-wilderness lands. We will look specifically at the effects of fire policies on wildlife management as they relate to elk (wapiti) habitat.

History

Fire has been an integral part of the ecology of the Selway-Bitterroot Wilderness since history has been recorded. Research indicates that repeated fire has been the norm for the discernible past: Habeck (1972) stated that "No area was observed during the summer of 1971 that did not reveal direct evidence of past fire disturbance." There is reason to believe that, next to climate in general, fire is the single most important environmental factor affecting vegetation in the area. Fire history maps of the Moose Creek Ranger District indicate that more than 60% of its area has been burned since 1870 (Keown, USFS 1978). This is in spite of an aggressive fire control policy dominant from the 1930's to about 1978.

Factors which significantly affect vegetation in a spatial and temporal manner will significantly affect the wildlife dependent on that vegetation. The occurrence of catastrophic wildfires in the late 19th and early 20th centuries, set the stage for the establishment of todays 40,000 Selway-Bitterroot elk (Cervus elaphus) herd

(Weaver, 1988). Other species which benefit from the resultant conversion to earlier seral stages and the mosaic burning pattern typical of wildfire in Central Idaho, include: moose (Alces alces), black bear (Ursus americana), ruffed grouse (Bonasa umbellus), mule deer (Odocoileus hemionus), and potentially, grizzly bear (Ursus arctos). Conversion of large acreages to an early seral stage equates with large increases of available biomass for species adapted to such seral situations.

Conversely, the supression of most wildfires beginning in the 1930's and accelerating in the 1940's brought about another type of vegetative change. This resulted in abnormally large acreages attaining later seral stages than would have occured without man's intervention. The inherent consequence was reduced carrying capacity on a large scale. In a 1988 pamphlet entitled "Grizzlies in the Bitterroots" the Interagency Grizzly Bear Committee (U.S. Forest Service, U.S. Fish and Wildlife Service, Idaho Fish and Game Department and Montana Department of Fish, Wildlife and Parks) postulates that the "Smokey the Bear campaign, begun in the 1930's successfully reduced the number of fires and may have had a negative impact on grizzly habitat." It may be argued that what resulted in much of the Selway-Bitterroot was a man induced or an anthropogenic climax (adapted from Odum 1971). In the Selway-Bitterroot context such a climax generally results in a reduction of total species numbers as the climax community usually cannot host as many species as the preceeding seral stages. There is no doubt that this is the case with elk and other ungulates, especially in winter range situations (interpreted from Thomas et al., 1979)

By the early 1960's work was being done in non-wilderness elk ranges as a result of perceived drops in elk numbers. Some of this pioneering work quickly showed the link between maintaining an early seral stage and elk carrying capacity (Norberg, 1967) (Leege and Hicky, 1971). What transpired next was a slow process of educating the public and involved agencies to the fact that a unilateral policy of complete fire suppression was not always the most beneficial stance for the involved resources. By the late 1960's some spring prescription burning had begun to occur on decadent elk ranges in North Central Idaho. These burns were generally in the 100-200 hectare range. Fire was being used to rejuvenate decadent elk habitat on hundreds of hectares per annum, but the areas being treated occurred within the scars of wildfires that occupied hundreds of thousands of hectares. It was apparent that these efforts were not enough to prevent the eventual loss of overall carrying capacity. By the early 1980's investigation of spring fire prescription areas were beginning to show vegetative responses that were less than adequate, qualitatively (Weaver and Benscoter, 1986). The most specific qualitative concern was centered around reproductive response to cool spring burning as opposed to the hot summer burns which indigenous vegetation was adapted. In addition it was noted that such burning did not reclaim decadent winter ranges already lost through plant succession. Other concerns were noted regarding soil productivity on sites which were burned repeatedly, as well as the effects on species composition associated with repeated short term burning (Leege, 1979).

As a result of these observations, and as a realization that inherent limitations on spring burning virtually preclude treatment on north and east aspects (Weaver and Benscoter, 1986), non-wilderness prescription fire is becoming increasingly a summer event. The overriding reason for this evolution in thought is that summer fire duplicates vegetative responses found in nature. The emergence of summer burning as a viable tool is also due to technological advancement in the field of fire behavior. Experience, extensive fuel inventories, increasing competence in fire weather prediction, and advanced computer technology are yielding increasingly accurate fire prescriptions. What was once viewed as risk taking is increasingly being seen as an effective and prudent tool for resource managers. Summer burning on prime winter elk range in North Central Idaho is now being accomplished at the relatively low cost of $9-$10/acre using aerial ignition (Weaver, 1987). This methodology has effectively

been used on all aspects with encouraging results. Summer prescription fire, however, is a tool which to date is only applicable to non-wilderness land management.

As previously noted, the 1930's through to 1978 were a time of nearly complete suppresion policy on the Moose Creek Ranger District. Although some fires were experimentally not suppressed starting in the early 70's (Saveland and Bunting, 1987). In the Bitterroot National Forest portion of the Selway-Bitterroot Wilderness an even earlier experiment with prescribed fire had been successfully completed. With the publication of the fire management plan in 1978 (Fire Management in the Selway-Bitterroot Wilderness, USFS 1978) these early efforts began to change policy. The publication of the document was not prompted by wildlife concerns, nor was it responsive to habitat management being concurrently developed on non-wilderness lands. Instead, it was a direct offshoot of the 1964 Wilderness Act. The law was passed in 1964, but implementation was a slow process earmarked by caution. While some fires in wilderness were allowed to burn as early as 1972, suppression was still the rule (Saveland 1988 Per. comm. 1988). By 1973 Forest Service policy, as reflected in the agency manual, stated: "Fire, or its absence, has probably had a more profound effect on natural life systems than an other single factor, or combination of factors. Naturally occurring fires will be allowed to more fully play their natural role in the ecology of the area." In 1976 this direction was incorporated in the "Selway-Bitterroot Wilderness Management Plan" as follows: "... develop and expand wilderness fire management planning to include fire management prescriptions for the entire Selway-Bitterroot Wilderness." Two years later this was accomplished.

The 1964 Wilderness Act describes a Wilderness Area, in part, as: "An area where the earth and its community of life are untrammeled by man, an area...which...generally appears to have been affected primarily by the forces of nature, with man's imprint substantially unnoticable." Clearly the natural role of fire falls within this interpretation. It should be emphasized that the entire wilderness issue is controversial, polarizing and value laden. Often these are political problems outside the realm of wildlife management, except where statute or interpretation of statute forges policy into agency action. In the case of wilderness management vis-a-vis fire management the policy will effect wildlife in both the short term and long term. In the specific case of the Selway-Bitterroot, current direction in fire management appears to have secondary or fallout benefits to species which inhabit early successional stages.

Elk are, therefore, a prime beneficiary of current wilderness fire management policy. In the case on the Moose Creek Ranger District, fire management per the Wilderness Act, is wildlife habitat management. Indeed it is the only large scale habitat altering tool currently available. The intentional ignition of prescribed fire in wilderness for the benefit of elk, or any other species, is not allowed. On the other hand, man made prescription burning (which may benefit elk habitat) may be allowed IF the primary purpose is to re-establish vegetative successional stages which would exist if it were not for man's past suppressive influences. This is the policy and logic framework in which the wilderness wildlife manager must work to be effective. Terminology is another item of consideration. The vernacular may find "let burn" acceptable and comprehensible, but in wilderness a fire is either a "prescribed fire" or a "wildfire." The difference in the two is intricate, but basically centers around whether or not a given fire meets a complex grid of parameters designating it "prescribed." If it does it is allowed to burn under close observation. Should it violate one of the guidelines (e.g., threatens to leave the wilderness) it will be suppressed (confined or contained). It is prudent for the wildlife manager, in wilderness, to be conversant in the jargon and aware of the parameters of fire management.

