proceedings

WESTERN STATES ELK WORKSHOP

Bozeman, Montana - February 20-21, 1973

PROCEEDINGS

of the

Biennial Conference

of the

WESTERN STATES ELK WORKSHOP

in association with the

WESTERN ASSOCIATION OF STATE GAME AND FISH COMMISSIONERS

Bozeman, Montana
February 20-21, 1973

Co-Chairmen

Eugene O. Allen
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FORWARD

This "Proceedings" is the result of an attempt to present in writing the informal presentations given during two days of discussion at the 1973 Elk Workshop. Presentations were recorded, excerpted from tape, and edited. Because visual aids were used with most presentations, editing was difficult and only partially successful at putting presentations into "readable" form - please bear this in mind when you read them.

These proceedings represent a great deal of time and effort on the part of many people - we hope you find them useful.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

WELCOME AND OPENING REMARKS

By
Dr. Les Pengelly[1]

You are going to get a lot of technical information about elk today, and in my introductory remarks I would like to raise some questions of a general nature that may be of interest to you. Elk are the number one game species of Montana and in many other states. Elk are a fine game animal, a good meat animal, and the trophy aspects are pretty obvious. The people of Montana have treasured them for a long time, as they have in other states. We are now trying to figure out where we are going in elk management and why there is public opposition -- I will mention some of the problems occurring in other states, but good information on elk management is very difficult to come by.

Seton estimated that historically there were probably 10 million elk in 42 of the 48 states. Elk have now been reduced to 16 states with a current population estimate somewhere around 1/2 million. This looks like quite a reduction but it was even lower about 1910 when they were reduced considerably lower than that - approximately 50,000 in the United States.

Currently we have more than 50,000 elk in several of the western states, resulting from management efforts. We have been riding on our laurels for the past 10 years pointing out what a great job we have done but suddenly we seem to be in trouble again. I would like to discuss what some of the problems are. The big elk producing states are Montana, Idaho, Wyoming, Colorado, Washington, Oregon and of course the Province of Alberta in Canada. We have elk in many other states but they are not the major game species. Elk are large colonial animals requiring a lot of territory. Their winter ranges are being invaded by loggers, sub-dividers and dam builders. There are all sorts of pressures aimed at elk ranges and we are finding it difficult to compete with the people who are trying to buy these lands away from us. We must take a new look at elk management and we had better start soon.

Recently in Idaho and Montana there have been legislative pressures affecting elk management. The Idaho legislature put a limit on the number of non-resident permits to be sold. The Montana legislature had a bill introduced to raise the non-resident fee to $500.00. It shows you how friendly we are to non-residents (i.e. anybody that was not here when Lewis and Clark trudged through); and so we have tremendous legislative pressure building up in the various states and it is being aimed first at the non-residents. We want their money but we do not want them. I think you can see what the prospects might be for this type of discrimination. In Colorado recently, the Commission chopped out a big chunk of the deer and elk seasons. They took the authority directly away from the Department and printed a notice in the middle

[1]Professor of wildlife, University of Montana, Missoula, and member of the Montana Fish and Game Commission.

of their game laws that says that..."if this reduction does not work we will cut it some more". This is the type of political activity which biologists cannot overlook; we cannot say what happened to Colorado cannot happen to us. It can happen to any one of us.

I recently received a letter from a sportsman who asked me to lead a struggle to save wildlife from mismanagement at the hands of professional wildlifers. Dan Poole, of the Wildlife Management Institute, has mentioned in many of his recent speeches that managers of all resources are in for increasing public criticism. ..."While the wildlifers are sitting there chuckling at the federal agencies getting clobbered", Poole said..."Don't laugh too loudly, boys, you are next". Satchel Page used to say, "Don't look over your shoulder, something might be gaining on you". I think what might be gaining on us is the public disapproval of some management practices. The public may be wrong, but I think they are going to say it, right or wrong.

The problems facing us today in elk management have been some 100 years in the making -- habitat destruction, displacement of animals, control of predators, range abuse, sportsman's opposition, and rancher opposition. Now we are faced with a new problem area, the anti-hunting opposition. It really is not very new. About 1910 Dr. William Hornaday left his job as a museum curator and switched from being a hunter to a rabid protectionist. He promptly took on all his old friends like Teddy Roosevelt, George Shiras, and Charles Sheldon. So there is a history of having gone through this protectionist phase before. I am currently receiving letters with stamps on them asking one and all to "Save a Cat". I have gotten all kinds of interesting letters in my life, but now they are coming from new sources - little old ladies in Billings who say that they think this cruelty to animals have gone so far that they think animals should now take precedence over children. I cannot read all the letter because it is blotted by tears, but I did get the message - "Save a Cat". You can see that I am going to meet a whole lot of interesting people in my new role as a Game Commissioner.

At this point I'd like to touch on some other areas in elk management that I think need our close attention.

The carrying capacity question is going to run us into some interesting problems. We have managed elk in Montana and elsewhere by pointing out range damage. The public has been told that it is their responsibility to support management of game animals so they do not destroy the plant or soil resources. I think we have had fair luck in Montana. Ranchers have generally supported seasons when elk competed with cattle for forage. But recently some ranchers have found that they can sell trespass fees and make a little money off fee hunting so we may see a very rapid shift in attitudes.

We also have opposition concerning early recreational hunts. Not all of the public, but some of the more well organized groups are objecting to the early, quality recreational hunt which the Department has promoted. Reuel Janson has written a paper titled "The truth about early bull elk seasons". I think, Reuel, this sort of indicates that everything

said by the opposition is untruthful, I would say at least it is largely inaccurate. I do not know what their real motives are, but they have some pretty fanciful ideas about what elk do after the lights go out.

Another question to consider concerns elk seasons. In Montana we can offer late, either-sex seasons and fill quotas very quickly (2-3 weeks) where formerly it took 6 or 8 weeks. We now have more people hunting, more access, and more equipment which enables more hunters to get into the back country. If we are going to use the carrying capacity concept, we will have to set quotas. What will we do? Go to either sex or antlered seasons? Or shall we go to permits and limit the number of hunters as well as the sex to be harvested? Shall we continue wide open general seasons and take a chance on the weather? I think we have enough hunters now so we do not need to encourage hunters to kill elk. Idaho once considered financing helicopters to put hunters on top of the ridges in the Selway Bitterroot. They could hunt downhill, hopefully, shooting elk on the way. Things are changing and changing quite rapidly, but that never came to pass.

Another school of thought is the self-regulation or natural regulation proposals of the National Park Service. The theory is that we do not need to kill elk to protect range or property in some of the larger ecosystems like Yellowstone Park. The Park Service has raised the question and is attempting to test various aspects of their hypotheses. We have become programmed to the idea of adequate harvest - raise so many, kill so many. But the Park service is saying that in some areas perhaps population build-ups and die-offs are not occurring and probably will not. I think this is one idea the game biologists had better examine. You are going to have a little trouble selling sportsmen and ranchers the idea that if you do not reduce elk populations, the sky is going to fall and the soil is going to come down and all hell will break loose. In other words, the proponents of natural regulation have challenged an ancient precept that elk can do irreparable damage. I think they have done us a favor in raising this question - at this point they have not yet proven it.

Another possibility is no hunting at all. There were bills introduced in Congress to stop all hunting on federal lands. In Montana, if you stopped all hunting on federal lands and then the private lands got posted, I think you have a fair idea of what your prospects are for the future of hunting. These non-hunting and anti-hunting questions are catching us in Montana somewhat by surprise. We still think they are kidding even though the movement is quite strong in the southwest. Anti-hunting legislation at the federal level is going to continue to be introduced and they have achieved some results with the Marine Mammals bill. There are some real threats here we had better get acquainted with.

Ranchers and sub-dividers are going to create new access problems for elk hunters. Fee hunting is spreading. In the San Juan area of southern Colorado and northern New Mexico, I saw an area fenced off for big game hunting. The price was $875.00 for a six point bull; $250.00 for a

mule deer buck; and the owners apparently had all the takers they could get. There arepeople who are willing to pay for this kind of hunting and as it becomes more difficult to hunt on public lands, fee hunting should increase.

There are many other problems wildlife managers are having to face. Logging and roading in the northern Rocky Mountains is of course foremost in our thinking right now. The Montana Game Department has just written a reply to the Forest Service proposal for the Porcupine-Buffalo Horn planning unit on the Gallatin National Forest. I can give you the summary very quickly. The Department stated they preferred management alternative "B" -- no commercial timber harvest and associated road construction. They felt that logging and road construction would degrade elk habitat, degrade the elk hunting experience, and degrade all other recreational experiences. They asked the Forest Service to consider other management techniques that would be less harmful to wildlife.

Twenty years ago while working for the Idaho Department of Fish and Game in heavy timber stands, I described elk and deer use of small clearcuts and recommended logging as a management tool. Last summer I was asked to be on a panel at Portland discussing forestry management practices and their effects on wildlife. I was assigned to discuss the detrimental aspects and there are many. Benefits or damage to wildlife are usually a matter of degree and intensification of any land use practice can generally be said to be harmful. Herman Goering, the Reich Marshall of Nazi Germany once said, "Whenever I hear anybody mention culture, I automatically reach for my revolver". I find that when anyone says I am doing this for wildlife, I reach for my mental revolver too. What wildlife? and what are you really going to do? We have had far too many agency slogans professing great things for wildlife - sort of management by implied generalization.

If we are going to have problems with excessive logging on the side hills and the river bottoms are being preempted by speculators, we will have to go without elk or keep them alive with pellets and hay. I guess they do just that in Jackson Hole each winter, but what are we going to do the rest of the year and in the rest of the places that elk once roamed freely?

We are also getting opposition from hunters who oppose management suggestions. This is an endless problem. The special hunts that have been attempted -- for instance, in the northern Yellowstone and the Gallatin areas pose difficult problems in sportsmanship. No matter how you select the hunters and spread them out, there is still a problem of trying to get an adequate harvest of elk without a loss of hunting values and public support.

We can do some things however. We can eliminate trophy hunting and manage for maximum meat production. John Harris described conditions on the White River Plateau in Colorado where the mean life expectancy of a bull elk is about 2.8 years; the cows ran about 5.5 years. The spikes are very likely doing the breeding and trophy bull elk are

almost non-existent on the White River Plateau. (What about those who feel that a trophy bull also provides aesthetic pleasure to non-hunters?). They have finally discovered in the White River area that they have to limit the take of cows to achieve maximum calf production.

Another problem we can probably work out is better cooperation between the state biologists and the Forest Service as far as kinds of logging, location of logging and time span considerations. But what can we do about sub-divisions like Big Sky of Montana and all the other development schemes that have burst upon us? It is almost impossible in a state that has no sub-division regulations to keep them off the elk winter ranges, and this is a serious problem with no easy solution.

I have been asking myself these two questions recently. What is our national priority for wildlife (and we can say elk here) and what is the best use of the wildlife resource? I think we had all better examine these questions. Hunters are outnumbered in this country about 20 to 1, and elk hunters are outnumbered about 100 to 1. If you are trying to manage elk just for elk hunters, you do not have a chance if the opposition decides to put it to a vote.

I am going to conclude with something that may be of more value to you than what I have said so far. It is called a Research Man's Prayer. You research types can bow your head and pray along with me:

> Help me to be manic so I may be joyous, though the results are equivocal;
>
> Help me to be depressive, for when a prediction is verified I must know that it will not later be confirmed;
>
> Help me be sadistric so I suffer not, though the subjects be sorely anguished;
>
> Help me be masochistic, for even the most obstinate experimental animal should be a pleasure to me;
>
> Help me be psychopathic to quiet the guilt when I tell loved ones that the experiment is going very well;
>
> Help me to be schizophrenic to sustain myself by finding hopeful trends in random data;
>
> Help me be paranoid so I can see in the hostile attitudes of others, the proof and the supremacy of my own work;
>
> Help me by having anxiety attacks so even on holidays I find myself toiling in the laboratory;
>
> And finally, please help my wife get a job, for when I cross over the shadowy border of normalcy somebody is going to have to support the kids.

ELK MANAGEMENT FROM THE CONSUMER'S VIEWPOINT

by
Jack Atcheson[1]

Basically, I see elk hunting three ways. First, as a hunter and father; my three sons and I all enjoy hunting. Second, we arrange hunting trips all over the world. We arrange somewhere in the vicinity of ½ million to $600,000 worth of hunting trips a year. Third, we are in the taxidermy business. We receive a lot of mail from people asking a lot of questions and we have some ideas and trends about what people question us about; to start off with, I will try and cover a few of these.

Of all the mail we receive, the elk is the animal that people are primarily interested in. Elk is the number one animal. When people write to us about coming to Montana, the biggest reason they come is to kill an elk. Now, a lot of people would like to think that the biggest reason people come is to enjoy hunting; shooting an elk is secondary. However, if I were to run an ad in a magazine to come to Montana to see the mountains, to see the scenery; and maybe shoot an elk, I don't think we would book any hunts at all. The main thing in these people's minds is that they do want to shoot an elk. And this is what they come for.

What is the trend? What do people want? A few years ago when we first started arranging hunting trips, everybody who wrote felt that they were going to get an elk. There was no doubt in anybody's mind. Today when people write, they primarily want to shoot an elk and they still all believe that they are going to get one. It is only a matter of how they can get the type of hunt they want for the amount of money they want to spend. This is the way it has been for quite some time, but I do know things are changing.

There are now people that will spend as much money for an elk as they will for other animals. Elk hunting, for instance, used to be $30.00 a day; that was what people wanted to spend on elk hunting. In our new brochure we have listed various types of elk hunts numbered from one to eight. Prices run from $65.00 up to $150.00 a day. More people are inquiring about the $150.00 a day hunt than the $65.00 hunt; people are willing to pay more for quality hunts. Now quality can be a lot of things. Just getting away in a remote area can be quality; but these people still want to kill an elk. And not just any elk! These people, after spending $150.00 a day, want a six point bull elk.

I have arranged thousands of hunting trips and I can assure you that a six point bull elk is the most difficult animal in North America to arrange a hunt for. There is a reason for that. With all animals everywhere there is sort of a magic number that people go after. After

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[1]Hunter, Hunting trip booking agent and taxidermist - Butte, MT.

several hundred letters of inquiry, I can tell you that people who go to Alaska for moose want a 60 inch spread. With sheep they want a 40 inch curl; with antelope they want 16 inches; mountain goat is 10 inches; caribou is a double shovel; alaska brown bear is 10 feet; a grizzly bear is 8 feet; and with an elk it is 6 points. Here is where we run into a problem. He has to have 6 points to satisfy a client! This is the ultimate. A 5 point bull is okay and a 4 point bull is alright, but six points is what is necessary to satisfy a client on elk. Now if someone goes out and shoots a moose, they have the horn to put up on the wall and not many people can tell a 50 inch spread from a 60 inch. So the client goes home happy. He can say "yes, I got a nice moose". How do you really compare a moose after you have seen a big one; maybe he isn't the magic 60 inches, but he is still a big moose. But with an elk you can count the number of points, and he just must have six points! This is where we experience most of our problems with elk. There aren't that many 6 point bulls.

The most ideal situation that we have found in Montana is for all around hunting, like in central Montana where there are a fair number of elk and deer. As far as I am concerned this is a better situation because these people come to Montana to kill something. The people from back east don't like to go back home skunked. This is why I like an area that is open for combination type hunts because I know most of these people are not going to shoot a six point bull elk; there are not that many of them around. The client who hunts strictly for elk ordinarily gives up about half way through the hunt. For instance, I would say 7 days is about as long as anyone wants to spend hunting elk. After the 7th day the client wants to shoot something and if he can get a deer he usually goes home happy. Outfitters that have deer available usually end up with a happy client.

Incidentally, we get a lot of mail from people who are apparently confused as to whether they are happy or unhappy; I think we have received about 50 letters over a period of years and someday I should publish them. I remember one in particular; he wrote and said, "Dear Jack: Everything went very well on the hunting trip up until the last day of the hunt. On the last day the outfitter took my horse away from me and made me walk 12 miles back to camp". When I saw the outfitter a few weeks later, I said "say, I understand that you had trouble with one of the clients-that you took his horse away from him and made him walk back to camp". He said yes. I said "why did you do that?" He said "because he shot my horse!"

You run into a lot of interesting people and sometimes it is hard to know how to please them or how not to please them. With some you get to a point where no matter what you do, it is wrong. I also have a pair of letters at home from a Reverend in Minneapolis; he wanted to hunt in Montana for elk, deer and antelope. We arranged a hunt in eastern Montana. Well, about a month later I got a letter from him and he said that we had misrepresented the hunt; that it was nothing that we had said it was going to be; that the hunting was difficult;

the game was poor; that he had lost weight; and that it was very much mis-sold. So I talked to the outfitter and he sent me a copy of the letter the Reverend had sent him. I actually have these letters. He wrote the guide and told him that his taxidermist told him that the deer and antelope that he shot were two of the finest taken that year; that it was the most magnificent hunt he ever had; and that he had gained 10 pounds. This is the same man that wrote to me! I took the two letters, made photocopies of them and sent them back to him. I wrote across the top of them - "You are part of the reason the Church is in the trouble it is today!"

Les was talking a little earlier about what people will pay to hunt elk. I think that the farmers and ranchers in this country eventually are going to realize that raising animals in a game farm situation can benefit them; whether I like it or not is immaterial. You will find that people will spend a lot of money to hunt that way. Many people want to kill these animals, but most of them won't take the time or won't hunt hard enough to actually get back in the hills to bag them. People, realizing that time is one thing that they don't have enough of, have enough money to buy what they want and are willing to spend it. If this wasn't true, the number 7 elk hunt for $2,100 wouldn't be in our brochure! Two or 3 years ago no one would oonsider this, but we already have several people booked for it. We even have one person booked for a hunt at $225.00 a day! Howard Coppenhaver of Ovando, Montana takes out 12 of our clients a year; they pay $1,500.00 apiece for a 10 day hunt. A few years ago they wouldn't have paid, but now they will.

People are willing to pay and I personally feel that many people underestimate the value of an elk. I saw something published, I believe it was from Idaho, that an elk was worth something like $600. Now I personally feel that an elk is worth far more than $600. I have seen questionnaires asking people what did you spend when you were out hunting? I have received these from all over the world asking me how much did you leave in the country? I don't think these are true figures. What I spend in a motel or at a restaurant is not much compared to what I put towards it, such as bows and arrows, jeeps, chains, accessories to get back into the hills and all kinds of other gadgets. Personally, I feel that any bull elk is worth over $1,000. An elk must cost me $10.00 a pound; I can't even afford to eat them!

Everyone that hunts the first time thinks it will be on horseback; people that write us have this thought in their minds. Most think it is going to be a Yellowstone Park situation and that there will be elk all over the mountain; that they are going to be laying around sleeping and this is the way you get them; and that everybody shoots an elk and everybody is going to go home and have one hanging on the wall. However, my experience with elk hunting is that the damn things are always running up hill in deep snow. This is the way about half our clients find them.

Most people say they won't be happy until they get a big one. But I know for a fact that on the third day of a sheep hunt most hunters will kill any ram he sees and on the 7th day of an elk hunt I sure wouldn't want to be a spike bull!

As I get some slides of my hunting trips ready to show you, I want to give you some advice on a sure fire way to hunt elk. My son and I one time were standing around on a hunt just doing nothing and he said, "Dad, I heard the indians used to draw pictures of animals on rocks and this would bring them good luck." I said, "go ahead and do it." So he drew a picture of him chasing this animal, throwing a spear at it or something. Don't laugh. The next day he got a goat; the day after that he got a mule deer; and the next day he shot a bull elk. Apparently it worked, so take your crayons with you!