It has now been ten years since the publication of "Fire Management in the Selway-Bitterroot," a period adequate for an initial assessment. What is the legecy of this policy? How has it affected the character of the wilderness and subsequently elk habitat? The figures tell the story:

AREA BURNED

Pre-Fire Plan Era

1956-1978

Controlled Fire	2,022 hectares

Post Fire Plan Era

1979-1987

Prescribed Fire	14,309 hectares
Controlled Wildfire	69 hectares
Confined Wildfire	8,927 hectares
TOTAL	23,305 hectares

The data demonstrates a tenfold increase in hectares burnt when comparing the pre and post fire plan time spans. Under the previous suppression-only policy, fires consumed an average of only 88 hectares/year on the Moose Creek District. In contrast the decade following plan implementation, when fires could burn within prescription, acreages burned increased to 2,590 hectares/year. Cost figures do not compare directly for the two decades, but a comparison is available with the previously cited figure of $9-$10/acre for non-wilderness prescribed burning. Non-wilderness burning costs are, therefore, $22-$25/hectare compared with $6/hectare for wilderness prescription burning in 1987 (Saveland 1988 per. comm.).

Hectares improved for elk, under the auspices of the Selway-Bitterroot fire management plan, on the Moose Creek Ranger District alone exceed the hectare tally of deliberately set prescribed fire for the entire U.S. Forest Service Northern Region in the same time period. The noteworthy point in this is that not one dollar of this money was allocated to wildlife habitat improvement. Thus we see some 23,000 hectares of improved elk range with a zero outlay of wildlife habitat improvement dollars. In contrast the $22-$25/hectare figure cited for non-wilderness prescription fire is entirely based on monies appropriated for wildlife habitat improvement, and/or monies donated under the Challenge Cost Share program. Each has its place and is cost effective relative to its role. The contrast is presented to indicate a minimum dollar value to wildlife through the maintenance of a sound wilderness fire policy.

Current Situation

Presently the wildlife role in wilderness is that of an advisor to all functions, including fire. Today fire management on the Moose Creek Ranger District is on the leading edge of technology. Observation under prescription is the norm. It does not spell the end for the smokejumper, nor is it assured because of common sense, the need for biological diversity, economics, ecology or the Wilderness Act. In the increasingly complex web woven by environmental politics, only change is certain.

Sound wildlife management is never a given. It is only secure so long as it is politically acceptable. This is the status of fire management in the Selway-Bitterroot Wilderness today. Not everyone is enthralled with fires burning for weeks or months in the Idaho backcountry. Where there is fire there is also smoke. Smoke is even more difficult than fire to contain. It can and does drift into adjacent populated areas and cause the residents varying degrees of irritation.

Fires burning late in the season can interfere with the elk hunter and outfitter, causing delays, plan changes and lost revenue. Fire burning around private inholdings can threaten structures and occasionally lives. It does alter vistas, negatively, in the very short term. All of these effects are anthropocentric and hence subject to political intervention. The question to be answered today is: will current wilderness fire policy, with its secondary benefits to elk and other early seral associates, be allowed to continue?

Conclusion

What lies in the future? There is no crystal ball to predict climatic changes or political winds. What is certain is the link between an animal and the habitat it occupies. Elk are dependent upon quality habitat. In the Selway-Bitterroot Wilderness context, quality habitat is largely dependent upon the natural role of fire. Idaho is characterized by its quality-of-life environment. For better or worse this includes vast wilderness areas. Elk are widely recognized as a "quality" component of the wilderness setting. The appearance of a large, branch antlered bull in a remote wilderness meadow is "a symbol of wilderness" (Lyon and Thomas, 1987). Certainly it fits with the context of the Wilderness Act. The Selway-Bitterroot herd may be the "quality" elk herd in the United States, from a branch antlered bull perspective (Weaver, 1988). We believe this is a function of remnants of a quality habitat base coupled with relatively remote and inaccessible terrain; also characteristics of wilderness. The perpetuation of the wilderness elk habitat depends upon the perpetuation of the current wilderness fire policies. This in turn is dependent upon widespread public knowledge and acceptance of the policy. Education is the key to future public acceptance or rejection of any Forest Service policy.

Fire, especially uncontrolled fire in a wilderness setting, is an awesome phenomena capable of drastically altering the appearance of the land. It is also sound, economical wildlife habitat management. As educated human beings and land managers, we are on the threshold of putting away fear as a factor in the fire equation and going beyond into understanding. Not all aspects of the prescribed fire program are beneficial or enjoyable in the short term. We must remember, however, that fire policy, like wilderness itself, is a collective decision. In the same vein suppressing fire, restricting human access, building trails, and maintaining wilderness runways are all conscious manipulative decisions in wilderness management. Wilderness is a "managed" resource. It is clear that the "control" of fire is not at odds with the Wilderness Act when done in a manner which protects and maintains certain desirable characteristics which are defined as wilderness. The question which is relevant here to future policy development is: whether or not it is within the intent of the Wilderness Act to deliberately set fires to evoke certain vegetative characteristics that we understand to be reflective of historical circumstances. Vegetative characteristics which would in fact be likely to exist if man had not intervened to the contrary in times past. Logic and the science of wildlife management would indicate that this is the next reasonable step. If, on the other hand, the answer to this question is negative, then perhaps our other manipulative practices should be re-examined.

Literature Cited

Christensen, Alan G. 1986. Coming of Age With Fire. Bugle the quarterly journal of the Rocky Mtn. Elk Foundation, Troy, MT. Spring 1986

Keown, Larry D. 1978. Fire Management in the Selway-Bitterroot Wilderness. USDA Forest Service, Moose Cr. Ranger District, Nez Perce N.F. 1984 Revision 64 p.

Leege, Thomas A. and Hickey, William O. 1971. Sprouting of Northern Idaho Shrubs After Prescribed Burning. J. Wildl. Manage. 35: 3 508-515

Leege, Thomas A. 1979. Effects of Repeated Prescribed Burns on Northern Idaho Elk Browse. Northwest Science, Vol 53, No. 2 1979 pp 107-113

Lyon, L. Jack and Thomas Jack Ward. 1987. Elk: Rocky Mountain Majesty in Harmon Kallman, Chief Ed. Restoring Americas wildlife 1937-1987. USDI, Fish and Widlife Service. p. 145-159

Habeck, James R. 1973. Fire Ecology Investigations in Selway-Bitterroot Wilderness. Univ. of Montana - U.S. Forest Service Contract No. 26-2647 Pub. No. R1-72-001. 119 p.

Nordberg, Elmer R. 1967. Brush = Deer + Elk. Idaho Wildlife Vol. 20 No. 1 1967 pp. 12-15

Odum, Eugene P. 1971. Fundamentals of Ecology. W.B. Saunders Company, Philadelphia, PA. 574 p.

Saveland, James M. and Bunting, Stephen C. 1987. Fire Effects in Ponderosa Pine Forests. Paper presentation at Ponderosa Pine Symposium, Spokane, Wa. Sept. 29-Oct. 2, 1987 In Press

Thomas, Jack W. et. al. 1979. Wildlife Habitats in Managed Forests the Blue Mountains of Oregon and Washington. U.S. Dept. of Agriculture Forest Service Handbook No. 553, 512p.

Weaver, Stephen M. 1988. The Big Herds: Selway-Bitterroot. Bugle the quarterly journal of the Rocky Mtn. Elk Foundation, Troy, MT. Winter 1988 pp 10-16

Weaver, Stephen M. and Benscoter, Michael J. 1986. Summer Prescription Burning on Elk Winter Range - A Significant Change in Habitat Management Philosophy on National Forest Lands. Symposium preceedings prescribed fire in the intermountain range, Washington State University, Pullman, Wa.

Weaver, Stephen M. 1987. Fire and Elk. Bugle the quarterly journal of the Rocky Mtn. Elk Foundation, Troy, MT. Spring 1987

Questions from the Audience:

Q - Has repeated burning on northern slopes in the Selway-Bitterroot Wilderness areas impoverished the situation to the point where we have got a subclimax being maintained rather than going on into timber?

A - No, we have not. In fact, it takes everything we can do in the middle of August on adjacent nonwilderness lands to get those north faces to burn including using heli-torch & alumigel aerial ignition. It is very difficult for that country to burn north and east aspects.

Panel Discussion

"The Costs and Benefits of Elk Ranching"

Moderator: Jack Smith

Speakers: Doug Crowe, Wyoming Department of Game and Fish
Don Koch, California Fish and Game
Gerry Lynch, Department of Energy & Natural Resources, Alberta
Gary Bumgarner, Washington Representative

PRIVATIZATION OF WILDLIFE - AN OPINION

Douglas M. Crowe, Wyoming Game and Fish Department

Abstract

In America, wildlife belong to all the people. Powerful private interests are pressing for special privatization of wildlife could result. Court rulings as well as legislation has consistently endorsed the public trust doctrine. Abundance of game may depend on maintaining game in the wild and preventing private ownership.

Privatization of Wildlife

Wildlife resources in America are held in common by all the people. No one person is more endowed than any other with rights or privileges concerning their use. Because the wildlife belongs to all, public agencies are entrusted with the responsibility to manage this resource in our common interest.

These basic tenants of wildlife conservation and management are under attack. There are powerful private interests now pressing for special privileges not enjoyed by the common citizen. Further, these interests seek for themselves management prerogatives superseding those currently vested solely with public agencies. This movement to "privatize" wildlife has as its objective granting private commercial interests the right to determine hunting seasons and bag limits, designate the recipients of licenses, and to control access to public lands.

Privatization of wildlife is not a new idea. In medieval Europe the rights to take wildlife were generally restricted to privileged classes. The restrictions were designed to keep weapons out of peasant hands and to reward those loyal to royalty. Our founding fathers left Europe to escape oppression of this sort and created a government in America which reserved wildlife to the people. The issue of the ownership of wildlife has since been challenged and brought before the courts several times. In the case of Geer v. Connecticut 161 U.S. 519(1896) the Supreme Court ruled the state can "...control and regulate the common property of game ... as trust for the benefit of the people." Since this ruling the courts have held again and again that wildlife in America belongs to all the people. This "public trust doctrine" is the principal used to protect the majority from the concentrated influence of an active and vocal minority.

Learning to apply the public trust doctrine within a democracy has been a hard lesson. The early history of this country is punctuated with episodes of wildlife exploitation when wildlife was a marketable commodity. The beaver, the buffalo, the passenger pigeon and a great many others fell prey to commercialization. American conservation rose out of the carnage of this commercial exploitation and with it came the notion that wildlife was not salable and the enjoyments associated with wildlife were for everyone. Theodore Roosevelt perhaps said it best when he wrote, "Above all, we should realize that the effort toward this end is essentially a democratic movement. It is in our power...to preserve game...for...all lovers of nature, and to give reasonable opportunities for the exercise of the skill of the hunter, whether he is or is not a man of means."

Since Roosevelt's time, great strides have been made. We have taken a resource of tremendous value to the people, recovered it from a period of exploitation and learned

to share it equitably and democratically. In the American system of wildlife management there have been no noblemen or privileged classes and so conservation has worked and hunting and fishing remain a part of our heritage and lifestyle. Wildlife has therefore flourished on public and private land alike, in many cases rescued from the brink of extinction by the citizen sportsmen and conservationist.

In many respects it is the success of the conservation effort in America, that has brought us to this dilemma. History repeats itself, and today we once again enjoy an abundance of game. This abundance is the result of the efforts of three generations of citizen conservationists. And once again there are those of wealth and power who view this public heritage as a commercial commodity to be exploited and sold to the highest bidder; to take as their own that which is here as a result of the political support and financial contribution of the people. Unless we can maintain equity in the allocation of this resource and access to it, public support for wildlife conservation is doomed and we will witness the demise of wild, free-ranging game populations and the remarkable social involvement that supports them.

LEGISLATION OF BIG GAME FARMING IN ALBERTA

Gerry M. Lynch

Abstract

Big game farming has been licensed in Alberta since 1959, but substantial changes were made in 1987. Alberta now licenses 70 big game farms, two zoos, and wildifel training centers and five other commercial wildlife facilities. This paper identifieds allowable activities, conditions, licensing, animal identification, records requirements, species restriction, facilities standards and conditions for importing wildlife to Alberta.

Game Farming Legislation

Big game farming is not new to Alberta, but it has been licensed there since 1959 when the original Big Game Farm legislation was passed. In 1971 there was a major revision of the big game farming regulations and in 1987 a totally new regulatory framework became law.

Under the old legislation, game farmers could raise big game and exotic animals and sell them to anyone who was authorized to possess such animals and they could export the antlers of game farm animals. They could not sell the meat nor could they sell antlers to buyers in Alberta. Hunting of big game was not allowed on game farms and use of public land for game farming was prohibited.

Legislation prior to 1987 defined big game farming but it did not recognize zoos, educational institutions nor any other type of facility that kept wildlife in captivity. While under the old legislative format, there were seven licensed big game farms and two unlicensed major zoos. It is interesting to note that though game farmers could profit from live animal sales and antler exports, the animals and products of game farms were legally the property of the Alberta government. There was no private ownership of wildlife concept at that time.

During the early 1980's a decision was made in Alberta to draft new captive wildlife legislation. The Wildlife Act was being rewritten, hence a need to revise regulations pursuant to the new act. Secondly, high world prices for wildlife parts stimulated a great deal of interest in wildlife farming. In light of these high market prices for wildlife products, it was believed that existing captive wildlife legislation was possibly not adequate for the protection of free-ranging big game populations.

The new Wildlife Act was passed November 13, 1984. Legislation pursuant to the new act was drafted and the entire regulations package went into effect April 1, 1987. Under the new legislation to date, Alberta has licensed 70 big game farms and is in the process of licensing two zoos, a wildlife training center and five other commercial wildlife facilities.

This paper deals primarily with big game farming, so I shall not discuss zoos or other captive wildlife facilities. Table 1 compares allowable uses and requirements between the old Big Game Farm Regulation and the new captive wildlife regulations.

Now in Alberta, three pieces of legislation govern big game farming. They include the Wildlife Act, the Captive Wildlife Regulation, and the Captive Wildlife (Ministerial) Regulation. The Captive Wildlife (Ministerial) Regulation provides for the licensing of big game farms and establishes conditions of licensing. The Captive Wildlife Regulation defines allowable activities on big game farms. A few items are embedded in the Wildlife Act itself, including provision for private ownership of game farm animals, prohibition of hunting on big game farms and restriction of game farm animals, prohibition of hunting on big game farms and restriction of game farms to private land and Metis settlements.