PUBLIC ATTITUDES TOWARD RECREATIONAL AND COMMERCIAL USE OF WILDLIFE

By
Eley P. Denson, Jr.[1]

I don't think I need to convince any of you who are involved in the management of elk that public attitudes toward the recreational use of wildlife have changed drastically over the past few years, and in respect to the freedom of action of resource managers, drastically for the worse. The California legislature passed a bill, in 1971, I think, which will effectively prohibit the hunting of tule elk until the herd reaches 2000 animals. An impossible goal, in all probability, in view of the limited amount of habitat available. There is pressure for a Federal refuge for tule elk and to make the 2000 animal goal a national objective. Montana has had problems with public opposition to balancing the Gallatin herd with available winter range and phasing out the Sun River Game Preserve which has long outlived its usefulness.

Two decades ago the general public was little concerned with wildlife. Hunters were concerned about their pet species, bird watchers were interested, but not too vocal or effective. Agriculturists bothered by depredating birds and mammals were concerned about their particular problems, but the general public could probably have cared less about how wildlife was managed. We had political fights about whether or not to shoot does and whether foxes and coyotes should be bountied, but so far as I know, no one was seriously trying to stop all killing of wildlife.

Ten years ago I was working for the Fish and Wildlife Service in South Dakota trying to preserve potholes from drainage, mostly sponsored by the Department of Agriculture. When court decisions and shifting populations reduced the strength of the rural vote we were delighted. We were confident that city people would be more interested in the aesthetics of wildlife and less willing to continue programs we viewed as both wasteful and detrimental to wildlife. We were correct, but we didn't consider that they might also be unwilling to continue to fund some of the programs which helped wildlife and would demand voice in the decisions on how wildlife is used.

I don't think a lot of field level personnel and sportsmen here in the less populous states realize just how serious a problem they're facing. Maybe those in some of the eastern states, such as Connecticut, where a bill was introduced to halt deer hunting, do. I am reasonably certain that most of you are not familiar with how what now seem to have been mistakes in judgment on the part of some of us in the wildlife profession, may have contributed to the predicament we now find ourselves, how international moves fit in, and how Federal regulations could be used to achieve non-use over the objections of Federal wildlife professionals who favor rational management.

It seems extremely unlikely that a bill would pass the Montana legislature in the forseeable future to stop hunting, even though letters to the editor of the Billings Gazette appear regularly opposing hunting, but if killing of wildlife were put to a national vote I have little doubt it would be stopped. Forty percent of the respondents in a poll conducted in 1969 for the National Wildlife Federation felt increased game law enforcement was needed and 25 percent believed

[1]Regional environmentalist, Bureau of Reclamation, Billings, MT.

it was essential to reduce hunting to preserve wildlife. Last year Congress established a moratorium on the taking of marine mammals by overwhelming majorities in a clear kick in the teeth to present day state management.

Field and Stream, Outdoor Life and other magazines have covered some of the problems created by the movement to curtail use of wildlife and its use of misleading appeals for funds, advertisements in periodicals, emotional stories and faked television documentaries. Their articles have been educational but I think they have overlooked significant elements of the strategy of the movement, and in particular its play on the American public's concern for endangered species. The movement has been discussed at I&E workshops and at the North American Wildlife Conferences. Nevertheless you may not be aware of the extent of the change in attitude toward commercial use of wildlife and wildlife products which ties in with anti-hunting sentiments. The connection between restrictions on importations of rare monkeys and local wildlife management problems may not be readily apparent, and a biologist with no other source of information than the TV may be almost as easily deceived about alleged wildlife slaughters in other states or countries as anyone else.

What is this movement, and where has the direction come from? It is part and parcel of the same movement which is confounding the construction agencies such as mine (in which, I have no doubt, most of you delight) and which has almost ended the Government's predator and rodent control program - a program most of us here have probably condemned at one time or another. It is partially a result of the very desirable growth of environmental consciousness. It is fueled by television and unfortunately receives much of its ammunition from researchers and amateur ecologists who can afford to take a purist attitude because they have never been faced with the task of saving wildlife habitat from those more concerned with the dollars to be gained by converting marshes to croplands and estuaries to marinas and housing developments. In retrospect, it has been unintentionally aided by decisions on the part of state legislators, and Government officials, and poor communication and trained-in conservatism on the part of the wildlife profession which makes it unwilling to take a firm stand in the absence of complete data.

Quite possibly from the standpoint of perpetuating wildlife resources over the long run, the change in public attitude has been for the worse even though the majority who suppost non-use probably don't believe it. Some of those who are responsible for the changed attitude probably could care less about what really happens to wildlife, though you wouldn't receive this impression from their public statements. You have to go a bit deeper, to testimony presented before Congress for evidence of this. Field and Stream's expose on the financial activities of Friends of Animals provides additional evidence of lack of actual concern for wildlife.

Which are the most influential groups? Senator Harris, praising those who supported the Marine Mammal Bill said on July 25, 1972, . . . "foremost among these organizations was the Committee for Humane Legislation (Alice Herrington). . . Organizations which have expressed support for strengthening amendments include (Alice Herrington's) Friends of Animals, Sierra Club, (Cleveland Amory's) Fund for Animals, Humane Society of the United States, World Federation for the Protection of Animals and the National Audubon Society." From my own experience you could add Defenders of Wildlife and the New York Zoological Society.

There is no question about the goal of several of these organizations being complete non-use of wildlife. A story in the May 1971 issue of the American Rifleman about the rash of movies and television programs which inflamed the public against users of wildlife in 1970, substantiated my belief that there has been a coordinated campaign toward this objective well thought out in advance. I am also convinced that the leadership of some other organizations through subconscious bias or a desire to impose their own particular philosophy on Government officials have unintentionally furthered the anti-use goal. For example, the official Audubon Society policy toward hunting is neutrality but their publication seldom misses an opportunity to take an editorial or story crack at hunters, furriers, hide dealers or wildlife officials. The Society has done much good. It can be a valuable ally. I'm not deliberately picking on them today; it's just that I have a better file of their magazines from which to draw my illustrations.

Sometimes you can't tell your friends from your enemies. The reasons behind the actions of some organizations are difficult to understand, though they may tie to the need for dramatic campaigns to raise funds or even to the personal vanities of the leadership. World Wildlife Fund, which has done much good work in saving wildlife habitat and funded extensive research here and abroad concerning endangered species, made a major issue of the need to preserve spotted cats. Its Executive Director promised political pressure if Interior failed to place them on the endangered list. I don't consider the Fund's leadership anti-use and I contribute to the Fund myself. Nevertheless, in 1971 they began a campaign that could only have been inspired by the old question about whether you have stopped beating your wife yet. Airlines were asked to sign a pledge to stop sponsoring safaris or booking tours or travel involving animals which the Fund classified as endangered. According to a news release, the Fund had 900 species on its list. A booking agent provided me with a list of some of the species the Fund was protesting hunting. It included alligators, antelopes, fallow deer, kangaroos, rhinoceros, black buck, Asiatic water buffalo, lion, polar bear, among others. Some of the species were not trophy animals, others were fairly abundant in some countries, and some were completely protected by the countries where they occur and could not be brought into the United States. The campaign has been a success. World Wildlife Fund undoubtedly looks good in the eyes of those who knew little about wildlife and safaris, and the hunter's image is further blackened.

If there is no concerted effort, then what I perceive as possibly being their strategy may be nothing more than my imagination. While there are certainly individual ties between the anti-hunting movement and the anti-gun movement, whether the anti-gun people are deliberately stirring up opposition to use of wildlife as has been suggested by some, I am not prepared to say. But it is patently obvious that the anti-gun movement stands to profit from success by the anti-hunting movement.

Make no mistake about it. The anti-use lobby packs a punch. The 1972 fall Eddie Bauer catalog apologized for including parkas with ruffs of fur on their hoods with the explanation that "This is not used as a trimming to please the fashion-conscious buyer, but as a most vital element to protect the lives of people who must exist in extreme cold." The catalog also contained the assurance that they had eliminated all sealskin garments and footwear from the catalog and discontinued products made of beaver pelts and kangaroo leather. This, at a time when

a good many states seem to be faced with problems of controlling surplus beaver.

Kangaroos have been harvested for dog food and leather. Australian wildlife officials stated in 1970 that most species were not in danger of extinction. I am uncertain about Australian laws regarding the export of wildlife products, but those dealing with export of live animals are among the most restrictive in the world. In December the New York Times reported that a petition bearing 151,000 signatures from 60 countries had been presented to the Australian Embassy in Switzerland demanding that kangaroos be completely protected. In January Australia announced that exportation of kangaroo products would be prohibited and we are now in the process of prohibiting their importation into this country. According to the New York Times, credit should go to the Fund for Animals.

Federal income from sealskins dropped by 50 percent in 1971 because of declining prices a direct result of the movement. Last year the U. S. Senate passed 88 to 2 and the House passed 362-10 a bill to establish a 15-year moratorium on the taking or importation of all marine mammals, including polar bear, seals, walrus and sea otter, as you can imagine, over the strong protests of the Alaska delegation. There are certain exceptions and provisions for the Secretary of the Interior to issue permits to authorize the taking or importation of marine mammals but under such restrictions and with provisions for judicial review at the request of parties opposed to the taking that it seems very unlikely that many permits will be issued.

Despite the magazine and symposium coverage I referred to before, the soul searching over the reasons for opposition to hunting, and anguish over the way wildlife management has been misrepresented in the press and on TV, it hasn't seemed to me that the problem has been analyzed in depth. We've been more concerned with coming up with logical reasons as to why hunting is necessary and praising the good hunters have done in preserving wildlife habitat. We haven't really examined the source of the opposition or their tactics.

A behind the scenes look at passage of the Endangered Species Act in 1969 gives an indication of how the anti-use groups can turn valid public concern for the environment and legitimate conservation objectives against management agencies. Their tactics seem to follow a pattern. Overstate the problem to arouse emotion and antagonism against wildlife users. Label any wild animal killed for meat, hides, or because they prey on livestock or captured for pets as being in danger of extinction. Get sportsmen's support for passage of a complicated law to protect these species and then attack the law before it can be effectively implemented as being too weak. Exaggerate the ability of the law to correct undesirable situations. Destroy public confidence in the ability and willingness of Government officials to enforce the law. Pit the various groups of people who kill or capture wildlife against each other. Pick small target groups and attack them one by one.

You are all familiar with the Department of the Interior's list of endangered species. I trust you all know that in enacting the first Endangered Species Act in 1966 Congress specifically withheld from the Secretary of the Interior authority to regulate the taking of resident fish and wildlife even though they might be classed as endangered. This lack of Federal protection, whether really needed by wildlife or not, has been a focus of preservationist complaints against the act and efforts to amend it. I'll cover two recent attempts to amend the

act later. While I was working with endangered species (and I presume the attitude still holds today) we preferred state protection for endangered species to Federal and worked on a model endangered species bill with the International Association of Game Fish and Conservation Commissioners. There is public pressure now to include species on the list which are not actually in danger. You can imagine what efforts the anti-use group would make if inclusion on the list carried a Federal ban on killing.

The rhetoric in support of the 1969 Act which controls importation of wildlife got pretty extreme. "Many species of animals are endangered because they are in demand for novelty uses, or because their skins provide specialty or decorative wearing apparel. The hides of spotted cats and zebras are in demand as luxury apparel and status symbols. Many species of rare and beautiful tropical fish have been dangerously reduced in numbers to supply an ever increasing market for aquaria fish."

The ban on importations was advertised as benefiting species such as the Ceylon elephant and Spanish lynx which have probably never been imported into the United States. In point of fact, we found no species of tropical fish which were in danger and most zebra hides which enter the United States come from game cropping operations. As a result zebras were not barred from importation under the Federal law, but last year California barred importation of their hides for sale.

Any group which wants to end killing of wildlife can mount a publicity campaign alleging that the species involved are in danger of extinction and elected representatives will put on the pressure. If the Federal or state agencies refuse to go along, then the legislature acts as it did in California. Legal action was taken to attempt to force Interior to designate polar bears as endangered. When this didn't work the anti-use group pushed the Marine Mammal Bill through Congress. The first version of this bill would have provided total protection and was opposed by every wildlife and fishery conservation organization in the country. The conservation organizations were placed in a position of having to oppose a "motherhood" bill designed to protect "endangered" species.

I always used to think that the Federal bureaucracy was less subject to political pressures than the States, and to some extent I think it's still true, at least so far as local issues are concerned. Unfortunately, it is less immune to pressure from the large urban blocks where sentiment for non-use of wildlife is more prevalent than are the agencies of the western states where a large segment of the population either hunts or has a family member who does.

I don't think there are any Federal wildlife administrators who really want to take responsibility away from the states, but this could come whether they want it or not, and I believe moves in this direction may be a part of the strategy of the anti-hunting movement.

Since 1969 Senator Cranston has sponsored bills calling for a Federal refuge for tule elk. His SJ 6 this year would also declare it to be Federal policy to restore the tule elk population to 2000 animals. In 1970, and I presume since then, Interior has opposed the establishment of a refuge, affirmed its confidence in California's ability to protect tule elk and insisted that the subspecies is not threatened with extinction. Let me quote what a colleague of mine and I in

the Office of Endangered Species wrote three years ago about the status of tule elk, which are described as "rare" in the Red Book. "Numbers per se are not a part of the definition of "endangered." Tule elk are rare because additional habitat is not available for them, but the few herds are too widely separated to be eliminated by disease or natural disaster, and under the State of California's competent management they are unlikely to become extinct." Federal funds are needed far more urgently for work with species which require additional protection; nevertheless the pressure for a refuge continues as well as mail demanding the species be designated "endangered."

About this time last year, after receiving thousands of letters as a result of campaigns by the Audubon Society and World Wildlife Fund, Interior proposed to ban leopard, jaguar and ocelot along with several other cats from the U. S. by adding them to the list of endangered species. Jack Atcheson sought the views of several African Game Departments on the leopard situation to see whether they agreed with Interior's ban. All replied that they intended to continue to allow leopard hunting, and he has shown me replies from Botswana, Mozambique, Tanzania, Rhodesia and Kenya stating unequivocably that leopards are not in danger of extinction even though they may be locally depleted. Sportsmen's support for the ban was enlisted and those who questioned it were assured that the hardship clause which allows continued importation for one year after the ban is imposed to fulfill existing contracts would allow hunters to bring back their trophies until the law could be amended to take care of the problem. If they knew anything about the ban at all, most sportsmen probably thought the activities of trappers who competed with hunters for the same animals should be curbed and that in any case only the sport of a few wealthy people would be affected. However, the law still hasn't been amended to allow importation of trophies, and groups such as Friends of Animals immediately challenged Interior's use of the hardship clause. Jack could tell you of the problems his clients have had in getting their trophies back.

Wildlife managers involved with grizzlies in Montana have had experience with how the preservationists handle statements that species are not endangered. Simply allege that they are either incompetent or have financial ties to continued hunting. Our own arguments about sportsmen's financial contributions to the welfare of wildlife are turned against us. Lewis Regenstein, lobbyist for the Committee for Humane Legislation, accused the Government in a Washington Post article of partial responsibility for the plight of whales because it had failed to place them on the list of endangered species several years earlier. Actually, they were on the first list issued to implement the 1969 Act. He also accused Interior with "encouraging the destruction" of spotted cats and "looking the other way while many species were driven to extinction." The Audubon Society in September 1971, claimed FAO groups wild animals into three categories; "those that are edible and/or marketable, those that are pests and all the rest that are of no account whatever and may as well be destroyed," and concludes "The philosophy of some game managers is that any species that can be harvested for profit should be harvested - to within a precarious inch of its existence." Such statements can only be part of a deliberate campaign to convince the public that professional wildlife managers cannot be trusted to protect the resource.

Positions of the anti-use organizations on the Endangered Species Conservation Act changed after it was passed in 1969. Furriers and pet dealers had questioned

passage of the Act in 1968 because they rightly feared it might be misused to put them out of business, but the furriers support for the bill was gained in 1969. Here is what Mr. Callison of the Audubon Society said to the Senate about this in May 1969: "Quite understandably, they wanted to see to it that the law would cover only wildlife that legitimately needed protection from extinction. We believe the current versions of this legislation now before this committee include wording that clarify these points and should allay any industry fears," and to the House in February "If I understand their concern correctly, they wanted clearer assurance that a species would be listed as endangered only if it was genuinely threatened with extinction. . . HR 4812 has wording which we assume is intended to clarify these points. We will gladly support that bill if it becomes the choice of this committee. . ."

The Act, as passed, provided that a full species would be listed only if it faced worldwide extinction; however, endangered subspecies could be listed and their importation prohibited. This was done. As you can imagine, implementation of this provision proved difficult though subspecies with restricted distribution could be effectively excluded from the United States. The New Audubon View of September 1971, contains the following remarks: "The adjective 'worldwide' was a compromise forced by the lobbyists for the fur and alligator products industries. . . IUCN. . . is undertaking to write the same deadend concept with the words 'threatened with worldwide extinction' into an international convention." It (the treaty) does not recognize the ecological necessity and aesthetic desirability of maintaining satisfactory populations of native wildlife species in all regions and countries." Think what it would mean to wildlife management here if we tried to carry out this concept and prohibited hunting any species which was in trouble any place in the country. From temporary support of the concept of excluding only endangered species or subspecies, which now seems to have been designed only to win the support of wildlife users for the bill, Audubon has switched to a demand for even more stringent restrictions.

The New York Zoological Society had supported passage of the Act. An article written by its executive director in its journal, which, from its timing, must have been prepared before implementing regulations were issued, condemned the law for being too weak. The Society's chief herpetologist made the same charge in an article in Natural History claiming that there was no feasible way to distinguish the hides of the endangered crocodilian species from those which were not endangered and that therefore a complete prohibition on importation of all crocodilian hides was warranted. At the same time, he was preparing a key for Interior on means of recognizing the hides! About the same time a technique for "belly printing" individual hides was being developed.

I spoke earlier of mistakes made by legislatures. The Montana Legislature in January killed a bill to provide management for non-game animals and endangered species. I leave it to your own judgement as to whether or not this plays into the hands of those who want wildlife under Federal control.

I also spoke of mistakes made by Government officials. One, made by Interior's Office of Endangered Species in the mid-60's probably seemed like a logical decision at the time, but has plagued them ever since and played directly into the hands of the preservationists.

In assembling data on endangered species prior to publication of Interior's endangered species list in 1966, a considerable volume of information on other species which were not yet in serious trouble was accumulated. Data on species which were peripheral to the United States were also accumulated in the process, and a lot of suggestions were made concerning species about which we simply knew very little. The decision was made to put all this information together into a single volume which would stimulate research on the little known species and provide a handy reference for wildlife workers. Data sheets on mammals, birds, reptiles and amphibians were grouped into four categories, endangered, rare, peripheral, and status undetermined. Probably because the endangered and rare sections were short, pages on the two categories were combined into a single section in taxonomic order. The volume was entitled Rare and Endangered Fish and Wildlife of the United States and commonly called the "Red Book." Ever since then we have been trying to overcome the public belief that all rare species are in danger of extinction and to correct the impression that the Government has a list of "rare and endangered species."

Let me tell you what I mean by an action on the part of state officials that has probably aided the non-use cause. The American alligator is probably the best publicized of all our "endangered species." New York and California, against the advice of wildlife officials, passed bills prohibiting the sale of all crocodilian hides. Even the manufacturers of plastic check book covers changed the name of their models which resembles alligator hide from "alligator" to "Zambesi."

Thanks to all the publicity and amendments to the Lacey Act the alligators' future is much more secure than it was a few years ago. If it were not for public fears continually fanned by magazine articles intended to prevent resumption of harvest it might well have been removed from the list of endangered species already.