Table 1. Comparison of allowable uses and requirements of big game farms under the old *Big Game Farm Regulation versus the new captive* wildlife regulations.

ACTIVITY		OLD	NEW
Allowable Uses:			
1.	Live animal sales	yes	yes
2.	Antler sales (Alberta)	no	yes
3.	Antler sales (Export)	yes	yes
4.	Meat sales	no	no
5.	Hunting	no	no*
6.	Use of public land	no	no*
Requirements:			
1.	Licensing requirements	yes	yes
2.	Species restrictions	no	yes
3.	Animal registration	no	yes
4.	Licensing of product buyers	no	yes
5.	Monthly reporting	no	yes
6.	Annual inventory report	yes	yes
7.	Animal marking requirement	no	yes
8.	Facilities standards	yes	yes
9.	Import restrictions	yes	yes
10.	Land base requirments (acres)	160	60

*These conditions are embedded in the Wildlife Act.

Allowable Activities

Let us consider the allowable activities on big game farms in Alberta. Any person or corporation which has a big game farm permit may raise and sell live big game animals to anyone else who is authorized to possess such animals. They may sell specified products, such as antlers, to licensed product buyers in Alberta or they may export them. Big game farmers may not sell the meat of farm raised big game, may not allow hunting on their big game farm, nor may they use publically owned land for the purpose of game farming.

Conditions

In Alberta, the Fish and Wildlife Division has the mandate for the conservation and protection of wildlife. Therefore, the Division administers laws that place conditions on game farming for the protection of wildlife from any potential damaging effects of the industry. We believe that good legislation and enforcement are keys to effective protection of the wildlife resource.

Licensing

A big game farm permit may be issued to an adult resident, a body incorporated, registered or continued under the Business Corporation Act or Societies Act. An applicant for a big game farm permit must submit a development plan for approval of the Regional Director. The plan must identify the species to be raised and the product types to be sold. Included with the plan must be proof of private ownership of a minimum of 60 acres of contiguous land, part of which must adjoin the permit premises. Public land located on a Metis Settlement is also eligible for licensing as a big game farm. Once the development plan is approved, the applicant may construct his facility according to the plan. To be approved, the plan must include construction of a handling facility and initial fencing of at least ten acres. After the facility is built, the applicant contacts the appropriate Fish and Wildlife office to request an inspection. The officer examines the facility to ensure that it has been built according to the approved plan. If everything is in order the officer submits a letter of approval to his regional office, the applicant pays the $100.00 annual permit fee and the big game farm permit is issued from the Fish and Wildlife main office.

Animal Identification

Identification of individual animals on a big game farm is essential to ensuring that illegally obtained animals do not become part of a big game farm inventory. Every animal on a game farm must be registered and marked with its registration designation. Registration designations are three-part, consisting of a registration prefix, a serial number and year code, as follows: TKIK012X.

> In this example the prefix (TKIK) is a unique designation assigned by the Division thatidentifies the game farm. The letter "T" portion of the prefix is the postal code assignment for Alberta. A three-digit serial number is next, followed by the year designation (X = 1988). When an animal is born on a farm or is imported, the farmer must immediately assign a registration designation. When animals are sold, the registration stays with the animal. The animal is not re-registered by the new owner. Every animal must be marked with its registration designation, either by tattoo or by use of a metal ear tag in each ear.

Records Requirements

Certain records must be kept by game farmers and submitted to the Division. A monthly log is kept which lists any transactions involving an animal, including animal and antler sales or purchases. The record must include the identification of the animal, the buyer, and the seller. An entry is made in the monthly log on the day the transaction occurs. Game farmers are required to submit monthly records to

Year———1988-89
Contact —VROLYK, JEFF
Farm Name—ELK MEADOWS RANCH
Address——R.R. #2
MILLET, AB. T0C 1Z0
Phone———403/387-5139 -Species-
Prefix———TJEFF ELK
District—LEDUC
Region——NE
Permit——0124GP

C=Carryover
B=Born Year Codes
P=Purchased in AB W=1987 D=1994
I=Imported X=1988 E=1995
D=Died Y=1989 F=1996
S=Sold Z=1990 G=1997
E=Exported A=1991 H=1998
A=Antler, Dry B=1992 J=1999
V=Antler, Velvet C=1993 K=2000

CONTINUOUS INVENTORY OF BIG GAME FARM ANIMALS AND PRODUCTS

INVENTORY SUMMARY

Elk			Moose			W.T.Deer			M. Deer			Other		
M	F	T	M	F	T	M	F	T	M	F	T	M	F	
3	17	20	0	0	0	0	0	0	0	0	0	0	0	

TRANSACTION SUMMARY

C	B	P	I	D	S	E	A	V
3	5	13	0	1	0	0	0	0

Current Count—— 20
Inventory Count—— 20
Transaction Count- 22

DATE			ANIMAL IDENTIFICATION			TRANSACTION									Mother/ Export- Imp.No.	Product Weight kg	BUYER/SELLER IDENTIFICATION		CURRENT INVENTORY		
Yr.Mo.	Day		Species	Sex	Regis.No.	C	B	P	I	D	S	E	A	V			Name	Permit No.	Species	Sex	Regis.No.
88	03	01	ELK	F	TJEF001W	C													ELK	F	TJEF001W
88	03	01	ELK	M	TJEF002W	C													ELK	M	TJEF002W
88	03	01	ELK	M	TKIK001X	C															
DATE OF LAST REPORT WAS FEB. 29,1988																					
88	03	08	ELK	M	TKIK001X					D											
88	03	03	ELK	F	TBEG003W			P									BECKER, RAYMOND		ELK	F	TBEG003W
88	03	03	ELK	F	TBEG005W			P									SAME		ELK	F	TBEG005W
88	03	03	ELK	F	TBEG006W			P									SAME		ELK	F	TBEG006W
88	03	03	ELK	F	TBEG007W			P									SAME		ELK	F	TBEG007W
88	03	03	ELK	F	TBEG010W			P									SAME		ELK	F	TBEG010W
88	03	03	ELK	F	TBEG011W			P									SAME		ELK	F	TBEG011W
88	03	03	ELK	F	TNOR045W			P									SAME		ELK	F	TNOR045W
88	03	03	ELK	F	TNOR038W			P									SAME		ELK	F	TNOR038W
88	03	03	ELK	F	TNOR005W			P									SAME		ELK	F	TNOR005W
88	03	03	ELK	F	TNOR007W			P									SAME		ELK	F	TNOR007W
88	03	03	ELK	F	TNOR012W			P									SAME		ELK	F	TNOR012W
88	03	03	ELK	F	TNOR008W			P									SAME		ELK	F	TNOR008W
88	03	21	ELK	M	TKIK034X			P									KIKIND WILDLIFE RANCHING ASSOC.		ELK	M	TKIK034X
DATE OF LAST REPORT WAS MARCH 31,1988																					
DATE OF LAST REPORT WAS APRIL 30,1988																					
88	05	21	ELK	F	TJEF003X		B								TBEG010W				ELK	F	TJEF003X
88	05	27	ELK	F	TJEF004X		B								TBEG007W				ELK	F	TJEF004X
88	05	27	ELK	M	TJEF007X		B								TBEG003W				ELK	M	TJEF007X
88	05	28	ELK	F	TJEF005X		B								TBEG005W				ELK	F	TJEF005X
88	05	29	ELK	F	TJEF006X		B								TBEG006W				ELK	F	TJEF006X
DATE OF LAST REPORT WAS MAY 31,1988																					

FIGURE 1. An example of a personal farm printout.

the appropriate Fish and Wildlife Division office by the fifth of the following month.

In March of each year, game farmers are required to submit an inventory of their stock. The inventory must agree with the compilation of the previous 12 monthly reports.

When the monthly reports are received at Fish and Wildlife headquarters, they are filed in a computer and certain tests are applied to the information. They are checked for completeness. If anything is missing, such as a registration or sex designation, the game farmer is contacted for the correction. The monthly reports are keyed into the farm's personal computer file. During filing the computer automatically updates and maintains a running inventory of the farm. The running inventory is the one that must match the annual inventory at the end of the fiscal year. Also, the computer automatically records each transaction in a main sort file.

If an officer suspects illegal activities on a big game farm he may request a copy of the farm's computer file. The hard copy lists every transaction since the beginning of the fiscal year and shows the running inventory. Any deviations from the printout must be justified by an entry in the current monthly log on the farm. Figure 1 is an example of a personal file print-out showing the list of transactions to date and the farm's running inventory.

Other resources can be generated from the individual game farm files. The main sort file mentioned above includes every transaction of every game farm animal in Alberta. All animals are sorted by species and registration number such that the entire history of an individual animal can be followed from the time it is born until it dies. Figure 2 is an example from the main sort file.

Another feature of the system is that it can generate an updated list of licensed game farmers, including their address, phone number, registration prefix, species on their farm and the Fish and Wildlife administrative district in which they are located. This file can also be used to print a list of selected big game farms.

Figure 2. Example from the Main Sort File, showing the history of an elk registered TALL213X. The animal was a carryover on the farm with the registrations prefix TALL. On March 6, 1988 it was sold by TALL to TFER. Finally, on May 15, 1988 it sold by TFER to TRIC.

Species	Registration	Sex	Yr	Mo	Day	I.D.	Trans
Elk	TALL213X	F	88	03	01	TALL	C
Elk	TALL213X	F	88	03	06	TALL	S
Elk	TALL213X	F	88	03	06	TFER	P
Elk	TALL213X	F	88	05	15	TFER	S
Elk	TALL213X	F	88	05	15	TRIC	P

Another program in the system compiles a list of animals that are on individual big game farms. The program lists each big game farm, the numbers of animals by species and sex on the farm and the provincial totals for each species. Figure 3 is a flow chart that shows the units comprising the computerized records system.

Species Restrictions

Big game farmers in Alberta may only keep big game species that are native to Alberta. The purpose of the species restriction is to ensure that exotic animals do not escape from big game farms and potentially establish free-ranging feral herds or interbreed with native species. All male elk presently on game farms and all elk that are imported must be parentage tested to ensure that elk-red deer hybrids do not become established on game farms in Alberta.

Facilities Standards

Facilities standards are not detailed in Alberta legislation. Big game farmers are offered a great deal of discretion in the design of their facility. The province does, however, insist that at least ten acres are fenced initially and that the perimeter fence is at least two meter high paigewire. As a further condition of licensing, the applicant for a big game farm permit must construct a handling facility capable of presenting the animals for inspection by a veterinarian or Fish and Wildlife Division staff.

Conditions of Import

Import conditions are in place in Alberta to help ensure that diseased animals and elk-red deer hybrids are prevented from entering the province. When animals are imported from another country they must be tested for tuberculosis, brucellosis, anaplasmosis and blue tongue (includes E.H.D.). The tests must be conducted according to standards enforced by Agriculture Canada.

When animals enter Alberta from another province of Canada, they must have tested negative for tuberculosis and brucellosis within 60 days prior to import. In addition, animals originating from British Columbia must test negative for blue tongue (including E.H.D.). No mule deer may be imported into Alberta because they could harbour the parasite Elaephora schneideri. White-tailed deer are prohibited because they could be carriers of meningeal worm. Elk may not be imported if they originate from areas of the United States or Canada where meningeal worm is prevalent. Any elk that enter Alberta from non-effected areas have to be quarantined and tested for the presence of meningeal worm larvae. One negative fecal test is required (two, 60 days apart, if the animal had been treated with Ivormectin within the previous six weeks). Proof of origin signed by an accredited and/or state or federal veterinarian is required when elk are imported.

The Alberta Fish and Wildlife Division requires that all imported elk pass a parentage test. The purpose of the test is to ensure that red deer or elk-red deer hybrids do not enter the province where they could compromise the genetic integrity of free-ranging elk should an escape occur.

Import and export permits must be obtained when animals enter or leave Alberta, respectively. No game farm animal or product may enter Alberta unless an import