Last fall Louisiana held their first alligator season in years over official opposition from the Department of the Interior and violent condemnation in Audubon magazine. There's a good description of the hunt in the February issue of Outdoor Life.

There are even more complications to it than that when one starts questioning whether the alligator was ever in actual danger of extinction. There's no question but what there was a serious problem in poaching and that Federal officials were unable to help because of limitations in Lacey Act coverage. The conviction of a Georgia hide dealer last year for selling poached hides is an indication of the extent of the problem. This one dealer had records concerning the sale of 127,000 hides from the period 1968-1971. But was the alligator ever really in danger? Let me quote from a December 3, 1970, letter from the Director of the Louisiana Wildlife and Fisheries Commission.

"As for the alligators remaining on the Endangered Species List we feel that in past years a huntable population no longer existed in Louisiana; however, at no time was the alligator in danger of going extinct. The placing of the alligator on the list helped tremendously in passing additional Federal legislation which I feel was badly needed. Now that the legislation has been passed, and populations have increased substantially here in the state, a move should be made to remove the alligator from the list." I have no doubt that the hunt may have been

justified on a biological basis, and if the present situation were dominated by logic rather than emotion might be useful in proving alligators can be successfully managed on a sustained yield basis. But this isn't the case. Louisiana officials probably enjoyed kicking sand in the eyes of the opposition, but what better argument could they have provided the preservationists who want to make it a Federal offense to kill "endangered" species.

Don't be lulled by faith in state's rights. The Marine Mammal Bill got around it by noting that the affected species move in interstate commerce. So, for that matter, do deer hides, furs and most of the animals shot on state-licensed shooting preserves.

Invoking responsibility under a treaty can also avoid the State's rights problem. The 1941 Pan American Convention for the Protection of Nature called upon signatories to prepare lists of species in danger and provide necessary protection. Another treaty concerning protection for endangered species is being discussed in Washington this month. In 1970 Senator Cranston sponsored a bill to implement the Pan American Convention which would have made it an offense to kill any member of a species a subspecies of which was listed in the Red Book. The Red Book contains tule elk, masked bobwhite, Aleutian Canada geese, Delmarva fox squirrels, Key deer, tule whitefronts, Attwaters prairie chicken, Florida panther, desert bighorns and Sonoran antelope. Few of these subspecies are hunted and several are listed as rare, not endangered, but they're in the book!

Senator Spong sponsored a bill in 1972 (S3818) which would have gone even further and allow the Secretary of the Interior to extend protection to any species or subspecies which so closely resembles a species or subspecies which has been listed as endangered that substantial difficulty is posed to enforcement personnel at some stage in attempting to differentiate between the endangered and non-endangered forms. The endangered list would include species or subspecies which are either presently threatened with extinction throughout all or a significant portion of its range or are likely to become threatened with extinction in the forseeable future. So far, at least five similar bills have been introduced into the House this year.

The Federal Government can also act in its capacity as a landowner to close an area to hunting or almost any other activity. This was done by the supervisor of the Superior National Forest in 1970 to protect wolves which were being given no protection by the State of Minnesota. A joint resolution has been introduced into the House this year to give the eastern timber wolf complete protection.

While I haven't seen them, I understand bills are being introduced which would prohibit hunting and trapping on Federal lands. Gruesome pictures of a dead raccoon in a trap (photo courtesy Monterrey Co. SPCA) have been appearing in an ad run in the National Observer by the Animal Protection Institute of America urging an end to the use of steel jawed traps in the U. S. and a ban on importing furs taken by steel traps. The ad states that "State laws regulating trappings are rarely enforceable," and urges the reader to inform others of the cruelty to animals caused by the desire for furs.

The Federal Government can also be compelled to close its land to hunting. I presume you are aware of the injunctions granted in 1970 against deer hunting

on Federal refuges in New Jersey and Virginia on the basis that the hunts would be inhumane because the average hunter was such a poor shot. This was probably the first move in a campaign to halt hunting on refuges and then all Federal lands. Interior won the case just last week. A logical next step would be to demand impact statements on the effects of hunting.

Lastly, the strategy calls for pitting the various groups of people who kill or capture wildlife against each other. Some of their interests do conflict. Encourage hunters and the owners of wild pets to dislike furriers and hide dealers. Encourage pet fanciers and zoo officials to attack hunters and collectors of scientific and laboratory specimens. Encourage zoo officials to attack pet importers and dealers. All this seemed to happen during passage of and implementation of the Endangered Species Act. Everyone was for it, provided someone else's importation was stopped.

Encourage hunters to condemn landowners who seek to protect their livestock or crops from damage by wildlife. Encourage the average hunter to resent those wealthy enough to travel to other states or countries to hunt. Unfortunately, irresponsible or illegal actions of a few people in all these groups have provided legitimate targets.

Having done this, pick small target groups and eliminate them one by one. The Endangered Species Act was publicly and primarily aimed at abuses in the fur trade, but it's been used against hunters, pet dealers and whale product importers. The Marine Mammal Bill is aimed at the fur trade and wealthy sportsmen. Recent actions barring importations of small turtles for health reasons have affected the pet trade and it seems likely that legislation is being readied to attack it.

Most sportsmen applauded when Federal action restricted the use of poisons to control predators, but at least in Montana, it was the sportsman who suffered the most from the reaction of livestock owners -- one of the few groups in the country whose philosophy about use of wildlife compares closely with their own.

The average hunter might well applaude the other moves such as outlawing steel traps. After all, who would be affected? Mostly a few trappers and "dishonest" fur dealers. I suspect most were also pleased by the Marine Mammal Bill and barring the importation of cat skins. After all, these too affected only fur dealers and a few rich men who have too much money to spend anyway.

In conclusion, I want to quote a few passages from testimony given before the House in Support of the Marine Mammal Bill last year. Better than anything else, I think they point out the nature of the opposition.

World Federation for the Protection of Animals

"Any person . . . who thoughtlessly and without feeling can take the life of another animal, (. . . can) also (take) that of another human being. The step is a very small one. Any one capable of cruelty to animals is capable of cruelty to human beings. To permit the senseless slaughter of animals is to encourage the dehumanization of man."

Friends of Animals

"The large numbers of people for whom I speak are very clearly and very stongly opposed to 'management' and harvest." What we are for is very simple. We believe ocean mammals should be left alone. They should be neither harassed, killed, managed, nor harvested."

"We should stop killing the animals. The only way to peace is to stop this war on the animals now."

Dr. Herbert Greenberg

. . . we say you shall not kill, but go ahead butchering animals and fighting wars. . . there is no difference (psychologically) in butchering seals or in butchering rabbits in a zoo, or butchering people.

Alice Herrington

In response to a question about killing livestock for feed. "We made captive slaves of livestock for our own survival purposes. We need these animals for our protein diet . . . You cannot justify the slaughter of a seal . . . for frivolous purposes."

Senator Hollings said last year, "There are persons who have suggested that all hunting in the United States be outlawed, and that if populations of animals get too large because natural predators have been removed, select teams of shooters should be dispatched to cull out these surplus animals."

Opposition spokesmen have said several times the basic question is philosophic and whether it is moral to kill animals merely to cater to man's vanity. Our opponents do not seem to be against killing, per se, they are against killing for sport or any purpose they consider frivolous.

In such context logical arguments about wildlife management and hunters contributions to the welfare of wildlife cannot prevail.

We now have an aroused public. What we need is an informed public. I can forsee little probability that we will ever have one. The producer of what may have been the best TV presentation of wildlife management problems told the 36th North American Wildlife Conference that the public response was overwhelmingly negative and abusive. American Sportsman switched from big game hunting sequences to motorcycle racing and aerobatics under public pressure.

The public is convinced most wildlife is endangered. The U. S. whaling industry was killed in 1970. The industry which used whale products was killed in 1971. The reptile hide processing industry, if not killed in 1971, is nearly dead. Trapping is under attack. The fur industry of the United States is sick and may have been dealt a mortal blow. State legislative moratoriums have been declared on the hunting of some species previously classified as predators or game animals. The ability of landowners to deal with predators has been drastically curtailed. The pet industry is under attack for humane and health reasons and their potential legal stock in trade curtailed by several millions of dollars. Importers of trophies are being harassed.

Even sport fishing is being sniped at. A 1971 article, in Audubon magazine, "Jungle Cocks, Trout Flies and Smugglers," was full of inaccuracies. The article and the editorial comments contained several basic elements of an anti-use campaign taking a swipe at fishermen, speaking of birds "slaughtered . . . to satisfy the whims of elite trout and salmon fisherman;" pressure from "sport fishing interests" being exerted to prevent U. S. protection of grey jungle fowl; and the unwillingness of Government officials to act.

Whether or not you feel these actions are justified, and I am certainly emotionally sympathetic to some of them, I think you will have to agree that they further the goals of non-use and fit the strategy I believe our opponents have adopted.

ECONOMICS AND ELK MANAGEMENT

by
Dr. Verne W. House[1]

Economics and elk management is one of the most exciting topics I have had the opportunity to examine. My enthusiasm comes partly from my image of the elk as a majestic animal and partly from the challenge of applying economic logic to something that definitely is in demand but does not pass through any market.

Elk fit into a larger group of goods that lie outside the market economy. For me and many other economists, this "extra-market area" of inquiry is "where it's at" in economics today.

Perhaps it is best that I begin by saying that I am not an expert on elk. Neither am I willing to present myself here as expert on the economics of recreation. My specialty is natural resource management.

My best read work, however, is on the economics of recreation. It deals with the economics of prostitution and appears in the 1967 proceedings of the Western Agricultural Economics Association. I asked Gene Allen if I should review it for you but he guessed the subject might be repetitious for this group.

There are too many economic aspects of elk management to include in one discussion so I will limit this paper primarily to economic constructs available to place values on non-market goods such as elk. Economic logic is largely market-oriented and the economics of elk management is a journey from the market system into the non-market world where elk managers necessarily live.

In the course of our journey we need to keep in mind just what economic analysis is all about. In its broadest interpretation, economic analysis defines the circumstances which affect the well-being of society. Economic logic is most incisive when it is quantified. One of the useful measures we use is the price of a good or service. Under certain conditions, price represents the value that society places on the use of a good or service. Therefore, prices are said to be indicators of social value.

Prices are an important weighting device in economic analysis. As such, the economist must always be concerned with how accurately prices reflect social value. This paper explains how social values may be measured for a non-market good -- elk. I will refer to these social values for non-market goods as pseudoprices.

Theoretically, perfect indicators of social value may be derived from two sources. Prices resulting from a perfect market are one source.

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Political decisions from a perfect democracy are the second source. We do not live in a perfect world, however, and there is continual intellectual dispute as to how well either market prices or political decisions reflect social values.

ARE SOCIAL VALUES SHIFTING?

Any discussion of our ability to measure social values must also face up to the possibility that social values themselves are changing. The importance of this possibility should become apparent from the following example.

Suppose we could rank our consumption activities by the amount of utility or satisfaction they give us. For example, a fishing pole gives me a lot of satisfaction. I would like to have a second pole for steelhead. A third pole migt be nice to have on hand but it is less important to me than the second one.

So it is with any thing. The first car is essential, the second car less so. One ice cream cone is great, a second one good, a third one discomforting, a fourth one nauseating, a fifth one disastrous. The utility derived from consuming added units decreases. This is the principal of diminishing marginal utility. Keep in mind that "marginal" is the same as "added" in the following example.

> In the last two centuries, especially, the developed nations have produced an increaingly impressive array of goods and services for their constituents. These goods and services have accumulated to such an extent in upper middle class homes that the marginal utility of "things" has surely dropped. At the same time, fresh air, clean water, wilderness, and quiet (things often called "amenities") have one by one become more scarce, more dear. They now have rising marginal utilities. The curves in Figure A may help clarify a useful point. The curves show the decreasing marginal utility of goods over time and the increasing marginal utility of amenities over time. These changes in marginal utilities reflect not basic changes in values held by people, but changes in the availability of the two classes of objects. In the past, amenities -- especially those associated with the natural world -- were plentiful. The homesteader in Montana had all the clean air and quiet he could use. As a result, the marginal utility he received from amenities of this kind was quite low. At the same time, goods available to him were few in number -- perhaps limited to cloth, tools, and a wagon. The relative scarcity of goods gave them high marginal utilities which in turn encouraged production of more goods and services. The low marginal utilities attaching to amenities allowed them to slip away almost unnoticed. As time passed, the relative marginal utilities change, with the MU of goods steadily dropping while the MU of amenities steadily increased.

Marginal utilities are subjective and can never be given numerical value. But some people are now beginning to wonder if the decreasing marginal utilities of added goods and services are not roughly equal to the increasing marginal utilities of diminishing amenities. If so, the wisdom of producing more goods should be questioned since, by moving into the future, past time period p in the figure, the added utilities of goods and services would be lower than the marginal utilities of the amenities that had to be sacrificed in order to produce the goods. At point p', amenities with marginal values of OD have been sacrificed to obtain goods with marginal utilities of OA. The difference (BC) indicates again the loss attaching to the production of good and services (Barkley and Seckler, 1972).

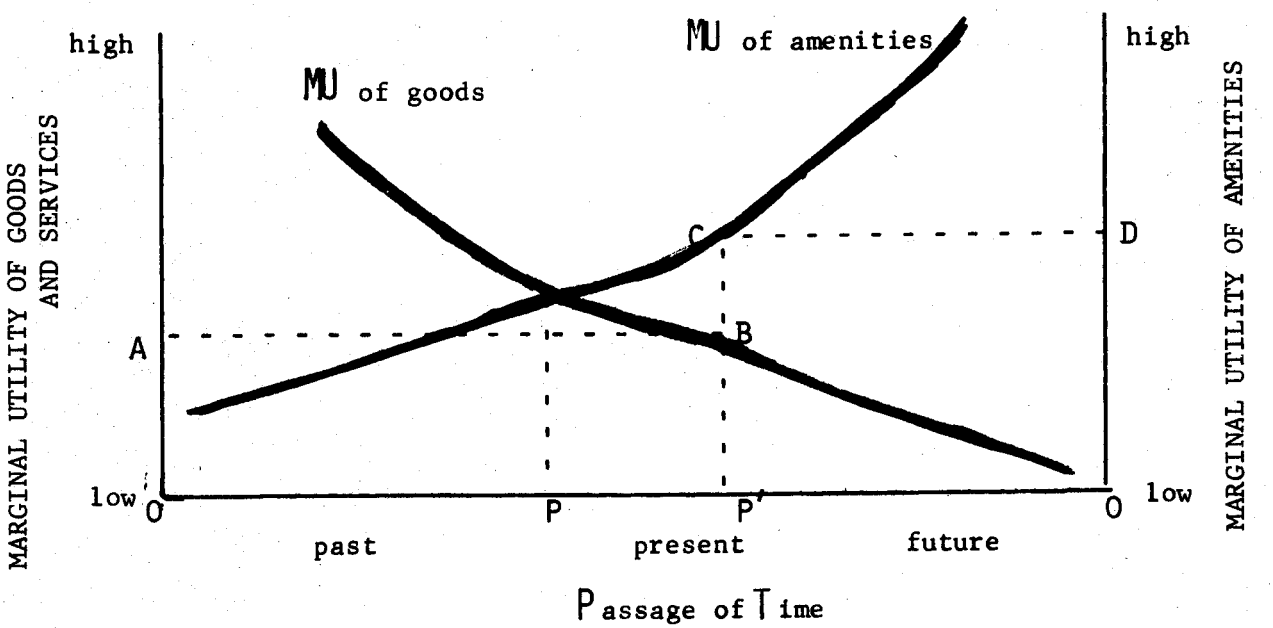

FIGURE A: Marginal Utilities of Goods and Amenities (Barkley and Seckler, 1972).

The underlying hypothesis is that the relative weights society places on material goods vs. amenities depends on the level of economic development.

To elaborate on this hypothesis, I offer the following two pieces of supporting evidence. First, ask yourself this question. How does the concern for game animals in the early history of this country compare with the concern today? I think our concern is greater now. Are we more concerned today because there are more people to be concerned and fewer

wild animals and species to be concerned about? Or are we more concerned today because we are enjoying the affluence of a developed economy? Perhaps we are more concerned because we are becoming satiated with market goods and are turning to amenities to increase our satisfaction.

As a second piece of evidence, let's consider how the interest in conservation and the environment has risen and fallen during this century. As an indicator, I will use the amount of attention given to these topics in economics journals. A review of the conservation movement as reflected in economic literature shows that interest began in the late 1920's. This interest did not increase steadily but it appears to have grown when the economy was stable and growing and to have fallen sharply during depressions and wars. (Barkley, 1968).

The implication I draw from these two pieces of evidence is that our society is more concerned about amenities when political and economic conditions are stable and the level of living is above that needed for subsistence. Our level of economic development gives people the time and means (and psychologists might add the need) to be more concerned about natural amenities and less concerned about where the next meal is coming from.

Economists study the choices consumers express by the way they spend their time and money. Because so much time and money is being spent on amenities it should not surprise us to see a growing literature on natural resources and recreation. This literature is both applied and theoretical. The state of the arts is still crude but progress is being made.

MARKET MODELS

Traditional economic models of market behavior provide a system of tight logic that permits rigorous though abstract analysis. We need to recall a few basic characteristics of these models before we depart from them into adaptation which more accurately describes non-market behavior.

As previously noted, we are looking for accurate indicators of the value society places on consumption. The accuracy of these indicators depends on the degree of competition among producers (or consumers) of a given good. When competition is perfect, then prices are perfect indicators of social value. Why? Because everyone has perfect knowledge of the product, no one producer or consumer can affect the price by his choice, property rights are well defined, and anyone who chooses can enter into production.

We know that in reality our knowledge is limited, firms do possess monopoly powers which provide them a degree of control over price, we are never absolutely sure of our property rights, and large capital requirements are an effective barrier to entry into many businesses. These conditons are accounted for reasonably well by models of imperfect markets. These models are not standard tools of the economist.

There are cases where there appears to be a large gap between social value and real world market prices. Such cases usually fall out of the cradle of economic logic into the political arena.

MARKET FAILURE

Some specific conditions have been identified which cause the market price-social value gap to be so large that the market is said to fail. (Bator, 1958.) These conditions encompass many environmental effects and natural resources such as elk. Therefore, I think it will be useful to explore some of the circumstances which cause market failure. Then we can talk about means of correcting for market failure so that more information can be brought into decision-making processes.

Non-exclusion and Free Riders

Exclusive use of something makes it possible to extract a price for it in the market system. If the something is freely available then no one is likely to pay for it.

What happens when you make a purchase in the market? You obtain the right to use it exclusively. The purchase is a voluntary exchange of money for goods which reveals your preference. Revealed preferences are quantitative measures of the worth of the good to buyers and sellers.

Exclusion is not always possible. For example, consider radio programs. Once they are transmitted, anyone with a receiver can tune them in. They are paid for by advertising but I may never buy from the advertiser who buys the program. The radio station sells the advertiser exclusive use of the airwaves but I am a free rider if I can avoid paying for the advertising. Moreover, once the radio waves are produced, the station incurs no additional expense to make them available to every radio. Radio could be cabled like television but it has not been economically feasible to do so. The same is true for elk; elk are public property until they are captured for private use. Non-exclusivity and free riders make it extremely difficult to know how many elk the public desires and what they are willing to pay for them.

Similarly, in my home town we had a ball park but no fence; hence, no exclusion. People parked their cars all around the park and watched free. No fence -- no exclusion -- no admission fee. Once in a while a small boy would be dispatched to solicit donations. I had that job once and somebody dropped in a cigarette which burned a hole in my hat.

A fence was economically infeasible because it would not pay. It was politically infeasible because it gave boys an excuse to park there with their girlfriends and old men parked there to watch the boyfriends and girlfriends. Nobody cared who won the games. If a fence had been built, no one would have shown up.