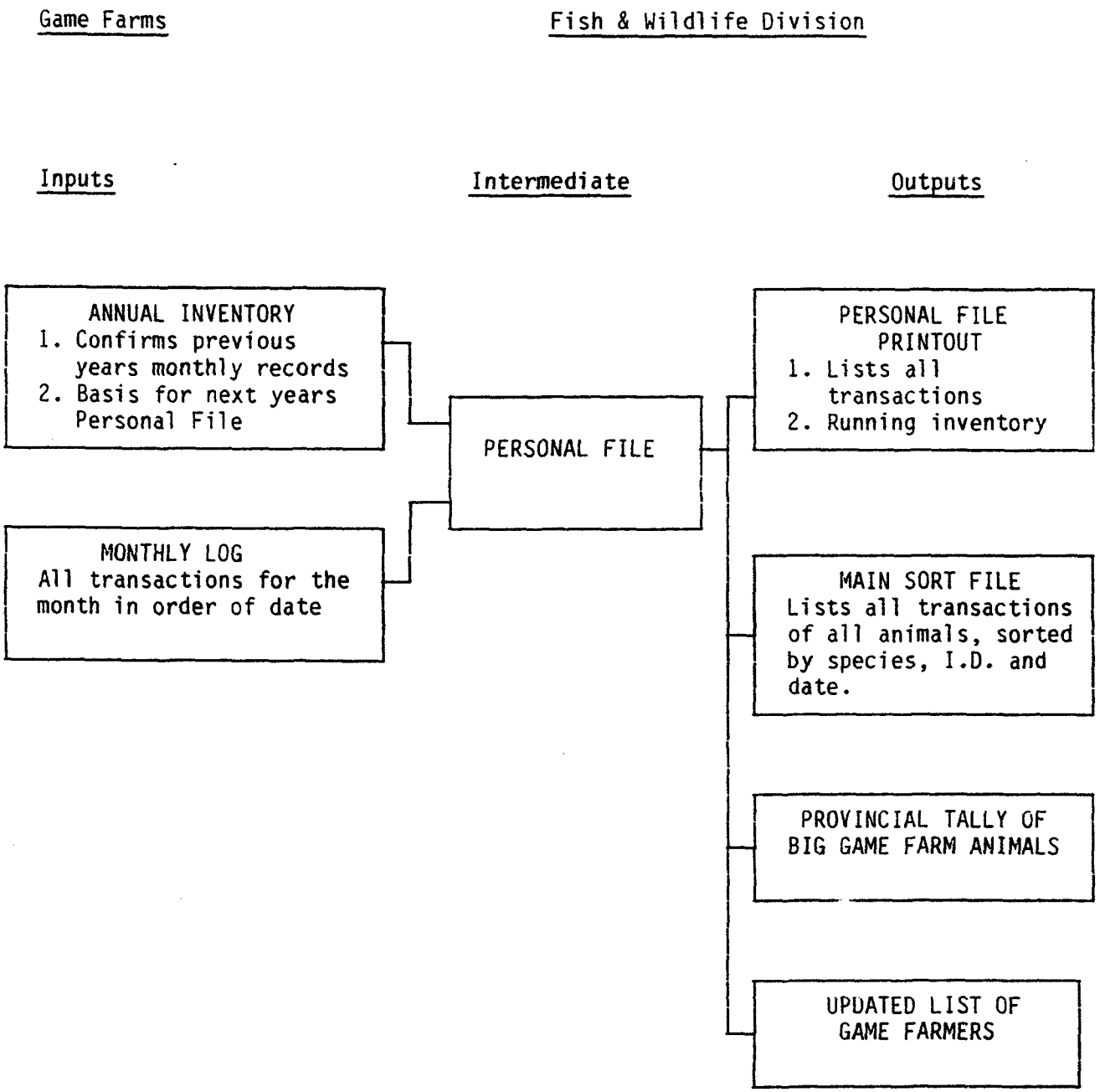

Figure 3. Flow chart showing the units that comprise the computerized records system.

permit has been first obtained. Likewise, an export permit is required when animals or products leave the province.

A LEGISLATIVE VIEW OF THE WILDLIFE RESOURCE

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Abstract

The people of the state do not own all wildlife resources. Landowners can regulate access to wildlife through exclusive leases or access fees. The only long term solution to loss of wildlife habitat is economic incentives to the private landowner. Managed private lands generally have better deer and elk populations than adjacent public lands. A landowner should be able to buy and sell native wildlife just like exotics. Several features are identified as necessary for a progressive wildlife plan.

Management of Wildlife

Legislative resource policy makers are charged today with evaluation of wildlife resources as they affect the economy of their states and of the nation. The management of timber, water, and mineral resources generates significant controversy, but perhaps no resource is more emotionally charged than fish and wildlife.

Throughout the United States fish and wildlife resources are managed unlike any other resource. Only this single resource which is argued to belong to all the people, has presence on private lands only when the landholder manages the land to provide for it, and is only harvested with the consent of the landholder, by a segment of the population selected by the landholder, usually at significantly less than its true market value. These facts shoot holes in theories that the people or the state owns all the resource.

Paradoxically wildlife in the U.S. is theoretically managed under a strict socialistic doctrine, while in socialist countries of the world, management is based on supply and demand economic value basis. We need to argue the merits of each, and recognize that current theory is not workable fact.

Historically, our wildlife policies were created in a time when it seemed that endless supplies of wildlife and habitat existed. The extinction or near extinction of many species had already occurred within slightly more than a century of existence of our nation, in fact by about the time the west achieved statehood. Since then, gradual land use changes have reduced the habitat and altered the migration opportunities of most species. Man had proven his ability to eradicate by hunting or habitat destruction nearly every species. A problem is that pressure destroys habitat. Some of these pressures are: wildlife is a negative factor to business; hunters are a negative factor to business: single use land management depresses wildlife; economics forces "efficiency;" economics may require sub-division: and bankruptcy forces sale and often sub-division. Evidence shows that we will likely continue this destructive pace as our socio-economic evolution takes place. Landowner income has higher value than the wildlife benefit on private land. Unfortunately, those who economically benefit the most from the resource today are the public wildlife managers. Hundreds of millions of resource dollars are spent on the homes, food, clothes, education, healthcare, travel, entertainment, and retirement of wildlife professionals. Yet

when a rancher suggests that he would like to make the same standard of living from the same resource on his land, he is often scorned and hated by those who manage or harvest the resource.

Adamantly resisting "privatization of wildlife" the vocal minority watches as alternative land uses destroy the habitat and populations of the wildlife they value so highly. What affects game on private lands? The type of private organization, its knowledge, its administrative ability, and its motivation. As the private habitat base shrinks, a segment of the resource users, the more affluent hunters, quietly leases the last remaining habitat and hunting privileges for themselves.

The opponents of landowner compensation are learning that the proponents have proceeded to monopolize private land access through exclusive leases. The landowner has the exclusive right to hunt game on his land, subject to hunting regulations. This right may be leased to another. The consequences of the non-paying versus the paying competitive hunter groups working against each other, appear to be elimination or reduction of the non-paying hunter on private land. We have to recognize that the ONLY long-term solution to many wildlife problems is economic incentive to landowners. As the opponents of fee hunting or leasing stop buying hunting licenses, the revenues available to support the public wildlife programs will disappear and many remaining programs will crash for lack of funding. Only small islands of exclusive private fee hunting will likely remain. Fee hunting has existed without enabling law in every part of the country.

So after two hundred years of human expansion in the United States we find that conditions are evolving to resemble those in Europe. Doesn't it make sense that an increasing human population and the need for economic development would cause history to repeat itself?

Legislators who are sensitive to the economic values of wildlife as well as those values related to our quality of life with nature, have sat idly by for too long. Why should we stack up surpluses of wheat on the ground and sell cattle below production costs? At the same time, lacking wildlife resources in our own states, our residents will pay premium dollars and travel long distances to view wildlife or hunt trophy quality animals elsewhere. How can we change the imbalance? Consider the political factors in private land wildlife management: The agency, legislators, hunters, protectionists, and trade associations. Agencies and hunters claim that hunting is valuable to the economy of the state. But what are the economic factors in the industry? It is true that hunting creates a redistribution of dollars within each state, but unless visitors come from outside the state and spend their money on wildlife related activities within the state, there is no actual revenue benefiting the state. To the contrary, if many hunters leave their home state to spend their money elsewhere to have a better experience or a better trophy, there can be a significant net loss to their home state economy. Consider also that hunters buy many products related to hunting that are manufactured outside their home state. Vehicles, guns, camping equipment, cameras, binoculars, motor fuels, and air fare are some of these. Therefore, from the economist, resource manager, legislator's viewpoint, it is imperative that the purchasing interests of the sportsmen, whether related to his willingness to spend his money on hunting or on his equipment, be met as much as possible within the state's boundaries. Moreover,

it is the responsible legislator's duty to enhance the attractiveness of the resource to bring visitor dollars into the state. Non-resident dollars will truly benefit the economy and thereby all of the state's residents, not just a minority of local hunters.

Privately managed lands have the ability to respond quickly to economic incentives if landowners are released from restricting laws and assisted, rather than hindered by wildlife professionals. Unfortunately, some biologists don't understand the importance of avoiding red tape. Field and Stream magazine, June 1988, has an excellent article on this subject. Without economic return, why should a landholder promote habitat for wildlife or even allow hunting? Landholder trade associations, whether ranching, farming, or timber, must recognize potential benefits and their political position is important.

Why do owners close land? Vandalism, liability, desire for solitude, and to exercise their proprietary rights are sufficient reasons.

What is unique about hunting on private land and why must we preserve it? There is an improved chance of seeing wildlife of all kinds. Managed private lands generally have better elk and deer populations than adjacent public lands, if for no other reason that less congested access. There is expectation of an experience designed for the comfort and exclusive access of the client with emphasis on congenial company or guide. The value of solitude and freedom from intense competition or conflict. Scouting in advance is not needed. The client has an opportunity to arrange the conditions of the hunt so that his expectations of the experience may be better satisfied. The provider of the service may accommodate the experience for specific physical limitations. Guesswork and disappointment are minimalized. The hunter can contract for a known quality of experience initially, and on repeated occasions.

So explain to a concerned natural resources legislator why a hunter must unnecessarily leave his home state to be able to access game that could be made available in his own state with private cooperation? This is of a special concern when agency fees seem increasingly inadequate to support their programs. What is the value of trophy elk resource opportunities that can't be accessed at any price back home, while agency fees are simultaneously insufficient to support a landowner compensation program? We have handicapped our wildlife resource production capabilities with outdated, philosophical, illogical laws. Kramer in 1982, and Steinbach and Ramsey in 1988 held that the state does not own game, but does regulate taking, use, and acquisition of ownership. With game freely able to cross state borders this seems a reasonable statement. Explain why a landholder who would like to purchase wildlife broodstock at his own expense to develop the resource, is prevented from doing so? No one really owns free ranging wildlife, but what about captive bred wildlife suitable for stocking programs? Explain why it is perfectly alright to put on the land great populations of cattle and sheep, but regardless of experience and intentions, it is not permissible to propagate the indigenous elk? Explain why a landholder can raise bison but not mule deer or pronghorn? Or Cervus nippon, but not Cervus elaphus??

We have seen poaching for antler velvet nearly eliminated by the private production of antler velvet. We have seen quality venison sources from captive game herds, including elk, begin to satisfy the needs of the world's venison

markets. Free ranging game has benefitted from commercial market saturation from captive resources. Explain any logical resistance to this? Explain why timber companies should not be able to manage their tree farms for wildlife profits in order to subsidize timber production costs and become competitive in both areas internationally? Explain why we should not act quickly to make valuable game lands from Conservation Reserve Program (CRP) lands? CRP is the best open window of opportunity in years. It may close again before we capitalize on the opportunity. Let's have a mature, successful way to solve problems: First Accept Facts. The challenge before us is to design the laws to maximize the wildlife resource by actively encouraging the participation of the public. Recognize that uncontrolled fee hunting generates habitat improvements. Landholders and the land base will develop and enhance the resource as long as there is value to the product: wildlife. Controlled fee hunting can generate much more in habitat improvements. There will be value and incentive as long as the demand exceeds the supply and the supply can be accessed at market value. Abundance will reduce the value. Fifty-eight years ago Leopold said it straight out. "The management of private land is the key to wildlife abundance in the United States." Our task is to achieve abundance. But is it necessary to abandon the cherished right of our citizens, to have equal opportunity to hunt at little cost? No! Let's look at hunter objections to the California Ranching for Wildlife Program. In spite of many successes of the California program, hunter objections still persist. They are basically the same as they first were at the start of the program: Fee hunting is for only a privileged few. Game will be destroyed. Hunting will become a rich man's sport. The rich will get all the trophies. Similar hunts are not provided for free to the public. Lands open for fee hunting would be free to the public otherwise.

If there is no free access, it means the program has no public benefit. The program is a public subsidy to private landowners. These arguments show little understanding of the reasons for loss of habitat, closed land or exclusive leasing. Nonetheless, legislators are responsible for setting policy on issues with the greatest controversy. It was well stated years ago. We must grant incentives for the landowner on the condition that he preserves game and safeguards the public interest. This was the statement of the American game policy by the Select Committee of the American Game Association, Aldo Leopold, Chairman. By proper planning the legislature, with the assistance of wildlife professionals, can design new laws that coordinate and utilize the voluntary financial support of those who would lease the land, or spend their hunting dollars elsewhere, to fund a far reaching landowner wildlife and habitat compensation plan that fairly includes the less affluent hunters or fishermen as partners. We can legislate new programs that will provide benefits to wildlife, opportunities of all values to the hunters, the landholder, and the state. Everyone may have to compromise something so that collectively all may gain.

More habitat and more wildlife are attainable but we must now be willing to make innovative changes for the needs of the future and not hopelessly be tied to the traditions of the past. As Leopold said, "We are in danger of pounding the table about new ideas, instead of going out on the land and giving them a trial." New and exciting management opportunities lie ahead for wildlife professionals and landholders to develop entirely new populations of wildlife for the enjoyment of all the public. The California "Ranching for Wildlife" Program has answered part of the problems, but it is still deficient. Those deficiencies can be corrected, and must be, to gain broader public acceptance. Regulation that overly

complicates management or fails to allow sufficient profit on private land will prevent wildlife benefits on public land. Migratory habitat corridors and dispersion depend on private land routes.

Recommend Features of Future Wildlife Management Plans

1. High value, high quality hunting, fishing, and wildlife viewing experiences must be accessible to the general public as well as those who can more easily afford to pay. But those who can afford to pay must receive some extra benefits for doing so. An equitable distribution of private land controlled hunt permits could be shared between the general public and those who are willing to pay the landholder for the expansion of the resource and access.

2. Landholders who are compensated for the wildlife taken from their lands should have a habitat management plan approved by the wildlife agency as a requirement to collect their compensation.

3. Participating landholders would not be able to lease exclusive hunting or fishing rights when participating in the plan to collect compensation from the funds.

4. Participating landholders should only charge for optional extra services, such as guides, lodging and camping.

5. Landholders should have the right to acquire high quality wildlife broodstock from which to stock their lands, and be able to sell their own propagated captive broodstock to other landholders. Releases of animals or fish however, should only be allowed with state agency approval.

6. Tribes should be supplied with broodstock and management assistance in return for renegotiating off reservation hunting activities. A great potential in tribal wildlife management is waiting for leadership.

7. The program needs to be adaptable to assure private land access for trophy hunting, antlerless hunting, bird hunting, upland game, and fish.

8. Access to those permits provided for the more affluent hunters must reflect the true value of the permit based on the hunters own estimation of its worth.

By initiating such a program, gradually at first, the needs of all participants can eventually be met. To be a success the fundamental features must be based upon economically proven free market principles. If properly defined, the traditional opportunities of the average man to access quality game under quality conditions can be regained and preserved. The mechanism can be simple, providing supply and demand flexibility, automatically adjusting for quality, and can be employed under full control of the agency exactly when, where, and how it needs to be. But even though we recognize that it is the sportsman who can and will pay the bill, we must not exclude the majority of our citizens who take great pleasure in the presence of wildlife. Wildlife that does not flee in terror at the sight of man. The contribution to the resources of the non-consumptive user on private lands has yet to be realized.

The very laws we create to protect indigenous wildlife from man are now preventing us from doing for those species what we could and should be doing. The only alternative for compensation for wildlife management we have left to landholders is to apply their enthusiasm, their interest, energy, and their funds on exotic species. Are we ready to listen to Leopold yet? Do we want elk or do we want Black Angus?

Questions from the Audience:

Q - Is there a ground swell - or uprising - to reverse some of the private lands program in California?

A - (Don Koch) I guess that is a relative term. There has been a lot of misunderstanding about the program and it turned into a partisan issue in our state. But most of it is total misinformation like I presented earlier. We don't have any public lands that are being land locked. There are no areas that are now closed to the public that was previously open without the program. I think the auditor general's report spells things out pretty clearly. The Department of Fish and Game has been negligent in their intents to provide accurate and concise information to the public. What we see happening now is a rapid increase in the programs. We don't think the programs are going to be killed. If we get through with our Tule elk hunts this year, we anticipate having numerous ranches enter the Tule program in next few years.