Many kinds of outdoor recreation suffer from non-exclusion and free riders. Free riders make political movements fail, too. Who's going

to join a "Save the Winter Game Range" movement when the outcome is uncertain and the movement may succeed without my money and time.

Two consequences of making benefits available to the public, regardless of individual contribution, should not be ignored. First, we are likely to produce less of a non-market good than the public desires if we strictly follow the rules of marginal analysis because prices are used for weights.[2] Suppose timber and elk compete for resources. If the price of elk is undefined or zero, elk should command none of the resource. By observation, we know this is not what society wants; we know the social value of elk is positive; hence, this rule fails to tell us how to allocate the resources.

The second consequence is that we lack a quantified measure of consumer preferences. (Musgrave, 1969, p. 9.) Looking at attractive girls on the campus could consume a lot of my time because I enjoy it and it's free, but if I had to pay I would look less. Having to trade off money for amenities would reveal my true preference; we would have a quantified measure of willingness to pay.

Externalities

Interrelationships between uses of elk habitat are also a cause of market failure because they commonly result in externalities. Externalities are not taken into account through voluntary exchanges. (McKean, 1968, p. 64). An externality is an uncompensated effect of the action of one party which causes another party to desire a change in that action. (Barron, 1972, p. 15). Pollution is an example -- the affected party desires a decrease in the action causing the pollution.

A key word in the above definition is uncompensated. This means that no market mechanism exists whereby either the affected party can pay for either more or less of the effect.

As an example of an externality in consumption, consider an elk herd in mating season. The prime bull has rounded up his harem of cows and keeps them nearby while waiting to fulfill his destiny. A young bull stumbles by downwind and comes charging in, convinced that God is on his side. No market exists to measure each bull's willingness and ability to pay.

That's a bit far out -- let's construct a better example. Suppose that I detest snowmobiles. The snowmobiler exists to enjoy racing up and down canyons. The noise and stink that he creates for me are merely byproducts of his fun. No market exists for noise and stink even though it is worth something to me to avoid them.

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[2]The equi-marginal principle is that resources used in production are efficiently allocated among competing uses when price times the marginal product (i.e., the last unit produced) is equal for all uses.

Externalities in production -- a good example is the research you will review later in this workshop on elk and roads. What are the physical interrelationships that exist between elk populations and road construction, maintenance and use? This important question must be answered by physical scientists. By contrast, an economic evaluation would combine this information with values of elk and roads to approximate a social optimum.

These examples demonstrate that there are common interests between environmental considerations (including outdoor recreation and other amenities) and economics.

OTHER SOURCES OF FAILURE

Market oriented economic models also fail to adequately consider unique or irreplaceable resources such as whales and the Grand Canyon. An additional failing is found in the consideration of long time periods.

Adaptations to Reality

Do these complications rule out further economic analysis of non-market goods? I assure you they do not. To support this point, I will describe just how these obstreperous problems are being attacked. The economist doesn't have to punt the ball to the politicians yet. By adapting economic constructs to these problems, more information can be made available to the public decision-making process.

Suppose you want to estimate the value of an elk herd. One way to go about this task is to derive Clawson-type demand curves using data on where hunters came from and costs of travel.[3] These data are analyzed to obtain a demand curve for elk.

Demand curves can be used to predict price-quantity relationships, responses to change in price, and total willingness to pay. The last item, total willingness to pay, can be used as an estimate of benefits in a benefit-cost analysis. (Clawson, 1972; Barkley and Seckler, 1972, pp. 161-163).[4]

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[3]The method in brief begins by defining hunts into zones of origin. The number of hunters in each zone is placed in proportion with the total population in each zone to derive the number of hunters per capita. As the distance increases, the cost of hunting also increases; hunters per thousand population decrease as expenses per hunter increase. Analysis of these data can yield a demand curve for elk.

[4]Alternative interview methods are compared to Clawson's method by Jack L. Knetsch and Robert K. Davis. See references.

Clawson's innovative work was applied to a park. An elk herd may be quite different because elk are usually produced on multiple-use lands and we may need to explicitly account for externalities between elk and other uses. One way of doing this is to simulate the ecosystem in which the elk lives by mathematical modeling techniques. The interrelationships between elk and roads and timber management and all other uses of the area are entered in quantitative terms. Eco-responses can be observed by manipulating the variables. Obviously, the better the data, the more useful the simulated results will be.

Ecosystem simulators can be combined with economic value terms (usually with time horizons). Optimization can yield estimates of both environmental and economic tradeoffs. For example, I participated in an interdisciplinary study of a watershed producing timber, deer, salmon spawning, municipal and industrial water, and magnificent recreation. A model simulating the relationships between these uses was combined with economic values to examine resource management decisions. Forest Service is implementing this same type of model under the name of Resource Capability System (RCS). One of the experimental sites is the Beaverhead Forest at Dillon, Montana.

Where does such a system get data on externalities? The bio-data must come from the physical scientists. At present, there are big gaps in the data, especially on game animals and hydrology. Economists are going to have to develop the value data.

Some value data can come from market prices but even these must be used with care. For example, stumpage prices are probably less than the real social value of stumpage because of the way publicly owned timber is marketed.

An alternative source of value data can be derived from what I will call a loss function. Suppose road construction degrades water quality. Further suppose the water is used for a municipality. Once the quality drops to a level that forces the municipality to clean it up, then a cost is incurred. This cost is a loss to the municipality which can be used as a value term even though it may not represent the willingness to pay for clean water.

Another type of pseudoprice can be defined by use of one of the economists' most powerful tools -- opportunity cost. Suppose you are considering alternate policies which affect some use that you just can't put a value on any other way. You can, however, estimate the effects of each policy and compare the two. The difference between the results is the opportunity cost. I used this technique to estimate the economic effects of eliminating the clearcutting of timber and satisfying the sustained yield policy.

Time horizons can be handled by estimating demands and supplies over time and using discounting techniques. This remains a troublesome factor when time horizons are very long, however, and sometimes the only way to preserve a choice for the future is to use strong government -- as we have for parks and wildlands.

Another approach to this whole problem circumvents the pseudoprice question to a degree. Input-output is an analytical tool which analyses the economic activity of an area in terms of dollar flows between economic activities. This method requires fairly complete data on the economic base of the area including how much is bought from and sold to each sector and by whom. This tool has its advantages and its limitations; the most serious limitation is not a weakness of the tool itself but is the frequent misuse of the results by non-economists.

One advantage of input-output is that the total effect of sectors can be measured. For example, the primary expenses for hunting can be multiplied by the appropriate multiplier to obtain the economic activity generated by hunting in an area. A recent example of this method and a description of limitations of the method is provided by Lovegrove and Rhody (See references).

SUMMARY

We have examined the problems encountered in economic analysis of non-market goods. We began by noting the increasing importance of non-market goods in our economy.

We departed from theoretical perfection into an imperfect world where prices may deviate significantly from social values.

Several cases were noted which cause markets to fail to do their job of efficient allocation of resources. Most of our attention was given to the problems of non-exclusive use of resources and externalities.

Several methods for dealing with these problems are suggested. Our goal is to identify useful pseudoprices for non-market effects including externalities. These methods include Clawson-type demand analysis, eco-system-economic models, loss functions, and input-output analysis.

I hope I have conveyed to you my feeling of optimism about this line of research. In closing, I note once more that bio-data requirements for further analysis exceed present knowledge, especially data describing relationships between major uses of multiple-use resources.

This is a brief overview of a large problem but I hope that it is of use to you.

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ADMINISTRATIVE REGION 1

Richard P. Weckwerth, Regional Game Manager

Region One is located in the northwest corner of the State with British Columbia to the north of us, Idaho to the west, Region 2 on the south and Region 4 to the east. The Flathead Indian Reservation and Glacier National Park lie within the Region but elk are not managed in either area. The Region is approximately 12,000 square miles in size and is approximately 85% heavily wooded. About 13-26 inches of rain falls annually.

Elk areas are at elevations from 2 to 7,000 feet. There are a few elk located in all hunting districts but the bulk of the harvest comes from Districts 12, 13, 14 and 15. Approximately 66% of the harvest is taken in these four hunting districts. The annual average harvest for the region is 2,100 elk.

We have no large state-owned game ranges but we do have a considerable amount of federal lands. The Flathead National Forest contains about 2-1/2 million acres, the Kootenai has 1.9 million acres.

I will now point out some of the elk ranges in the Region. (A number of slides of various hunting districts). This is hunting District 10 in the Fisher River portion of the Clark Fork Drainage. Here is another shot in Prospect Creek in the same area. Both are densely wooded. There are some open winter game ranges created by old forest fires. This is a shot of hunting District 14 winter range; the Hungry Horse Reservoir is in the background. This area was burned during a 1929 fire which created many of our elk winter ranges.

This slide is one of the few grass-type winter ranges in the region; it is located in the Middle Fork of the Flathead River. These ridges range in elevations from 5 to 7,000 feet. They all winter some elk. Snow depths on the average are quite deep but wind action keeps ridge tops quite bare. This picture is of a small grass winter range in the South Fork located at Basin Creek. This area is back in the Middle Fork. A small isolated band of elk winter on this range at an elevation of 7,000 feet. This area is completely surrounded by conifers; only wind action from east of the Continental Divide keeps the ridge snow free.

This shot was taken in the Black Bear Creek drainage of the South Fork in hunting district 150; the areas in the foreground are elk winter ranges. These areas have been invaded by conifers and have gone out of the picture for elk. This is true of much of the winter range in the Bob Marshall Wilderness. We haven't had any large fires for several years. The last fire of any consequence that was located near an elk winter range in the South or Middle Fork was the Tango fire in 1953. This slide of the area was taken in 1958, it is located on Big Salmon River and is still in the weed stage. This picture is one of

the major elk winter range areas in the Bob Marshall. It is near the mouth of the White River and takes in such drainages as Phil, Pine, Lewis and Woodfir. This area burned in 1910 and you can now see the invasion by conifers on portions of all these drainages. This conifer invasion is one of the most important problems facing us in elk management in the Bob Marshall Wilderness. This is a winter range on the lower South Fork above Hungry Horse dam, it is primarily a browse range. Maple, serviceberry, chokecherry, both species of *ceanothus* and some willow are the important browse plants. Most willow has practically gone out of the picture through succession, overbrowsing and their aged condition.

Region One has the lowest calf/cow ratio in Montana. The past heavy browse use started in the early 30's. There were severe winter die-offs of elk from the mouth of the White River to Cayuse Creek above Big Prairie, with estimates of approximately 600 dead elk in one spring.

Some of the problems we are facing in the management of elk in the Bob Marshall or hunting District 15, are related to logistics. Since 1966 we have been banned from flying into USFS air strips. The only way you can get in the area is by horseback travel or back packing. These horses consume a considerable amount of forage during the summer. People are using the area from the first of July until November 1 when the mountain passes are closed by snow. I would say that between private hunting parties, outfitters and other users, a considerable amount of elk food is consumed by horses. Even though we depend on these to get people in the area to harvest elk, they are a problem.

This slide is of a typical outfitter camp on the Little Salmon River. There are approximately 45 outfitters using the Bob Marshall last year. Hunters average 30% success on elk in the area as compared to 13 to 18% in the remainder of the Region. Approximately 3/4 of their clientele are non-residents.

Before 1966 we were able to do spring range work with a helicopter; now that we can't land in the area it makes getting calf/cow ratios difficult as we have to fly outside the wilderness to refuel. (Slide of very deep snow). Very little hunting is done under these conditions when elk would be easy to harvest. It is an early hunt from September 15 to the last of October.

Most of our range work is done in the summer through the use of horses. It takes at least 1-1/2 weeks to get a trip completed and much time is spent just getting to the area we wish to work.

Snow depths are also a problem. This slide is of the Danaher in a light snow year. This is from the same area during a heavy snow year with all the browse covered by snow.

Some of the other problems we have in the region are related to logging. The whole region is heavily logged. (Slide of shaded area within one mile of a road). This shaded portion is within a mile of a logging road.

You might say that most of the South Fork outside of the wilderness is readily accessible. We have too many roads. What the final outcome of this logging will be we don't know. (Several slides of areas and when they were cut). Clearcuts seem to take the area out of use for elk. The only use by elk are near the edges.

We also have a lot of roads. For example, the Kootenai Forest alone, which has about 3,200 miles of roads, has an ultimate objective of about 13,000 miles of new roads in the next few years.

Questions: Did you say the mountains won't allow you to make cow/calf classifications with a helicopter?

Answer : We can make cow/calf classifications with a helicopter, but we only have about 2½ hours flying time. Because the area is so far away we have to go out of the area to refuel to finish the area; it makes it a little bit tough. Especially with the type of flying conditions that we do have in the area. The cow/calf ratio work is mainly a - you only get one or two days a month when you can get in there to fly and we just make the best of it, although we would like to fly a lot more than we do.

ADMINISTRATIVE REGION 2

Reuel Janson, Regional Game Manager

Montana is divided into seven Fish and Game Administrative Regions. Region Two is a relatively small area of 10,000 square miles in the west-central part of the state. The annual elk harvest from this region ranges between 3,000 and 5,000. We have divided Region Two into four game management units: the Clark Fork, Blackfoot, Bitterroot and Deer Lodge. Physical and biological features differ among these units.

The Clark Fork Unit is the lowest, warmest, wettest and hence the most heavily timbered. Elk range in this unit occurs chiefly on areas burned by great forest fires between 1910 and 1920. Above 6,000 feet, timber regeneration is slow, giving the high ridges an alpine aspect, and providing good summer elk range. Old burns below 4,000 feet provide winter range. Evergreen ceanothus is perhaps the most important winter food plant for elk, white-tailed deer and mule deer.

Loss of range due to plant succession is the foremost problem in this unit. Tall browse plants such as willow have grown out of reach and conifers are taking over the openings.

Prescribed burning, or carefully planned clear-cutting with slash disposal by burning are possible methods of maintaining game range.

The Blackfoot Unit is higher and colder than the Clark Fork Unit, with more varied habitat types. Grizzly bear occur in the Lincoln-Scapegoat Wilderness in the northeast portion of this unit. Deer ranges have been chronically over-browsed, and heavy winter mortality of white-tailed deer occurs frequently. Both browse and grass winter elk ranges occur. Ovando Mountain is a browse type winter range created by a succession of forest fires. Mountain maple and serviceberry are important elk forage plants. There are many large grassy parks in the Blackfoot Unit which provide native bunch grass forage including rough fescue, Idaho fescue and bluebunch wheatgrass.

Some of the best elk range occurs on the Blackfoot-Clearwater Game Range, owned by the Department. This is a good rough fescue range. Deep, crusted snow at times prevents elk from using much of the grassland. During these periods they stay in the timber and feed on browse or paw for grasses under the trees. Winter elk numbers are relatively low, probably no more than 300-400 on 50,000 acres controlled by the Department. During the past few years hunting seasons have been shortened and the number of elk using the Game Range has increased.

The Bitterroot Unit is the best elk area in Region Two. The average annual elk harvest from this unit is about 1,400. Portions of two wilderness areas, plus other roadless areas provide a large summer and fall range. The Bitterroot Valley has a relatively mild, dry climate,

and winter elk range is chiefly bunch grass. There is also some bitterbrush, serviceberry and mountain mahogany. Elk probably compete with mule deer to some extent, but winter deer losses from malnutrition are rare.

Prior to 1970 most of the Bitterroot Unit was opened for either sex elk hunting in late September on a desired harvest basis, and the seasons sometimes ran into December. However, accelerated roading and logging made the area so accessible that the harvest quota in one area was obtained in three weeks in 1969 and public sentiment put a stop to early either sex seasons. Sights such as pick-up loads of harvested elk hastened the demise of the early elk season. However, we still use a harvest quota and last fall (1972) the season ran from October 22 to December 3 for either sex elk. Logging practices in the Bitterroot have attracted national attention. Large terraced clearcuts fostered public indignation. The effects on elk are not well known, but it is suspected the greatest impact is the esthetic effect on people.

The Deer Lodge Unit has the best elk winter range potential of the four management units. The climate is relatively dry so that snow depths are seldom excessive on the winter range, and there are extensive grasslands in the foothill zone. There are also several mountain ranges providing summer and fall range. However the large open areas and many jeep roads make elk very vulnerable, and this has held down the population. Conflict between elk and ranching has also discouraged high elk populations. Recently hunting seasons have been reduced to bulls only, or short either sex seasons in portions of this unit, and there is evidence that elk are increasing. The Deer Lodge National Forest has excelled in size of clearcuts - 300 to 600 acre cuts are not uncommon.

Accelerated roading and logging on National Forest lands in all management units has caused concern about the effects on elk populations. We have observed apparent declines in elk numbers in newly-logged areas, so have urged safeguards to protect elk. The increased hunting access provided by logging roads appears to be the most detrimental feature of logging. Where protective timber cover is already scarce, logging would also be detrimental by reducing cover.

West Central Montana was formerly regarded as a relatively wild region with vast roadless areas. In 1970, I plotted the area lying within one mile of a road on a map of Region Two. The results show that only 25 percent of the area remained more than one mile from a road, and this percentage has been further reduced in the past two years. The effect on elk hunting has been a considerable reduction in the length of either sex elk seasons in the Region, thereby reducing the recreational potential.

Another threat to elk populations are housing developments. Some winter range areas are being invaded by real estate subdivisions. The disturbance caused by the activities of people and their pets, as well as taking these areas out of forage production, will probably result in fewer elk.

There will probably continue to be adequate summer range in wilderness and back-country areas, but the already limited winter range will continue to suffer from the onslaughts of civilization.

Question: About when were the two pictures taken of the terraces that were shown?

Answer: That was in 1966. I don't have any recent ones of the terraces.

Question: What types of vegetation now occupy those sites and are elk using these areas?

Answer: The elk are using them to some extent. There hasn't been a real good vegetative response. Some of them are still occupied by weedy vegetation. There is some grass coming in on some, but very little browse.

ADMINISTRATIVE REGION 3.

John Ormiston, Acting Regional Game Manager

Region 3 is in southwestern Montana and is probably the leading elk producer in years Region 2 is not. Elk winter ranges in Region 3 are of wide variety. Elk here are primarily grazers and winter ranges are primarily windblown or low elevation snow-free ridges, although some elk winter in areas of deep snow. Most elk winter ranges in the Region are in relatively good condition.

The Fish and Game Department has purchased six winter game ranges in Region 3. Our newest acquisition is the Blacktail Game Range near Dillon. We own two Game Ranges on the Upper Madison River, Madison Wall Creek and Madison Bear Creek. Porcupine Game Range is in the Gallatin drainage just outside Yellowstone National Park. Fleecer Mountain Game Range is southwest of Butte and Bull Mountain Game Range, a relatively small area, is north of Whitehall. All of the game ranges are located in foothill situations with only Porcupine Game Range receiving snow in excess of three feet on the level.

Elk summer ranges are typically scattered timber, open park situations with lush meadows and dense timber interspersed. Isolated high basins are favorite summering areas, as are dry parks surrounded by dense timber. Since elk east of the Divide are primarily grazers, they compete directly with cattle for forage on both summer and winter ranges. Heavy cattle use in summer may remove most or all the forage from elk winter range and can reduce forage available for elk in summer and fall.

Timber harvest east of the Continental Divide is mostly in elk summer ranges and has not enhanced elk habitat. The physical removal of timber and the resultant change in habitat may or may not be detrimental to elk populations, but I do not think it has been beneficial. Roads and resultant hunter improved access has certainly had a harassing effect on elk, and have been directly responsible for shorter, more restrictive seasons.

People are a part of the problem, as well as part of the solution. We need people to encourage good land management; land, after all, is the basic resource. Satisfied hunters help, and our philosophy is not to let nature take her toll, but to put the animals in the hunters bag.