Q - Have any of your county supervisors passed resolutions or something regarding the private lands program?

A - (Don Koch) Yes, I don't deal with the program closely enough to know exactly which counties are involved. For those of you who don't know, essentially deer management was taken out of the hands of the department after the 1956 doe hunt. The county supervisors can veto any special hunt (i.e., antlerless hunts). In the private lands program, the county supervisors have no veto authority. The legislature is the only body that can kill the programs, and they have indicated their support.

Q - What are the average costs charged to the hunter by the landowner?

A - (Don Koch) Depending upon services that are offered - you can go and shoot an antlerless deer for $25. The highest fee that I know of is around $3,000 for a buck. But, that also includes gourmet cooking - the only thing you do is pull the trigger.

Q - Is there a minimum acreage for your program?

A - (Don Koch) Yes, the minimum is 5,000 acres. It does not have to be simply on one ranch - it can be a combination of ranches.

Q - Is there a monitoring of disease/parasite situations on game farms other than your importation checks?

A - (Gerry Lynch) There is no organized system to monitor disease on game farms once the animals have been imported. Our Department of Agriculture does have quite a disease testing program, and

offers assistance to the agricultural sector, including game farms.

Q - Do you determine the number of tags based on capacity of the site or the herd?

A - (Len Carpenter) We have deer herd plans for all of our deer herds in the state. They have target objectives - buck:doe ratios and number of tags is based on those plans - per site.

Q - Shouldn't the tax dollars produced by the revenues that are turned over from hunting in the state be recognized as a revenue to the state?

A - (Len Carpenter) No, it is a tax revenue into the state government but it is not a revenue benefit to the entire state. It is dollars within the state, you refer to, are the ones we keep here - relative to the outflow of state borders.

Q - Do you can what you have in Alberta, a game or antler farm?

A - (Gerry Lynch) The Alberta government has come up with its own definition of ranching versus farming and the definition of ranching is the sale of meat. We have game farms and that does not include the sale of meat. Most of the game farms in Alberta (70 in Alberta) are raising animals to sell livestock to other game farms. At some point that is going to come to an end because everybody is going to have their stock built up and the price of livestock is going to start dropping. The government is considering changing the legislation to allow the sale of meat from game farms but it has been an issue. The public has expressed some views on that and because it is controversial at this point, the government has not made a decision to allow the sale of meat from game farms. Farmers who wish to cull animals at this point can export the animals to provinces of Saskatchewan, Ontario and get rid of cull animals that way. But right now, they're making money selling livestock. Elk are going for $5,000 a head for cows, and calves go for $2,500 to $3,000. Some of them are selling antler velvet, but that is a minor component of their operation.

Q - Have you had the opportunity yet, in the Colorado program, to assess the attitude of the general sportsmen of Colorado?

A - (Len Carpenter) Somewhat. In the last year or so there have been a few situations where there has been some opposition raised to the program. It was very much as indicated a minute ago about California. Much of it was based on the wrong information and just the idea that sportsmen were losing opportunities. That we were putting too much effort into the large landowner to the sportsmen's detriment. We had the opportunity to explain the program to them in public meetings and discussions and I think in

most cases those concerns were alleviated. That has been the only concern that I am aware of at this point.

Q - (to Representative Bumgarner) As a state legislator, how do you benefit your constituency by promoting programs that will benefit landowners in other parts of the state and may decrease the hunting opportunity of the voters in your district?

A - (Representative Bumgarner) That's a complex question - First of all, anyone that comes in from out of state, and I would prefer they come into my district, if they can, because when they spend that money with a business man or rancher that money will also go into local grocery stores, and to a carpenter to build his home and tax system, locally as well as statewide. The licensing that we would provide for him, particularly if he is a nonresident, would generate revenue for the management of the wildlife and more habitat programs. I think that any program we can put together that gives us some new animals that we didn't have before and new hunting opportunities, we would see that the money that comes in off those are earmarked for new habitat programs that benefit the average hunter.

Q - What can we do in Washington so we don't end up with the exclusive system in Europe?

A - (Representative Bumgarner) Right now on private lands where the timber companies are being generous enough to allow open hunting to the public that could change at any time. The other private owners are disappearing and if it's not leased it's only the local doctors or lawyers, or brothers-in-law who get on the land. We have to try to provide those incentives or compensation back to the private landowners. He should be compensated only if he has a habitat plan in place and if he is willing to allow open hunting. There are some ways you can do that.

In Europe we have the argument that the public can't get on the lands and it has to be expensive to hunt, and that the only way you can get on private land is to pay. If we are going to preserve our opportunities for the average hunter, without having to pay, we have to design formulas to accommodate the four major groups of hunters out there. We have the guy that hunts now and feels what he pays for his license is his total contribution to wildlife management. We should give those payments to the department for all privileges of hunting. Then you have the fellow who is willing to pay more for his lease, those two are in competition with each other. This hunter is quiet because he bought a lease and he knows right where he is going next Saturday. The third type of hunter is the fellow who quietly packs his pickup and heads for the state of Wyoming. Then you have the fourth guy who contributed money to the fund raisers like Elk Foundation, or Safari Club. If we could channel all four of these people's funding capabilities into a program managed by the state. If this program guarantees open access and

permits to hunt on those lands, we would solve the whole problem. It means the state has to get into a form of leasing business of its own.

Q - Are you saying European hunting is for the wealthy?

A - (Representative Bumgarner) I think that is pretty generally accepted.

Q - For all state or provincial representatives, whether or not their programs are paying the administrative costs of putting together the plans - how are those programs monitored to make sure the system stays legal?

A - (Len Carpenter) That is one of the basic questions that we have in terms of making recommendations to continue the program. You are right there is a certain administrative effort and as you get more and more ranches involved it gets more and more complex with a different number of species, administrative costs go up. It does take time and it takes dollars to do. That will be something we will try to do, much like Don Koch mentioned for California of trying to track the time that is being spent. Part of our evaluation will be, how much time does it take to administer the ranches that we have. Then the other side is the cost benefits side; how do we judge benefits. I mentioned earlier that is very difficult. It is very difficult to put any kind of benefits in terms of dollars. We have to talk about some of these other things - the goodwill, the decreased damage payments, etc. There is an attempt being made in Colorado to judge those. As far as the monitoring, that is something we have as ongoing. It falls into the realm of the local game biologists or district wildlife managers to do and it is not as formal as the program that Don mentioned in his presentation. There is an attempt to be sure that the landowner is meeting the obligations of the cooperative agreement that we have.

Q - In areas that have the game ranching, you are trying to get more animals for the landowners to have on their property, and they are manipulating habitat; how are you controlling the game damage to other area residents in and around those ranches? Or are you even looking at that? Because the animals are wild and they are not fenced like they are in Alberta, they have to be going some place.

A - (Len Carpenter) I can address it. That was one of the concerns we had when the program was started in Colorado. As I mentioned before, we do have a fairly extensive game damage requirement in Colorado and that was a concern that was voiced early. If one neighbor is involved and the other then is depredated upon, who pays those bills? That was one of the reasons for the large acreage. To this point we have had almost no problem. All of the cooperative agreements that we have with the individual landowner say the landowner involved in that cooperative

agreement will not claim any damages during the existence of that contract. The landowner that is involved cannot claim damage and we hope with the larger acreage we do not create some problems next door. However, that can happen and that is one of the concerns that will be voiced more and more as we make the evaluation.