Region 3 has more either-sex elk permit areas than the rest of the state. We are blessed with good access and quite a few people. Elk, of course, attract people, particularly hunters. In order to achieve a sustained high yield we have initiated bull only seasons with a specified number of either-sex permits.

In order to limit access and hopefully to extend seasons we have worked with the Forest Service to close roads in several highly accessible areas.

It appears this may have been successful in spreading the total harvest more evenly over the entire hunting season.

We have done considerable work with the Forest Service to try to improve range conditions, with primary emphasis on elk winter ranges. We have also worked with the Forest Service to try to minimize detrimental effects of timber harvest on elk. This includes things like closing roads, adjusting sizes of clearcuts and altering cutting unit patterns.

Questions:

1. Q. What are some of the habitat improvements you have accomplished through cooperation with the Forest Service?

   A. Our habitat improvement work does not involve burning, plowing or physical improvements. We try to work with cattle numbers, season of use, rest rotation systems, fencing, etcetra.

2. Q. Would that be on summer or winter ranges?

   A. Both. We have found that elk don't associate with cattle when they have a choice; that is, they don't get along socially.

3. Q. You mentioned that logging east of the Divide was not beneficial to elk populations. Do you have any information that would indicate that logging is detrimental to elk?

   A. We do know it is detrimental in some specific drainages. For instance, in Upper Jerry Creek there was a fairly extensive clearcut. In fact, about 18% of the drainage was cut. It formerly was a relatively inaccessible area and fairly heavily timbered. Past records indicate a sizable number of elk were harvested in the drainage prior to the timber sale. Virtually no animals are harvested there now, primarily because they are harassed out of the area because of increased access and lack of cover.

4. Q. Do you have any indication that rest rotation is either beneficial or detrimental to elk on summer ranges?

   A. No. Rest rotation, if it is used as Hormay describes it, to build vegetation in a manner in which you want to build it, can certainly be beneficial. I know a place where it was detrimental for at least one year. All the elk winter range in a particular allotment

was grazed heavily because all the elk winter range was in one pasture. If the system is properly applied and administered, there is no reason it cannot be beneficial.

5. Q. What per-acre rates were you having to give for the winter ranges that you are acquiring?

   A. Usually more than the market value of the land as range land. However, Federal Aid (P-R) will supply matching funds for only the appraised value. Anything above the appraised value must be State funds. The value of a piece of land may be higher as elk winter range than as dry cattle range. Therefore, the price paid may be somewhat higher than the market value, but is nevertheless, the going price for elk winter range.

ADMINISTRATIVE REGION 4

Jim Mitchell, Regional Game Manager

I think the general aspects of Region Four were pretty well covered in the previous discussion, so I will spend my allotted time discussing the three Department owned game management areas located in the Region, namely the Sun River Game Range, the Judith River Game Range and the newly acquired Beartooth Game Range. All three were purchased primarily as elk winter ranges.

Sun River Game Range

This 20,000 acre unit is situated in the foothills of the Rocky Mountains approximately 15 miles north and west of Augusta, Montana, which in turn is about 50 miles west of Great Falls, the Regional Headquarters. The typical habitat is mostly flat grassland types grading into rolling foothills, grasslands interspersed with timber and thence on to the abrupt reef (Sawtooth) west of the range. The range abuts the U. S. Forest Service boundary to the west which is near the top of the Sawtooth Reef.

This range offers elk almost a strictly grass-type diet. There are browse species on the range, but these are used primarily by the large, migratory deer herd. As with most land acquisitions for elk range, the vegetation was in pretty poor shape when we got it, but the vegetative condition has vastly improved and now offers a good condition grass range for the elk with the associated variety of species. The fescues, Idaho and Rough, along with bluebunch wheatgrass are the primary grass species found in the range. On the average, about 1,500 elk winter here annually. The number is dependent on the weather with more elk under severe weather conditions. It is felt more elk could be wintered here successfully but range conditions in the back country and distribution problems create conditions we have not been able to overcome as yet. We are working on the problem.

Strong downslope winds are very common in the area, making for an ideal wintering condition. The winds do not normally allow a continuous snow cover to persist for over a few days, thus the vegetation is available.

We have had a problem in the total area since 1913 when the state legislature created the Sun River Game Preserve located about 20 miles west of the Game Range. It's a "Yellowstone Park" in our midst with all of the associated problems. A major part of the elk herd in the Sun River area summers in this 200,000 acre Preserve area. They refuse to come out in the fall until weather pushes them out with the obvious result. That is--abused vegetative (primarily grass)

ranges along the line (North and South Forks of Sun River) between the Preserve and the open area. The elk stay on one side and peer across at the hunter who is across the river looking back. We have had unsuccessful runs at getting rid of the Preserve since shortly after its creation but to no avail.

The Preserve area is mostly covered by evergreen timber. Shortly after the major fires in 1910 and 1919, a large portion of the area was open and afforded good habitat and forage.

In fall during the hunting season, large numbers of hunters' horses eat forage outside the Preserve area along the North Fork of the Sun River that the elk should be eating. The ensuing firing line situations, created when the elk are forced from the Preserve by weather, are dangerous. Fortunately, no one has been killed as yet.

We are currently holding the total Sun River elk herd at about 2,500 head and have an annual quota of cows and calves. The quota is set annually depending upon elk production and survival rates, range conditions, etc. We maintain a 24-hour checking station in the area to monitor the harvest to keep as close to the pre-set quota as possible.

Beartooth Game Range

This 32,000 acre area was acquired in 1970 and is approximately 50 miles south and west of Great Falls. The range condition at present is generally poor in the lower elevations but grades into better condition grass ranges higher up on the slopes where the previous owners had trouble keeping the livestock. The area is quite ideal for elk winter range with its fairly steep grassy slopes interspersed with evergreen timber areas and creek bottoms that afford cover. The major grass species are again Idaho and Rough fescue and bluebunch wheatgrass.

The area abuts the U. S. Forest Service which lies to the south. A small wilderness area (Gates of the Mountains) is located here. Portions of the herd summer in the Wilderness Area; some also summer on the Game Range.

We are currently in the midst of determining the carrying capacity of the range for elk through the use of utilization transects and agronomy cages as well as determining elk distribution to better manage the herd. We have transects to determine grass condition and trend, also.

Currently, only bulls are hunted in the area on a general season basis, but we anticipate implementing a permit season shortly.

Fortunately this area isn't a heavy snow area and much of the vegetation is available to elk almost every year.

There is also quite a bit of browse for the deer population in the area; Skunkbrush is the major browse species found in the area.

Judith River Game Range

The third and last major elk wintering land acquisition in Region Four is the Judith River Game Range. It is located approximately 70 miles south and east of Great Falls in the foothills of the Little Belt Mountains. It also abuts the U. S. Forest Service. It is primarily a rolling grassland interspersed with small pockets and fingers of evergreen timber. The timber doesn't afford adequate cover at most times and the elk normally move to areas off the range, moving back to feed. This is especially true during the hunting season when weather pushes the elk down from their back country haunts. They will move onto the range at night to feed and move off the following morning by their own volition or through hunter pressure. At times quite a few elk are harvested on the range.

We are currently in the process of plowing up several smooth brome patches and converting them to more desirable species of selected grasses. Small grains are planted in the interim and afford a very desirable food for the elk. The elk do not seem to like smooth brome for food, especially when it has been standing for several years. We have been getting some use on it by mowing and providing current vegetation, but other grass species appear to be much more suitable.

A major problem exists on the range. There is a mine ownership (sapphires) right down the middle of our holdings along with a county road. Year-long activity at the mine (sometimes 24 hours a day) and along the county road prevents good elk distribution, resulting in some parts used hardly at all. We have not come up with a solution to this dilemma as yet. Added land acquisition to the north would help greatly, but the landowners currently are not in a selling or trading mood.

About 800-1,000 elk winter on and immediately adjacent to this 6,000 acre area. We may have to decrease that number unless a solution is found to the elk distribution problem noted above.

Question: How far back does mining activity push the elk?

Answer : Not far. They just move back onto the burned mountain you noted in one of the slides or onto other adjoining timbered area. A mile or two. The county road not only allows miner travel but also any number of sight-seers. The road and the mine drastically curtail movement from the north side of the range and its associated cover areas to the south side with the poorer cover areas.

Question: What grasses are you putting in to replace the brome?

Answer : (By Judith River Game Range Manager) I went through quite a few grasses. I found some that

were somewhat desirable such as the native grasses - rough fescue and Idaho fescue, but it was very difficult to find seed and they were hard to establish. I finally decided I may be overlooking the obvious and got some orchard grass. The elk really liked it, so I've been seeding a mixture of orchard and green needle grass.

Question: Have you noticed any use of the bluegrass? (Directed at Judith River Game Range Manager)

Answer : Yes, there is some use, but they seem to prefer orchard grass. The rainfall is about 15 inches annually which is a little on the light side for orchard grass. It grows up to about a foot high and stays green the year around.

Comment : (By Game Manager)
Incidentally, Bob Varner, Judith River Game Range Manager, uses small grains for a cover crop rather than leaving the land fallow and the elk seem to relish the barley and oats about as much as anything, don't they Bob?

Bob : Yes. They work it over very thoroughly.

ADMINISTRATIVE REGION 5

Buck Compton, Regional Game Manager

Region 5 comprises about 16,500 square miles in south central Montana. Elk locations in the region are associated with a number of isolated to semi-isolated mountain ranges: the Beartooth-Absaroka, the Crazys, the Little Belts, the Bulls and the Pryors.

Region 5 does not produce a large number of elk and subsequently we only harvest in the neighborhood of 230 to 250 elk per year. However, we do winter one of the largest elk herds in the state. I will go into this a little bit later.

Many of the manageable herds in the region are small and relatively static. Habitat limitation is the primary reason the herds remain small. Much of the elk range is in rugged, recently formed mountains with few south slopes. Winter ranges are mostly on limited north exposures and the terrain graduates rapidly onto private lands, which is a limitation by itself.

The habitat limitations placed upon these isolated herds have allowed us to pretty well delineate summer and winter ranges. I'll talk briefly about each herd complex. In the Stillwater-Boulder Complex there are five major wintering areas with their associated summer ranges. One is the Mt. Greeley area between Big Timber and Livingston. Elk from this winter herd summer across the mountain above Livingston in Region 3. Between the Main Boulder and West Boulder Rivers is the McLeod Basin winter range. Elk in this herd summer on the West Boulder Plateau at about 10,000 feet. The third winter range is Suzy Creek on the East Boulder Drainage. Elk from this area pull up through the high sagebrush parks, where they calve, and on up to the East Boulder high country for the summer. The Main Boulder River Canyon winters a sizable number of elk in small isolated parks amidst heavy timber. This is a tough wintering area because it is a heavy snow zone and open areas are limited. Different from the grass winter ranges already mentioned, the Main Boulder is a combination grass-browse range. Elk from this area go two ways to summer. On the west side they move up onto Carbonate Mountain and the plateau between the Main and West Boulder. On the east side they pull up onto Placer Basin on the Stillwater-Boulder River divide. Domestic sheep have provided some complications on the Main Boulder. Traditionally, sheep have been trailed up the drainage to and from the high country. The small parks, elk winter range, have been virtually grazed to the ground twice a year. Two years ago the U. S. Forest Service fenced several of these little parks. This has helped tremendously in leaving feed for winter elk use. The last winter range in this complex is Horseman Flats on the Stillwater River. Elk from Horseman Flats share the Placer Basin summer range with those from the Main Boulder. Another complicating problem exists in the Placer Basin-Horseman Flats-Boulder relationship -

this being a huge mineral seam running across the Upper Stillwater, Placer Basin and down into the Main Boulder. In places it is several miles wide. This area has been explored and mined to differing degrees for many years. However, within the last four to five years copper, nickel and particularly chrome have become valuable. Exploration has picked up and mineral extraction in volume is pending. The seam bisects fragile high country. Discovery pits and other soil disturbance, noise - any number of mining-associated factors - will have an effect on elk. This is of major concern and the Department has two biologists studying relationships at present. Elk are being trapped, marked and radioed for distribution and movement information.

The second herd complex is above the city of Red Lodge in the Beartooth Range, noted for the Beartooth Highway to Yellowstone Park, and Granite Peak, highest point in Montana. In this complex there are three main winter ranges, all distinct but associated to some degree in summer. Two of the areas, Main Rock Creek and West Fork of Rock Creek, are in heavy snow country. Elk winter on high, long-sloping hillsides and small parks. The terrain is rugged. Range condition generally remains good to excellent. Elk from these winter ranges summer in high country bordering and below alpine plateaus. Around the mountain east from Red Lodge on the Clarks Fork side and butting up against Wyoming is the Line Creek winter range. This is rain shadow country and it is usually dry and snow-free. Elk winter on long, grassy south exposures. In summer they move up through the timber zone and spend their time on and bordering the Beartooth and Line Creek Plateaus.

Across the Clarks Fork Valley, eastward from Line Creek, is the isolated Pryor Mountains. This is a unique area, graduating rapidly and in a short distance from Utah juniper desert up to alpine and subalpine. This is the home of the infamous Pryor Mountains wild horse herd. Other complications come under the heading of administration. Besides the Montana Department of Fish and Game, agencies with their hands in the administrative pie here include: Bureau of Land Management, U. S. Forest Service, National Park Service, Bureau of Indian Affairs, Bureau of Reclamation and the Crow Indian Tribe. We are hunting elk here for the first time this fall, with permits.

I mentioned earlier that Region 5 winters one of the largest herds in Montana. These are found east of the Pryors and across Bighorn Lake (Yellowtail Reservoir) on Crow tribal lands. These animals, 2,000-5,000 head, are in Montana in winter and in Wyoming's Bighorn Mountains in summer. We winter them and Wyoming shoots them. The elk season is closed on the Crow Reservation.

Elk in the Crazy Mountains, north and west of the Absaroka-Beartooth area, are concentrated primarily in the north end of the range. They winter and summer here with reports of some summer movement into the Castle Mountains in Region 4. Movement information is needed here and we have a trapping and marking project planned.

The next area, the Little Belt Mountains, is the most important in Region 5, elk number-wise. The Little Belts encompass a large land

mass and several important winter ranges are recognized. One of these is on the south side and falls within Region 5. Along the south face, we winter about 500-600 head on long, grassy, foothill slopes. In summer they move back into the higher country, mostly in Region 4. Cattle competition has been and still is a problem on the South Little Belt Mountains winter range. This area is also the location of the Haymaker Game Range, encompassing about 1,500 acres and purchased by the Department several years ago as an elk range. There is little elk use on this range as it is below the main foothill wintering area.

The last elk area is the Bull Mountains. This is located further east and is typically dry, open ponderosa pine hill country. We have 80-100 head here, in primarily a private land situation. The landowners either like the elk or hate them. We're going to try a permit archery season this year.

General season elk hunting in Region 5 has been primarily antlered bulls with some either-sex permits. We've also had a one-week general either-sex season for several years in the Boulder.

Question: Do you have any difficulty wintering elk in your region and having other regions harvesting them? Is there any lack of coordination or difference of opinion?

Answer : There are some problems, but they are usually resolved quite easily.

ADMINISTRATIVE REGION 6

Richard Trueblood, Regional Game Manager

Region 6 is located in the northcentral part of the state. There are small herds of elk in the two isolated mountain ranges in this region - one in the Bear Paw Mountains and the other in the Little Rockies, but these have never flourished, mainly because they are on or adjacent to Indian Reservations. The herd of elk I'll be talking about numbers 5-600 head and occupies the breaks of the Missouri River above Fort Peck Dam.

Most of this herd ranges within the Charles M. Russell National Wildlife Range. CMR itself contains over 900,000 acres, most of it potential elk range and there is probably an equal amount adjoining the Wildlife Range and upriver from it. However, the present range encompasses about 300,000 acres (roughly 500 square miles).

When CMR was established, jurisdiction over wildlife was given to the Fish and Wildlife Service, but the area was also to be managed for livestock grazing under the Bureau of Land Management. This joint administration has created conflict and problems. For example, the BLM has set up several rest-rotation grazing systems in CMR and no one knows just what effects this will have on wildlife, notably elk.

The elk herd here occupies historic range, reminding us that the elk in Montana was also a plains animal. Lewis and Clark first encountered elk while they were coming up the Missouri River in 1804 in what is now North Dakota. Their journals make frequent mention of elk throughout this portion of the Missouri River Breaks. Elk were still present until around 1905, according to our best information. We re-introduced them to the Breaks in a series of four transplants from the Northern Yellowstone herd in 1951 and 1952.

The elk habitat consists of four main vegetation types. The *Pinus-Juniperus* is by far the largest, making up at least 60 percent of the area. Next in importance is the *Artemisia-Agropyron* type, comprising perhaps 30 percent. The *Populus-Salix* type on the river bottom makes up most of the remainder. There is also a small amount of the *Psuedotsuga-Juniperus* type and the *Sarcobatus-Agropyron* type. Elk use all of these types freely, depending on available forage; this in turn depends on livestock use. Mackie, in his study of elk, deer, and cattle relationships in this area of the Breaks, found that elk sought out areas of light, prior use by cattle; rapid and extensive movements by elk occurred at all seasons.

Topography generally does not restrict movement of elk in the Breaks, except in some extremely steep and broken country in the central part of the range. Also, deep snow has never been known to restrict movement, unlike some of our mountain herds. Maybe this is one explanation

of why the area was apparently so well-suited to elk in earlier times. For whatever the reason, the extreme mobility of the elk definitely enables them to adjust rapidly to environmental changes and constantly utilize the most favorable portions of the range.

Pre-season data on sex and age composition show that the CMR herd has a high reproductive rate. Out of 16 yearling reproductive tracts we have collected the past four years, 13 (81%) contained fetuses. Of the total of 62 reproductive tracts collected, three sets of twins were found.

Hunting, except for archery, is by limited permit only. During the first few years of hunting, a number of trophy-class bulls were taken, including one that would rate 6th or 7th in Boone & Crockett record book. In more recent years, as we have increased our permits, the trophy-class bulls have been almost completely removed, and we have not had one reported in about 10 years. One possible remedy would be to set aside a portion of the Breaks for mostly antlerless permits, giving some bulls a chance to produce a set of trophy antlers.

Much of the open pine type is very accessible to the hunter, allowing him to be as selective as he wishes. Obviously, such is the case, considering that hunter success has averaged a little over 70 percent.

Four-wheeled drive vehicles can drive almost any place in the Breaks. Recently the Bureau of Sport Fisheries and Wildlife has instituted off-road travel restrictions, but these are proving difficult to enforce. Harassment by hunters, apparently to the point of causing permanent shifting of elk into rougher and more remote parts of the Breaks, has definitely become a problem in the management of this elk herd.

By any standards, the hunting here can be very unsporting. In one case, permit holders surrounded a small herd of elk in stubble fields just outside the Wildlife Range, shot the entire bunch, and simply drove over and loaded them into their pickups.

Archery hunting has become more popular each year since it was first allowed in 1965. Our 1971 statewide harvest analysis indicates that this area attracted almost one-third of the state's archers (an estimated 650) and they harvested about half the elk killed by archers in Montana (an estimated 29). So the elk here have proven to be more vulnerable to the bowmen as well as to the gun hunters; and some bow-hunters very quickly found a way to make even that sport less sporting. This was by using horses to drive the elk out of the small timbered coulees and onto the flat prairie ridges where they could run them down with relays of fresh horses "pony express style". It got so bad that our Commission had to pass a special regulation making it unlawful for archers to kill or harass elk while "riding any livestock".

ADMINISTRATIVE REGION 7.

Neil Martin, Regional Game Manager

My comments concern Region 7, an area encompassing approximately 30,000 square miles of southeastern Montana. Characteristic are the limited number of people (fewer than in Billings), wide variety of topographic and vegetative types and interspersed private and public lands. Few elk occur in the region although sizeable areas of suitable habitat exist. Occasionally elk are reported in the Missouri River Breaks south of Fort Peck Reservoir or in the rough timbered terrain along the Montana-Wyoming border. The Department has discouraged introduction and establishment of elk for two reasons. First, the region lacks large uninhabited blocks of public domain; consequently, the potential for every possible problem associated with elk and their damage to private property exists. Since the principle stable economy of the region is livestock grazing, competition from an additional large herbivore such as elk is undesirable to many landowners. Secondly, southeastern Montana is the finest "deer factory" in the state. To illustrate, in 1972 all hunting districts in Region 7 were open to residents for hunting of two deer either sex-either species, except one which was two either sex whitetails. Non-residents purchasing the $151.00 license were afforded like privileges; 9,500, $35.00 non-resident permits for one deer were also issued. The region is a deer producer and that is what we as game managers intend to manage it for, without interference from elk. Thank you.

A QUALITY LIFE IN IDAHO

by

Dr. Richard Knight[1]

About 2 years ago Maurice Hornocker and I sent out a questionnaire to people in Idaho to find out their idea of a quality life. Two thousand names were chosen by computer from the state motor vehicle registration list. Questionnaires were sent to selected persons asking them to list what they considered the two greatest advantages and two greatest disadvantages of living in Idaho. They were also asked their age, occupation, if they were native to Idaho, the size of the town where they lived and if they intended to stay in Idaho.

Over 500 people responded to the questionnaire. Distribution by counties was excellent with only Clark and Owyhee counties not represented. Otherwise the percentage of returns from the various counties closely followed the percentages of the population for each county as shown by the 1970 census. Age of respondents ranged from 17 to 87 with only 18, 20, 79 and 84 year-olds not represented between the two extremes. Thirty-five percent of the sample came from towns over 10,000 in population, 28 percent came from the country, 24 percent from medium sized towns (1,000 to 10,000) and 13 percent came from small towns (under 1,000). Forty-three percent of the respondents were born in Idaho, 40 percent had moved here as adults and 17 percent had moved here as children. The most prevalent occupation among respondents was labor at 20 percent followed by farmers (18 percent), technician (14 percent), office workers (12 percent), professional (11 percent), non-categorized (7 percent), merchandizers (5 percent), other businessmen (5 percent) and housewives (4 percent). Four percent did not indicate any occupation.

Low population was the number one advantage mentioned by the most people with climate and outdoor recreation tying for second place. If scenery and hunting and fishing had been included in the outdoor recreation category, it would have been the first choice with 34.8 percent of the people listing it as their first advantage and 37.7 percent of the people listing it as their second advantage. There was little difference of opinion among occupations as to the greatest advantage of living there. All but laborers, housewives, and non-categorized occupations had the highest number of respondents listing few people as an advantage. Laborers preferred the hunting and fishing, housewives were split on climate and environment and non-categorized occupations were most enthusiastic about the climate. There was a difference of opinion on the most important advantage between natives and non-natives. Those people born in Idaho thought that few people was the greatest advantage while those who had moved there either as children or adults favored climate as their first choice. There was

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also a difference of opinion according to the size of town the respondents lived in--those living in the country and in large towns gave their vote to few people while those living in small and medium size towns thought that outdoor recreation was the greatest advantage.

Environment was a popular choice in the general sample and in all classifications of respondents. This category really encompasses all other categories and probably reflects some indecision on the part of those listing it as to what the greatest advantages really are. We would have to conclude that persons listing environment as their first choice just like it there for no particular reason, or for lots of equally important reasons.

It is clear that the people of Idaho prefer their outdoor living without congestion, but could it be better? Not much, apparently. When asked to list disadvantages, 17 percent of the sample couldn't think of any and another 17 percent could think of only one. The single major dissatisfaction was low wages and there was some disagreement among occupations on that. Farmers and businessmen were not very concerned over low wages while it was the major concern of laborers, office workers and technicians. Professional people were split between low wages and distance from cultural centers, merchants also thought that distance from cultural centers was the main disadvantage, and the greatest disadvantage category chosen by all other occupations was none. Both natives and immigrants and people from all sizes of towns were in agreement that there are few disadvantages other than low wages. Most of the minor disadvantages might be classified as "pet peeves" shared by several people. Only educational facilities, inadequate transportation, distance from cultural centers, and poor employment opportunities seemed of major concern.

Question: What were the disadvantages?

Answer: The biggest thing was low wages at 18 percent and 17 percent couldn't think of any disadvantages. Then we ranged from a lot of miscellaneous things like poor transportation, distance from cultural centers, poor state government to quite a hodge podge of stuff. Incidentally, a good state government was only 0.2 percent of the people in the advantage category.

Question: You had 73 percent that were non-respondent; were these not content, or what?

Answer: I don't know what it was. We were on a limited budget; in fact, we kind of moon lighted the whole project. We couldn't send out a follow-up questionnaire. I throw away many questionnaires I receive in the mail; I don't think I have answered one in 2 or 3 years now. I think a lot of people get fed up with this questionnaire business.

THE MEASUREMENT OF HUNTING QUALITY

By
Dr. Harold Picton[1]

When we talk about quality I find myself agreeing with previous speakers that some hunters like scotch and champagne and others like beer. There is a large variety of opinion as to what constitutes quality. John Ormiston presented some information dealing with this facet which came from the Butte hunters.

A member of our Big Sky study team,[2] which is an inter-disciplinary study team with 20 different disciplines represented, conducted a survey of some of the hunters. I would like to talk a little bit about Anne Williams' data which was derived from 270 questionnaires returned by hunters. It was rather a thick questionnaire and was passed out at a hunting checking station; the hunters were permitted to take them home and either forget about them or send them back. One of the questions on it was directed towards why people hunted. Seventy-eight percent of them said that they hunted to gain outdoor recreational experience. Seventy-three percent said to obtain meat. Of course, we've got a lot of hungry students here in Bozeman so we certainly have our share of meat hunters. Sixty-seven percent said they were hunting for the challenge or the sport. They were also asked the question: What makes up a good hunt? Sixty-nine percent said seeing lots of game was of prime importance; seventy percent listed actually killing an animal of good quality; sixty-one percent listed avoidance of other hunting parties as being important; and sixty-one percent also listed good companionship. When Anne analyzed this information she came to the conclusion that when you evaluate hunting success or the quality of a hunting experience you can pretty well break the aspects of hunting quality into three categories. One are those things that are related to the actual animal itself. That is, whether you get your animal or not - hunting success. Second are those aspects which are related to the quality of the outdoor environment - scenery, and so on. Many of the hunters said they hunted in the Gallatin area because of the scenery. The third category that Anne set up was related to what might be called social related qualities such as companionship and things that go along with it; drinking companions and so on. This information was derived from a sample of hunters primarily from the Gallatin Valley and represent pretty much a cross section of the male population of the Gallatin Valley. Like John Ormiston mentioned, we don't really have any information on the hunters that went to outfitters because they typically do not stop at the voluntary check stations operated by the Fish and Game Department.

Anne has attempted to combine these three aspects of hunting into what she is going to call a hunters' satisfaction index, but has run into some temporary mathematical difficulties. Incidentally, under the terms

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[1]Associate Professor of Zoology, Montana State Univ., Bozeman.

[2]This research was conducted under National Science Foundation Grant GI29908X.

of our grant from the NSF, we are obligated to come up with these indices if we can because presumably these indices can be used in other areas. We are supposed to expend quite a bit of effort on development of indices and building models so that our information is transferable.

Quite independently, at least at this phase of Anne's investigation, I came to the conclusion that if we are going to measure the impact of a recreation development on an area, you should get some handle on the quality aspects. I was not so concerned about getting things precise, only "close enough for management" purposes. The assumption that I based my efforts on is that one can describe quality, or at least a reasonable facsimile of quality, by taking into consideration several things. One of these is hunting success. Two, the area of huntable habitat which is available for hunters. Three, the number of hunters, and four, the length of the season. I worked out a formula which I tentatively called the hunting quality index (see appendix) in which I combined these aspects. Of course, all of these are based upon routine management information. By this, I mean that Fish and Game mail surveys can give you the number of hunters and you can get the area in square miles from the map and the length of season from the hunter regulations. I have applied this to the Gallatin. The hunting in 1971-72 rates at about ninety-eight percent of the quality index for 1962. So far there does not appear to have been a substantial change in hunting quality. However, if you project the index ahead and, subject to all the problems in making projections, it appears that by 1985 this quality index will probably drop to perhaps 40 to 50 percent of the 1962 level.

This, then, is an indirect index. It is not a direct opinion measure of what people think about quality; it is an indirect look at the environment that we are providing for the hunter. This index does include a couple of things which Anne, working independently, found to be important. These are the animal related qualities, and to some extent, the outdoor related qualities. The pleasant companionship aspect is not included in this index. It summarizes those aspects of hunting quality which are subject to modification by managers.

One thing that can be done with this index is to convert it to an index of wilderness hunting opportunityif this is what one is particularly interested in offering. This is done by determining the percentage of the hunting area which is roadless and multiplying that times the original. One of the problems with indices is that eventually you are compelled to establish its validity. Although this index seems sort of rational to me, it may not be to someone else. About the only information that we have analyzed so far concerning the validity of this index was obtained by comparing the indices computed for the three elk seasons which were held in the Gallatin in 1971-72 and comparing them against the spontaneous comments that people wrote on the questionnaires which were handed out (at that time I was conducting an economic survey and the questionnaire had space for comments by the hunters). The three seasons which we had in 1971-72 included an early bull season in September, a regular hunting season in October and November and then the special elk season

in December and January. The number of the ratio of favorable to unfavorable comments which I received on the economic questionnaire correlated well with the calculated hunting index. The correlation between the independently arrived-at conclusions of Anne Williams and myself tends to support the validity of the index described

APPENDIX

Hunting Season Quality

The quality of life and of hunting is a major concern of the hunting public (Knight and Hornocker, 1971). Therefore, an attempt has been made to provide a numerical index to the basic aesthetic qualities believed to be important in hunting.

This index can be expressed as follows:

(DSI) (HAI) (HSR) = Hunting Quality Index, where

DSI = Demand Supply Index. This is an expression of the assumption that the demand for hunting a game species in a given area is dependent upon the rarity of the species, the hunting population to draw from and the hunting success. The number of hunters is assumed to be self-regulating with respect to a minimum tolerable success level which differs for different species. The highest possible success is 100%; therefore, the maximum demand is 100. Assuming that self regulation of hunting level is reflected in a minimum success level, then the maximum tolerable proportion of the number of unsuccessful hunters = (100 - % success) = unfulfilled demand.

Low success is more tolerable with a short season than a long one; therefore, unfulfilled demand should be divided by season length. If the season is a special permit season, success percentage is computed on the basis of the number of applicants. Thus, in a special permit season, the DSI success differs from the success percentage used in the HSR. If a term is zero it is dropped out of the equation. The demand-supply index is computed as follows:

$$\frac{100 - \%\ \text{success}}{\text{Hunting season length in days}} = \text{DSI}$$

HAI = Hunter Area Index. This is an expression of the amount of huntable terrain available for each hunter. The area is adjusted for weather conditions and the actual habitat of the animal.

$$\frac{\text{Square miles huntable habitat}}{\text{Number hunters/season length in days}} = \text{HAI}$$

HSR = Hunter Success Ratio. This is the ratio of success during the current hunting season with the minimum tolerable level of success for that species. Information furnished by the Montana Fish and Game Department suggested to me that an 8% success level appeared to be the minimum tolerated by hunters for both sheep and elk over periods of two or more years.

WHQI = Wilderness Hunting Quality Index. This is determined by multiplying the HQI by the percentage of roadless huntable sections in the hunting area.

Table 1. Hunting Quality Indices for several Gallatin Canyon big game hunts.

Season	HQI	WHQI
Composite of 1967 & 1968 Unlimited Big Horn Sheep Hunt	211	182
1971 Early "Bugling Bull" Elk Hunt (West Fork)	97	71
1971 Regular Big Game Season[1]	14	11
1972 Special Permit Elk Hunt[2]	137	111

[1]1970 data for outfitter hunters was combined with 1971 data for non-outfitter hunters.
[2]Estimated from data for the first half of the season.

These hunting quality indices can be compared with the percentage of hunters spontaneously making either positive or negative comments about the hunting season on the economic questionnaire sheets (Table 2). The discrepancy between the early bull elk season HQI and the comment rate may be due to higher expectations of a quality hunt for this type of season.

Table 2. A summary of the spontaneous comments made by hunters during several 1971 Gallatin big game seasons.

Season	Number of Questionnaires	Comment Rate[1]
Early Bull Elk Season	58	-29.3%
Regular Big Game Season	407	- 8.9%
Special Permit Season	66	+ 7.6%

[1]The comment rate was computed as follows:

$$\frac{\text{Favorable comments - negative comments}}{\text{Number of questionnaires}} = \text{Comment rate}$$

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HUNTING QUALITY AND THE AREA 319 HUNTER

By
John Ormiston[1]

Immediately after the 1971 hunting season, the Deerlodge National Forest, the Dillon District of the Bureau of Land Management and Region Three of the Montana Fish and Game Department, sent a questionnaire to hunters who hunted Area 319. The questionnaire was intended primarily to give us information relating to harvest of deer and elk. We did ask several questions relative to quality and these questions are the topic of this discussion.

Hunting District 319, the Fleecer-High Rye Unit, lies southwest of Butte (population 44,000) and southeast of Anaconda (population 10,000). About 63 percent of the hunters checked at checking stations in Area 319 were from Butte, about 21 percent from Anaconda. Only 2 percent of the hunters were non-residents. The hunting heritage in Butte and Anaconda is very strong. The economy of the area is based on mining and smelting and elk and deer are depended upon as a source of protein.

The elk herd in the Fleecer-High Rye Unit was relatively small and over-harvested until the Fish and Game Department purchased Fleecer Game Range in 1963. A bull-only bag limit was placed on the area for the 1963 and subsequent seasons. We went to a quota either-sex permit system in 1968. The elk herd is increasing at a rather rapid rate; in fact it has tripled since 1963.

Area 319 is one of the most heavily hunted areas in the state; about 3,000 hunters spent about 18,000 hunter days in the area in 1971. The area is relatively accessible and the people are prepared for tough going. About 2/3 of the vehicles checked at checking stations were four-wheel-drive and another 20 percent were pickups. Only about seven percent were cars.

The general big game season was 43 days in 1971. The average Area 319 hunter hunted a total of nine days, six of them in Area 319. Area 319 had an antlered bull season and 100 either-sex permits. About 100 bull elk were taken, about three percent success. Either-sex permit holders took 54 cows and calves for 55 percent success of those who hunted. Incidentally, one of the questions we asked was whether, in the hunter's opinion, the elk population was up, stable or down. Over half thought the population was down; only 16 percent recognized the fact it was increasing.

There was an either-sex deer season. About 400 mule deer were taken. The deer population is declining as a result of overused range and probably competition from elk.

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We sent 1,306 questionnaires to hunters whose names we had gathered at checking stations. Nearly 600 were returned. Hunters were asked some very basic questions (age, sex, years hunted, etc.) as well as for hunting and harvest information. We also asked several questions at least related to quality.

One of the questions asked was, "If you had an either-sex permit, would you shoot the first elk you saw, a spike bull, a trophy bull, a cow or a calf?" We compared this with their elk harvest experience (Table 1). The most significant point is that almost 2/3 of the people would shoot the first elk they saw, regardless of experience. The spike bull category increased with experience reflecting the thinking, I believe, that yearlings are the best eating. As number of elk harvested increased, the value placed on a trophy decreased. The trophy bull is usually difficult to get home and tough to eat when you get it there.

Table 1. Answers to, "If you had an either-sex elk permit would you shoot the first elk you saw, a spike bull, a trophy bull, a cow or a calf?" compared with lifetime elk harvest.

Lifetime Elk Harvest	First Elk Seen	Spike Bull	Trophy Bull	Cow or Calf	N
0	72%	6%	14%	8%	169
1-4	72%	11%	11%	6%	198
5+	60%	18%	10%	12%	205

We asked, "do you hunt for recreation, meat or both equally?" Table 2 is a summary of the answers to this question compared with hunters elk preference. Even though a hunter hunted primarily for recreation, the ultimate recreation appeared to be to shoot the first elk seen. The recreation hunter did place a higher value on a trophy bull than the meat hunter, and the meat hunter placed a slightly higher value on a spike. Notice that most of the hunters hunted for both meat and recreation. We feel the way the question was asked may have biased the answers.

Table 2. Responses to "Do you hunt for recreation, meat or both equally?" compared to elk preference.

Reason for Hunting	First Elk Seen	Spike Bull	Trophy Bull	Cow or Calf	N
Recreation	64	13	20	3	86 (16%)
Meat	70	14	5	11	56 (10%)
Both equally	68	12	12	8	403 (74%)

A third question was, "If elk hunting pressure doubled everywhere, would you quit hunting, continue elk hunting or hunt another species?" The responses to this question are compared with elk hunting experience and summarized in Table 3. The young hunter was the most flexible; at least fewer of them would quit hunting and more would hunt another game species.

Table 3. Responses to, "If elk hunting pressure doubled everywhere would you quit hunting, continue elk hunting or hunt another species?" compared with total years of elk hunting experience.

Elk Hunting Experience (Years)	Quit Hunting (%)	Continue Elk Hunting (%)	Hunt Another Species
0 - 3	26	60	14
4 - 8	49	41	10
9 -15	37	60	3
16+	42	51	7
Total	40	52	8

Was your 1971, Area 319 hunting experience satisfactory or unsatisfactory? In Table 4, the responses to this question are compared to the percent of hunter trips on which elk were seen. Almost 2/3 of the respondents had an unsatisfactory hunt for various reasons, but almost 1/5 of those who had a satisfactory hunt never saw an elk. Hunting satisfaction increased with elk seen.

Table 4. Responses to, "Was your 1971, Area 319, hunting experience satisfactory or unsatisfactory?" compared with the percentage of hunter trips on which elk were seen.

Hunter Opinion	% hunter trips on which elk were seen			N
	0	25	50+	
Satisfactory	19%	42%	39%	122
Unsatisfactory	56%	31%	13%	270

We also asked why the hunt was satisfactory or unsatisfactory. The reasons stated are shown in Tables 5 and 6. We listed no reasons on the questionnaire and categorized the answers after the questionnaire was

returned. Well over half (63%) of the reasons for a satisfactory hunt were directly related to the animal, either seeing game or sign or harvesting an elk. About 1/3 of the respondents who had a satisfactory hunt just enjoyed the outing and/or experience.

Table 5. Reasons stated by hunters for a satisfactory hunt (% of respondents, N = 122).

Reason for Satisfaction	Frequency (%)
1. Saw game and/or sign	35
2. Enjoyed the outing, good experience	32
3. Bagged an animal	28
4. Had an either-sex permit	3
5. Others	2
	100%

Table 6, is a summary of the reasons given for an unsatisfactory hunt. Again, it is obvious the animal played a very important role in hunting satisfaction.

Table 6. Reasons stated by hunters for an unsatisfactory hunt (% of respondents, N = 270).

Reason for Dissatisfaction	Frequency (%)
1. Saw no elk, not enough game	42
2. Too many hunters	16
3. Saw only cows, no bulls	8
4. Didn't bag an animal	7
5. Too many vehicles	6
6. Too many roads	3
7. No either-sex permit	3
8. Miscellaneous	15
	100%

The last quality related question we asked was, "Which of the following would have increased the quality of your 1971 hunting season (rank in order of importance, 1, 2, 3)?" The eight categories we listed and their rank of importance to the respondents are shown in Table 7.

Table 7. Responses to, "Which of the following would have increased the quality of your 1971 hunting season (rank in order of importance, 1, 2, 3)?"

Factors	Rating (%) 1	2	3	Rank
See more animals	41	23	16	1
Fewer roads	17	20	12	2
Have an either-sex permit	14	19	16	3
Bag an animal	12	10	21	4
Harsher weather	8	15	12	5
Miscellaneous	3	5	15	6
Other hunting companions	2	3	5	7
Milder weather	1	4	3	8
More Roads	0	1	2	9
	100	100	100	

Obviously, animal-related aspects would play a very important part in increasing the hunting quality for a large majority of Area 319 hunters. The hunters in this area were not very interested in more access.

Quality, in the opinion of Area 319 hunters, involved the animal. They do not necessarily have to bag a trophy bull, or even an animal, but do want to see animals or their sign. If they do bag an animal, it really doesn't matter if it's a cow, calf, spike or trophy bull; in fact, the trophy bull may be low on the list. Quality is affected by other hunters in the area and numerous other personal value judgments.

In short, quality is not a precisely definable term, but a matter of each hunter's personal preference, opinion and value judgment.

DISCUSSION

Question: Were the questionnaire replies from non-residents different?

Answer: We did not have a big enough sample to separate non-residents from residents.

Question: Don't you think quality means something different to an out-of-state hunter than it does to a miner out of Butte?

Answer: I think quality means something different to you than it does to me, and it means something different to each one of us in this room.

Question: But don't you think quality to out-of-state hunters as a group is similar?

Answer: I think non-resident hunters are interested in shooting an animal. They have to pay more for the privilege of hunting so their interests are necessarily different. With only two percent of the Area 319 hunters from out-of-state, our management priority must be to satisfy the resident.

EFFECTS OF COLORADO'S DEFINITION OF QUALITY ON A BULL ELK HERD

By
Raymond J. Boyd[1]

Beginning in 1957, the Colorado Division of Wildlife started an intensive investigative program on the White River elk herd in northwestern Colorado. Which included, among many items, determining accurate sex and age ratios of the herd, both pre- and post-hunt. These classifications involved the use of helicopters to census the elk and each census attempted to sample at least 1,000 animals. By 1962 we began to notice that it was difficult to find large bulls, the heavy beamed six point that is pictured as "typical" of harvested bulls. By 1965 we were getting all kinds of hunter complaints to the effect that there were no large bulls left and our pre-hunt counts substantiated this fact in that the 1965 pre-hunt ratio of branch-antlered bulls per 100 cows was 10.3. These were the bulls that hunters were going to see--10 branch-antlered bulls per 100 cows.

Elk hunting in Colorado has never, up until 1971 anyhow, been restricted to the type of bull a hunter can take. Hunters were allowed to take any animal on a bull license that had 10 inches of hard antler material above the skull. This meant that spike bulls made up the majority of the bull kill each year over the whole state and on the White River area nearly 72 percent of the bull kill every year was in the yearling age class. At the same time that the bull ratio dropped down to about 10 branch-antlered bulls per 100 cows, we noticed a drop in our calf production. For this reason and the fact that hunters were also complaining about numbers of hunters on the White River, we decided we needed to cut back on the bull kill so we initiated a specified permit system in which elk hunting was totally permitted. If you wanted to hunt bulls in that area, you had to apply for a bull license, if you received a bull permit, you had to kill a bull (any bull was legal) and you were restricted to the White River area for your hunt. We also had antlerless-only permits which allowed a hunter to take a cow or calf; there were no either-sex permits.

On the surface this sounds as if we were unduly restricting the hunter, but numbers of permits allowed were high enough that few, if any, complaints were received from persons wanting to hunt the White River area who did not get a permit. For the first three years of the specified permit system we allowed 2,500 antlered-only permits each year, 1,000 antlerless the first year and 1,500 antlerless permits the next two years.

Immediately upon the inception of the specified permits, the trend in numbers of mature bulls in pre-hunt counts reversed. Between 1961 and 1965, under a wide-open bull hunt regulation (no limit on numbers of bull hunters), we found a significant linear decrease in the number of branch-antlered bulls available to hunters. As soon as we went to specified permits, we in effect, limited pressure on the bull segment of the herd

[1]Research Biologist, Colorado Division of Wildlife

and the curve went right back up and we found a significant linear increase in the number of branch-antlered bulls in pre-hunt classification counts. There was no restriction on the age or antler class of bull that was legal on the antlered-only permits and spikes made up about 70 percent of the kill. This trend continued until by 1969 we were finding 17.5 branch-antlered bulls per 100 cows in this herd in pre-hunt census counts. This was almost double the ratio we had when we went to the specified permit regulation and it appeared that we were reaching one of our objectives, that of increasing the mature bull segment of the herd.

Then, in 1971, the Colorado Wildlife Commission attempted to set their own definition of quality on the elk herd in Colorado. They stated that most elk hunters wanted to kill a six-point bull and that the Division of Wildlife would furnish them this opportunity by protecting spike bulls with the intention of increasing numbers of "trophy" bulls available for harvest in the various herds. Their idea being that by protecting spike bulls we would allow them to grow into larger "trophy" animals. The regulation that was placed in effect for the 1971 elk hunt required that a bull be branch-antlered before it was a legal target. The legal definition of a branch-antlered bull being: "Any elk with at least one antler six inches or more in length which has two or more points. A "point" is a portion of antler protruding one inch or more from the main beam."

As we have reported at other elk workshops, an average of about 32 percent of our yearling bulls have more points than the typical spike and many of our hunters also know this. When the season was over and all check station reports, aerial survey checks and questionnaire returns were in, we estimated that at least 2,000 spike bulls had been shot and left laying in the field because they did not have extra points. On many legal yearling bulls that I checked, the extra point or points were only one or two inches long and were buried in the hair at the base of the antler. There appeared to be no way that the hunter could have seen the extra point before he shot the bull and walked up and looked for an extra point. This then is the reason we believe the 2,000 spikes were shot and left.

Another item that turned up in addition to the loss of illegally killed yearling bulls was the fact that in some elk areas of Colorado, a spike bull regulation did not adequately protect yearling bulls which is what a spike bull protection regulation is really trying to accomplish. Under the 1971 branch-antlered bull regulation, some herds still carried upwards of 50 percent of the 1971 bull kill in the yearling age class. So if the intention of the Commission was to protect yearling bulls, the spike protection did not accomplish this.

Pre-hunt classification counts of the White River elk just prior to the 1971 hunt indicated that we had 14 branch-antlered bulls per 100 cows in the herd. Post-hunt counts, after the spike protection hunt, revealed 1.7 branch-antlered bulls per 100 cows. I counted nearly 2,000 elk on the post-hunt census and found only 17 branch-antlered bulls. So, by trying to increase the number of branch-antlered or "trophy" bulls in the herd, we wasted all of the illegally shot spikes and placed all of the bull hunting pressure on the very class of bulls we were trying to increase.

When these data were pointed out to the Commission, they let most of the state go back to hunt regulations allowing any bull to be legal, but they set up ten areas in the state to try and completely protect yearling bulls, These ten areas, including the White River were placed under a four-point regulation in that a legal bull was required to have at least one antler with four points. They hoped that this regulation would solve the problem of the illegal kill of spikes. It did not work at all. What happened was that hunters shot three-point bulls and left them lay, two-point bulls were abandoned and they still shot spikes and left them.

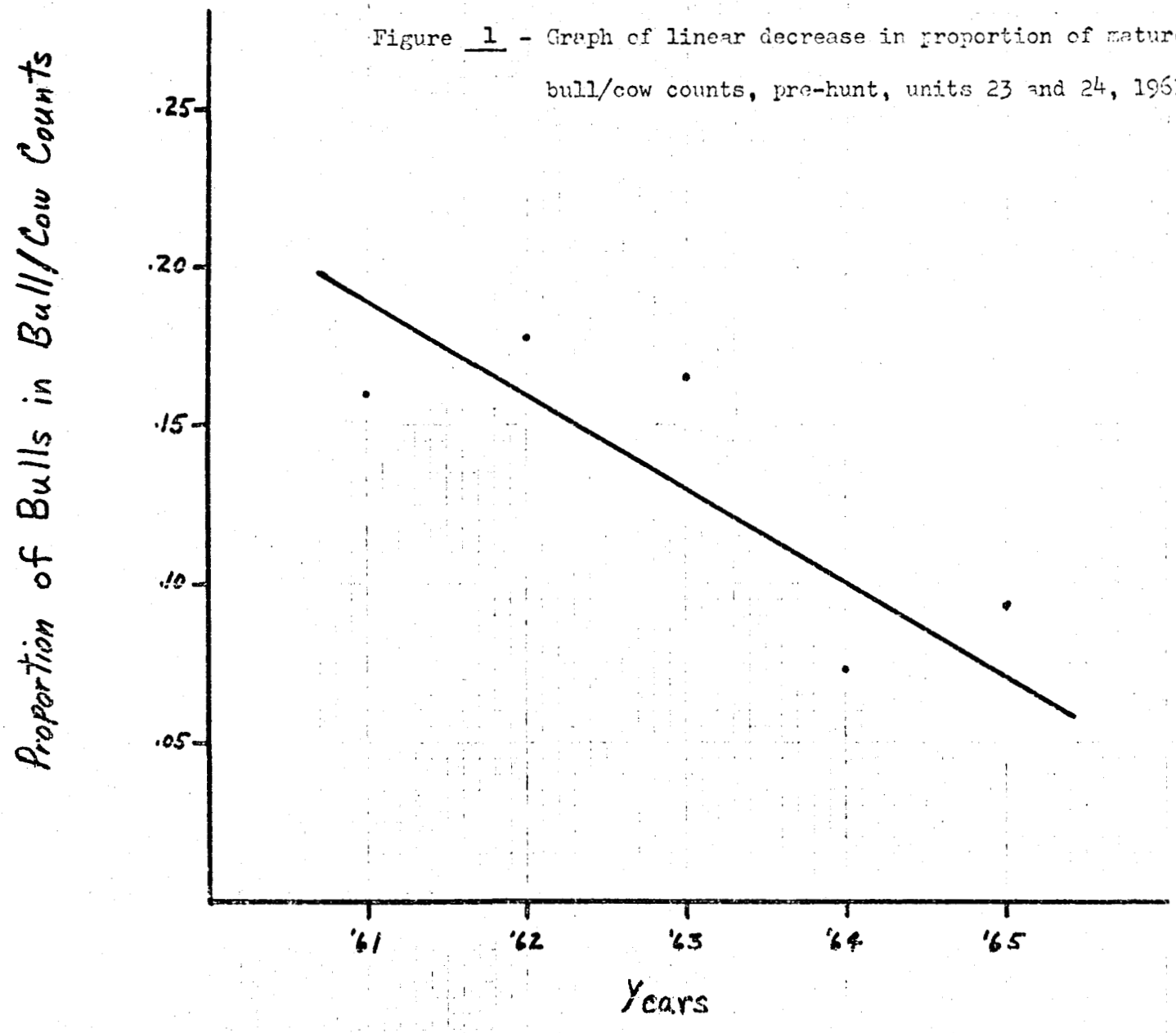
Post-hunt census counts on the White River after the 1972 four-point bull regulation indicated that we were up to 3.8 branch-antlered bulls per 100 cows. The management implications of this increase are very interesting, however. In our estimate of the bull kill on the White River for 1972 we predict a legal harvest of 497 branch-antlered bulls, but our estimate of illegal bull kill is 450 animals. This means, that for all practical purposes, the legal and illegal kill are equal. We feel this is too large a price to pay to try and increase numbers of large bulls in the herd by protecting yearling bulls. We were accomplishing the same thing under specified permits and had virtually no illegal kill of bulls. It appears that if an increase in branch-antlered bulls is wanted, limiting pressure on the bulls is the best way to accomplish it.

Figure 1 indicates what was happening to the White River elk herd as far as the trend in proportion of branch-antlered bulls during the five years immediately prior to the inception of the specified permit system. This graph shows the proportion of larger bulls in the pre-hunt herd and is a significant linear decrease in the proportion of bulls. Figure 2, on the other hand, indicates that in the first five years under specified permits, there was a significant linear increase in the proportion of branch-antlered bulls in the pre-hunt herd. By limiting pressure on the bull segment of the herd, we allowed more bulls to grow up into a "trophy" size animal.

Data shown in Figure 3 is the aging information from the White River area showing ages of male elk older than calves for the five-year period under specified permits with wide-open bull hunting, ages of harvested bulls under the spike protection regulation and ages of harvested bulls under the four-point regulation. Under the specified permit regulation with wide-open bull hunting, about 65 percent of the bull kill was yearlings. In 1971, with spikes protected, nearly 50 percent of the kill was still in the yearling age class. The 1972 data show that we still had about 10 percent of the bulls killed being yearlings and 55 percent of the kill was in the two-year-old age class and we found no six or seven-year-old bulls in our age samples.

Managementwise what does this mean? What is the cost of a regulation such as this? First of all, as mentioned above, we had a high illegal kill of yearlings. We lowered bull hunter success considerably. In previous years, under specified permits, hunter success for bulls averaged 27 percent which is pretty good bull elk hunting. When we went to the spike bull protection and the four-point regulation, success dropped to 9 percent. Also, because of these regulations, we had to carry over a

Figure 1 - Graph of linear decrease in proportion of mature bulls in bull/cow counts, pre-hunt, units 23 and 24, 1961-1965.



large number of unproductive male elk. These were the yearling bulls that were not harvested. They do not produce a calf but they eat as much or more than a cow and calf so we had to carry a smaller herd. We feel this is too great a price to pay to grow a few "trophy" bulls when just limiting pressure on the bulls will accomplish the same thing.

Question: Do you have the figures available for us?

Answer: Yes, I brought 20 copies of this with me and I will hand them out until they are gone. Those of you who want this data, give me your name and address and I will get them to you.

Question: What would your non-residents do about this quality thing?

Answer: Our antlerless license requires the man to take an antlerless elk. It is not either-sex; he has to take a cow or calf. Approximately 20 percent of our antlerless elk licenses are sold to non-residents. Those non-residents put in for the cow validations. They are telling us that they not only don't want to kill a big bull, they don't want to kill a bull, period! They are taking expensive, guided hunts with an antlerless-only license.

Question: How did you find your illegal kills?

Answer: We questioned all hunters that came through our check stations. We had maps and we tried to make a mark on a map down to at least the section where these animals were and then tried to eliminate all possible duplicates we could. When I say there were 450 illegal elk laying around up on the White River this year, that might be a minimum figure.

Question: How did this affect your calf production?

Answer: Our calf crop was dropping before we went to specified permits. When we went to specified permits, the big bulls started to come back and our calf crop came up a little bit. We did not, however, have a significant increase in our calf crop. We got worried on the White River when our calf crop dropped to 60 calves per 100 cows. Its average is about 64, so maybe we shouldn't have worried too much.

Question: How many bulls do you plan to harvest and what is the hunter success on these bulls?

Answer: This year, our projected bull kill under the four-point regulation in the White River was 497 bulls. Last year, under the spike regulation, the bull kill was 323.

Before that, our bull harvest averaged about 800 when spikes were legal. Our success just went completely to pot. We bounce around between 3,000-3,200 maybe 2,500 bull-only permits in there.

Question: What do you get on the returns on your permits? What percentage of the permits are filled?

Answer: Antlerless-only permits average 80 percent on the White River. I would say on bull permits that it averaged about 27 percent until we went to the spike bull protection and the four-point regulation.

Question: Has a decision been made for next year yet?

Answer: Not yet. We get one more shot at them with this type of data to see what happens.

SOCIAL SCIENCE INVOLVEMENT IN WILDLIFE MANAGEMENT

By
Dr. George Stankey[1]

The human behavior aspects of wildlife management is an area that is beginning to receive increasing attention among some persons in social sciences. It is long over due, because I think the social sciences have some important expertise and some important perspectives to bring to the problems currently confronting wildlife administrators. I might point out that the thirty-eighth North American Wildlife Conference will present a full technical session on human behavior aspects of wildlife management. Seven papers, focused on a variety of different topics, such as quality and ethics, are scheduled for presentation. Additionally, because of the number of high quality papers submitted for consideration, a special workshop on the second day of the conference has been scheduled to provide an opportunity for some of the other research that is going on to be brought out into the open. We are hoping that both the technical session papers and the workshop papers will be published in a special volume by the Wildlife Management Institute.[2]

One of the reasons I'm glad to see various persons in the social sciences bringing their interests to wildlife management, is because many of the difficult problems confronting wildlife management today lie on the interface between people and the wildlife resource. The inherent nature of many of these problems requires an understanding of the clientele, more so than of the resource. Because of the very short time here today, let me touch on some selected topics where social science expertise is badly needed by wildlife administrators.

There has been some discussion today about social science methodologies, particularly questionnaires and the proliferation of them. I don't know if it is so much a problem with a proliferation of questionnaires as it is a proliferation of bad questionnaires. Questionnaires are not something that can be prepared in a short time with any expectation that the data generated will be valid. Questionnaire design is a technical, sophisticated task and should not be undertaken by the unskilled. Considerable talent is available, however, and when administrators decide a questionnaire might provide needed information, this talent should be utilized.

Too often we get locked into questionnaires as the only source of information on users. Although questionnaires can provide a lot of information, there are some substantial methodological shortcomings that directly

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[2]The volume, entitled Human Dimensions in Wildlife Programs: Reports of Recent Investigations, is available for $2.75 from the People/ Natural Resources Research Council, 4507 University Way, N.E., Seattle, Washington 98105.

affect the validity of that information. Non-response, for instance, can invalidate the data obtained by questionnaires. Acquiring an unbiased pool of names or a sampling frame that permits clear identification of the population is another major problem. Questionnaires that don't anticipate these and other problems will provide information that can only serve as general indicators of what might be--they can mislead administrators as easily as they can provide helpful insights.

There are other kinds of social science research. For example, many social scientists as well as resource managers are primarily interested in the behavior of clientele groups. The heavy emphasis on attitude studies is based largely on the belief in a close link between attitudes and behavior. However, the link between attitude and behavior is, at best, shaky. Attitudes are generally poor predictors of human behavior. Collaborative efforts between social scientists and wildlife administrators could result in more productive research efforts as administrators provide information, constraints, and other relevant input to the research design and social scientists provide feedback on what questions they can help answer, what different research strategies will yield, and so forth.

Some people might wonder "Why bother involving the public (both consumptive and non-consumptive users of wildlife) in the first place? We know what the problem is and we know how to get the job done - if only people would leave us alone." The "public" plays two vital functions in its relation with resource managers. First, don't doubt the usefulness or the effectiveness of going to the public to explain your management programs, to obtain more information, and to gain new ideas. The Forest Service is deeply involved with public involvement now and despite numerous problems (stemming largely from the lack of any crystallized notion of what public involvement was supposed to do), there appears to be the general consensus that involving the public is both useful and proper. Second, I would like to make a distinction in the kinds of decisions made in resource management. Much of the discussion here at this workshop has concerned technical decisions--how do you do something. How do you increase elk populations, or how do you manipulate habitat or whatever? These involve technical decisions. Perhaps the more important, and certainly the more difficult type of decisions are the normative or prescriptive decisions. These are decisions that concern what it is we want in the first place. And, this type of decision is, in a participatory democracy, the domain of the public. Now, I am not advocating at all that we adopt management strategies that slavishly follow whatever people tell us. People's ideas and concepts can be very short ranged, they can be selfish; they can be based on faulty information. But, at the same time we cannot ignore them. Systematic and objective mechanisms for feedback of public opinion to administrators can provide the bases for a realistic appraisal of agency policies and programs. In some cases, one might decide that the public needs better information and institute some program to accomplish that. However, the values expressed in public opinion might call for programs that the agency cannot, for one reason or another satisfy, at least in the short run. Nevertheless, these values may be valuable clues that call for broad changes in policy that will result in long-term shifts in agency programs.

In regard to the issue of hunting quality, a lot of people say, "we know what quality hunting is" or "well, it's something different to everybody, so there's no way we come to grips with it." Often, managerial concepts as to what constitutes quality become the dominant factor in policy formulation. But our perception of quality can be very different from that of the publics we serve. We suffer from a variety of biases, some of which are linked to our own professional training. We suffer from problems like selective perception--that is, we see only that which we are looking for and we pick out that which essentially documents what we think is right in the first place while suppressing or ignoring that which we do not agree with. Another problem concerns the frequent use of moralistic statements about what is right and what is wrong. These statements are often our own personal judgment, rather than the result of any logical ethical argument. We must be extremely careful of these.

My remarks should not be interpreted as an argument to make social scientists out of wildlife managers or vice versa. I do think we need to sensitize wildlife professionals beginning at the college level, to some of the problems I have mentioned as well as many others on the people-natural resource interface.

Considerable pressures are already with us with regard to the extent to which the supply variable (in this case, wildlife) can be expanded. When we look at the demand variable (for example, projections of hunting use) we see increasing pressures coming. The crunch between reduced opportunity and increasing use is, I think, pretty evident. This is going to force us to start giving more and more attention to perhaps what we might call the social engineering aspects of resource management. There are some basic problems here with which we must contend. Many people are attracted to wildlife management and forestry for reasons related to the opportunity to avoid contact and conflict with people. Ask any practicing resource manager how realistic an appraisal that is of his job today. Involvement with people is a phase of the resource management job that will demand increasing attention and skill. We are going to have to go to the public for assistance more and more in the future. My concluding remark to you would be that a distinct body of people with various backgrounds and perspectives in human behavior research is beginning to develop interest in the kinds of problems that confront you. I would urge that you make every effort to seek these people out and to utilize the kinds of abilities they have.

Chairman: We were discussing something one day, you and I, and I think one thing came up that I think this group would be interested in. You were telling me about a formula, or ratio, that someone has devised that is one measure of quality experience. Do you remember that?

Answer: No I don't but I'll comment on it anyway.
Quality indicates satisfactory judgments about an experience by the participant. I noticed in the draft statement of quality hunting by the Montana Wildlife Society that satisfaction is a key concept. They implicitly recognized that

when people go out to hunt, they carry with them a set of aspirations, or expectations. When they engage in this activity, they can relate the actual experience against their aspirations. One general way of putting this into a formula is that satisfaction is simply a function of the extent to which the aspirations are realized. One of the basic research tasks ahead of us is to simply try to determine some of the broad dimensions that attract people to hunting. Why do people hunt? Some reasons are obvious while others are not, and the relationship between a lot of them are not fully understood. Right now, I think we are in a period of trying to define some of these dimensions. For instance, the evidence from some studies suggests that the reason hunters go out is solely to get an animal is not an accurate picture.

There are a variety of satisfactions derived, harvested if you will, from hunting. Sociability, enjoyment of the natural environment, simply having a chance to get out in the outdoors, displaying one's skill, and others are some examples. Many of these satisfactions are essentially independent of success. I would characterize the role of success as kind of a catalytic function. Many other kinds of returns to the individual are probably highlighted in the presence of success, be it birds or deer or whatever; but just because a hunter comes back empty handed doesn't mean that he has had an unsatisfactory experience. The concept of some minimum probability of success is important here. Basically, it posits that people will continue to hunt as long as they perceive some minimum probability of success. Once we drop below that, and I cannot give you any kind of figure for it, but once we drop below that minimum probability, then some persons will drop out of hunting into other kinds of recreational opportunities that supply the same or similar kinds of satisfaction.

QUALITY HUNTING - A DEFINITION[1]

by
Jim Cole[2]

To properly define "quality hunting", we must answer two basic questions. First, why does an individual hunt? What are the basic motivations behind sport hunting? Second, after a hunter has hunted, how does he judge the quality of his experience? If we can begin to understand why an individual hunts and what he expects from the experience, perhaps we can then begin to identify this elusive thing called quality hunting.

Hunting Motivation

When an attempt to answer the first question was made, a basic complex of values was discovered. To generalize, the motivations which are behind an individual's choice to hunt are basically no different than the motivations behind any other diversion. Like any generality, there is one exception which I will discuss as we continue.

Essentially, the motivations which were identified fall into three categories. The first involves motivations which are "individual centered" such as solitude, challenge, competition, achievement, and diversion. Other hunters are not a part of these motivations.

Second, "group centered" motives were identified. These include companionship or other socially oriented aspects of hunting. Finally, some hunters have an "economic" motive for hunting, namely the desire for wild meat. This motive is the exception to the generality that hunting motives are no different than the motivations behind any diversion.

Few of us, if any, are motivated only by one of the previously mentioned factors. Normally, we are moved by varying degrees of each factor in varying combinations which tend to change over time. As you can see, hunting motivations are indeed a complex.

Let me illustrate this discussion with the hypothetical case of an elk hunter who holds an either-sex permit, but decides he will accept only a six-point bull. As the hunting season progresses, he by-passes other elk and is unsuccessful. He then reduces his goal to include any bull as he realizes six-point bulls are not plentiful enough to satisfy his goals. As he hunts further and remains unsuccessful, he includes cow elk in his hunting objective. In desperation, he is ready to shoot any

[1]This paper is based on the Quality Hunting Position Statement Committee Report to the Montana Chapter of The Wildlife Society, January, 1973.

[2]Wildlife Biologist, Deerlodge National Forest, Butte, MT.

elk which passes his way as the hunting season nears its end and he is still unsuccessful.

It is not too difficult to analyze this hunter. He was first motivated by the challenge of a six-point bull, which is without question, the greatest challenge this species offers. Perhaps he was also driven by the need for competition, whether it be with the animal or other hunters. Finally, he adjusted his values and was driven primarily by an achievement motive and/or the desire for wild meat. This action could have transpired over any period of time, not just the entire hunting season as I illustrated. The action could have occurred in one day or even five minutes into the hunting season if this hunter shot the first elk he saw immediately after daylight on opening day!

My point here is, quite simply, hunters' motivations may change through any period of time.

Let us compare two seemingly different hunters, the "back packer" and the "road hunter". Of course, the former is motivated by the need for solitude and, perhaps to a significant degree, by challenge. Challenge motives are different in this example in that this hunter sees challenge in the entire hunting environment, not simply in the animal which he hunts.

In contrast, our lowly roadhunter may well be driven by the very same motives. He responds to his need for solitude by isolating himself on a far-off ridge in his four-wheel drive vehicle. Challenge may also be a primary motivation for the road hunter. Again, he merely responds differently to this motivation than does the back packer. He finds challenge in placing his vehicle higher on the mountainside than anyone else. Perhaps he isn't the "vulgar slob" he is commonly judged to be.

This example illustrates the point that the response by two hunters to the very same motivations may be quite different.

I earlier alluded to a generalization about hunting motives, namely all diversions, from bird hunting to bird watching to ping-pong are based on similar motivations. (The single exception, of course, is the desire for wild meat, which I mentioned previously.) Those who have discontinued hunting have replaced it with another activity which satisfies the same motivations formerly fulfilled by hunting. Sport hunting is simply a timely way to pursue these basic motives.

One who replaces hunting with bowling, for example, is simply responding to basic needs for challenge, competition, achievement, companionship or whatever because he can fulfill these needs better in this endeavor. Of course a reverse situation in which bowling was discontinued in favor of hunting would have a similar displacement effect.

Judgment of Quality

The second basic question which needed to be answered before we define quality hunting was "After an individual has hunted, how does he judge

the quality of his hunting experience?" Very simply, one's concept of hunting quality is based on the degree of fulfillment of his expectations.

Allow me to illustrate. Suppose a hunter whose prime hunting motive is solitude hunts an area where he knows hunter density has been consistently low. On this particular occasion, however, he literally finds a hunter behind every tree. Obviously, there is no way his expectation for a high degree of solitude can be met. Thus, he experiences a low quality hunt.

A legitimate question at this point is, where does hunter success or bagging an animal enter into the quality hunting discussion? I contend hunter success is important only as it influences the formation of expectations. Only a strong motivation for achievement and/or wild meat can influence the hunting quality judgment. If a hunter fully expects to bag an animal and he does not, his judgment must be low quality. A reverse example, of course, leads to a high quality judgment.

Definition

With this brief discussion of hunter motivation and expectations as background, I offer the following which has been taken directly from the Quality Hunting Position Statement Committee Report to the Montana Chapter of The Wildlife Society, as the definition of quality hunting. "Quality hunting encompasses a spectrum of meaning rather than a single definition. It is a relative concept which varies with the values of the individual hunter. Although 'quality hunting' implies high quality, what is high quality to one may be low quality to another. Furthermore, the concept of quality hunting is dynamic for each hunter. This constant change is based on influences which include the hunter's experience base as well as personal and social motivations. Quality and quantity are not necessarily contradictory - quantity may be quality to some. Any expression of hunting quality is valid, provided it is non-destructive of the natural resources upon which it depends and provided it does not create unresolvable conflicts with another's concept of quality."

Management Implication

If you accept this definition and the associated concept that our resource management agencies must ultimately manage for quality hunting (and I do), one management implication is clearly significant. The mechanism by which quality hunting can be managed is the allocation of hunting space and time. These tools have been used for years in wildlife management. However, quality hunting management dictates they must be used to a far greater extent in the future.

For example, if a given percentage of hunters desire a certain type of hunting, I think it is the responsibility of all resource management agencies involved to provide these hunters with a similar level of opportunity. Let us hypothesize that 10% of the hunters of a hunting

region want a wilderness hunt, primitive arms hunt, or some other specific type of hunt. The appropriate agencies must provide them with 10% of the total hunting opportunity. There are different ways to accomplish this. One way would be to set aside 10% of the hunting area (the allocation of space). Another approach would be to allocate 5% of the area and allow only half of this type of hunter in the area at one time. This approach might require a given hunter be restricted to use of the area in alternate years only. Such an approach combines the allocation of space and time, of course.

In summary, let me emphasize that quality hunting is a manageable commodity. Further, the ultimate objective of quality hunting management must be maximization of diverse hunting opportunity. Obviously this objective recognizes that all expressions of quality hunting are legitimate.

CALF:COW RATIOS - WHAT DO THEY REALLY MEAN?

by

Eugene O. Allen[1]

The calf:cow ratio is a statistic which, where properly interpreted and applied, can help determine the direction for management of an elk herd. While it is probably most commonly used as an index to herd productivity, it can have a broad spectrum of applications, including: rate of herd increase; mortality rates; intensity of harvest; harvest potentials; helping determine herd age structure and often as an indication of herd health, nutrition level and even range condition. Unfortunately, the calf:cow ratio is, like many other statistics, dependent upon the validity of assumptions and limited in its application.

Defined, the calf:cow ratio is the proportion of calves to adult cows for a group of elk at a given point in time. It may not reflect or be an indication of anything more than just that! It is the purpose of this session to point out and discuss some of the assumptions upon which a valid calf:cow ratio depend and the limitations in its subsequent application.

I would like to briefly mention some of these assumptions. First of all we assume that we have properly identified calves and cows. Anyone who has done this from a helicopter in the spring under marginal observing and flying conditions know that it is not always an easy thing to do with confidence. Another assumption is that there is no differential distribution between or within herd segments sampled. In other words, we assume calves are with their respective cows. Or if there are variations between groups we assume that we have a large enough sample to smooth out and make an accurate average. The basic assumption is that the ratio is representative of the population sampled. We have all experienced minor variations in sex and age composition of various groups when we are making classification. I think it is less commonly accepted that there can be differential distribution on winter ranges. By this I mean, calves are not with their respective cows; they are in different, separate groups and may be several miles away. I have some information that we have gathered over the years in two or three places that indicate that some of these assumptions are not always valid.

Table 1 summarizes some information gathered from the Gallatin Elk Herd during the 1968 and 1969 winters.

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[1]Chief, Research Section, Montana Fish and Game Department, Bozeman, MT.

Table 1. Differential distribution of cows and calves between two segments of the wintering Gallatin Elk Herd.

	Calves:100 cows Winter Classification	
Segment	1968	1969
Porcupine	27	20
Yellowstone National Park vicinity	61	68

This herd summers mostly within Yellowstone National Park and goes various directions when it migrates out to winter ranges. Two of the segments - Porcupine Creek and the Yellowstone National Park vicinity - have a differential distribution of calves and cows. This is not because one segment of the herd is more productive than the other one. It is a difference in where calves and cows end up on the winter range. Porcupine Creek is further away from summer range; it is an extra 10 miles or so. Apparently not as many calves go that additional distance. It is not unusual to see groups of elk in the Yellowstone National Park vicinity containing more calves than cows. Occasionally people in the Canyon who think that we do not manage the herd properly feel that the elk need additional winter food and they throw out hay. On these feed grounds during that 2 or 4 week period the calf:cow ratios commonly run more than 100:100. The calves are more easily drawn into or feel the need for this artificial food situation than the cows. This is just an example of a differential distribution of calves and cows between two segments of the same base herd.

We also noted a differential distribution within one segment of the herd, the Madison segment. For the 1969 winter classification (March), all groups classified (total of 398 elk) resulted in an average ratio of 42 per 100 (Table 2). The ratios of individual groups, however, ranged from 29 to 92:100. Whenever you get a range of calf:cow ratios that extreme, it is very important that you sample a large percentage of your herd or you may not come up with an accurate representation of what actually exists. The last group I saw in this particular classification was 77 animals, and we almost missed it. I am sure you all have experienced it: you were quitting and on your way back home and out of the corner of your eye you see a group of elk a mile away. The calf:cow ratio in that group was 92:100 and if we had missed it we would have ended up with an average of 34:100: obviously a lot different than 42 per 100.

Table 2. Differential distribution of cows and calves within the Madison segment of the Gallatin Elk Herd, 1969.

Groups	Calves	Cows	Total	Calf:Cow Ratio	Range of Group Ratios
Total for all groups seen	118	280	398	42	29-92
Last group seen	37	40	77	92	
Without last group	81	240	318	34	

We assume that the sample size will smooth out this type of problem. What is an adequate sample? One-Half a herd - 2/3? If you pick 1/2 or 2/3 as adequate, how do you know when you get there? You don't, unless you are able to spend a lot more time with each elk herd than we can spend in Montana. We just do not get enough chances to fly or classify to know when 1/2 or 2/3 of the herd has been classified.

Assuming the problems of classification have been overcome and a ratio representative of the population has been obtained, what does it mean? I'm not sure, but I know it can have different meanings different times of the year. Table 3 presents calf:cow ratios derived from winter classifications of the Gravelly Elk Herd.

Table 3. Winter classifications of the Gravelly Elk Herd.

Winter	Calves:100 cows
1966-67	72
1967-68	68
1968-69	78
1969-70	80
1970-71	70
1971-72	58
1972-73	69

Classifications to obtain these ratios included 1000-2000 animals each year; a good sample representing a major portion of the wintering herd, and I am confident that these ratios do accurately reflect the composition of that herd during late winter when the classifications were made.

The reason these ratios seem unreasonably high is partially explained by figures in Table 4. The fall hunt is a permit hunt for anterless elk with bull only on the open license. The past few years we have had about 750 either sex permits in this area. Hunter success ranges from

Table 4. Seasonal classifications of the Gravelly Elk Herd.

	Calves:100 Cows		
Year	Summer	Fall Hunt	Winter
1966-67			72
1967-68			68
1968-69		16	78
1969-70		21	80
1970-71	57	13	70
1971-72	48	14	58
1972-73		31	69

40-60 percent, so we annually remove approximately 350 antlerless animals from the herd. The calf:cow ratio in the harvest is very low

compared to what is actually in the herd. Because it is a very scattered, open area hunters are able to select cows over calves, and they do, resulting in these low ratios. When antlerless animals are disproportionately harvested heavy to cows, more calves are left in the population than were originally there before the hunt. In 1970-71 this disproportionate harvest resulted in a change from the pre-hunt ratio of 57:100 to the post hunt ratio of 70:100. Both of these ratios are correct and accurate for the population at different points in time, but their meanings are completely different.

Table 5 is an example of how this phenomenon works. Both the summer (50:100) and winter (67:100) ratios are correct for their respective

Table 5. An example of how differential harvest rates can change calf:cow ratios.

Season of Classification	Calves: 100 Cows	Cows	Calves	Total
Summer	50:100	100	50	150
Fall Hunt (25% removal)	15:100	33	5	38
Winter	67:100[1]	67	45	112

[1]This ratio represents a 34 percent increase compared to the summer ratio.

seasons, but there is a 34 percent difference. In actuality, the degree of change in calf:cow ratios resulting from a differential harvest is directly related to the proportion the harvested animals comprise of the total population: the greater the proportion of harvested animals, the greater can be the change in calf:cow ratios.

One of the most common uses of the calf:cow ratio is as an indicator of herd productivity. An accurate summer classification does reflect this; a winter classification may or may not; and a ratio derived from harvested animals probably does not. The same ratio obtained from two different elk herds may be considerably different when compared to the potential production of these two herds. Potential production is defined as the proportion of the female segment comprised of cows which were physiologically capable of breeding during the previous breeding season (assuming only one calf will be produced by each pregnant female). Because the youngest age class is totally unproductive (yearlings at the time of classification), and the second youngest only partially so (2½ year olds), the age structure of the female herd segment is an all-important factor in determining the potential productivity of an elk herd. The greater the proportion of 1½ and 2½ year olds, the lower the potential herd productivity (Table 6).

Table 6. Potential production from elk herds with different levels of yearlings in the female segment.

Winter Calf:Cow Ratio			Percent yearlings at time of calving[1]
80:100	=	40 female calves:100 cows = $\frac{40}{140}$ =	29
60:100	=	30 female calves:100 cows = $\frac{30}{130}$ =	23
40:100	=	20 female calves:100 cows = $\frac{20}{120}$ =	17
20:100	=	10 female calves:100 cows = $\frac{10}{110}$ =	9

[1]This age class is completely unproductive.

Dick Trueblood, our Region 6 game manager, mentioned yesterday that 81 percent of the yearlings were pregnant in a collection of reproductive tracts from elk in the Missouri Breaks. This is extremely high for yearling pregnancies. We know we are getting yearling pregnancies in the Gravelly herd because we have 2½ year old cows that are lactating.

We don't know the extent of it, however, but between these two age classes, one of which is totally unproductive and one of which is only partially so, in a relatively young herd that is harvested to its potential, these two age classes contribute more than 1/3 of the total animals.

This immediately puts your potential production down to 60 or 65 percent at the absolute maximum if 100 percent of your breeders were successful in bringing off a calf and raising it. The greater the proportion of 1-1/2 and 2-1/2 year olds, the lower the potential production the next year. So when we are out there in the winter and obtain a classification of 80 per 100, which we had one year in the Gravelly herd, we can expect a drop the next year in the calf crop merely because we are putting an unusually high number of unproductive females in the population the next year.

A winter classification of 20:100 is pretty bad. But the next year the potential for producing calves is considerably higher in this herd than in one that has produced many calves. If the ratio is only 20:100 consistently, there is something drastically wrong because the potential is very high.

The point I am trying to make here is that when you only classify a herd of elk once a winter, it can be very misleading because you do not know exactly what your ratio means; it also limits you as to what you can use that ratio for. I am not familiar with how other states operate, but in Montana we have so many elk herds in so many places, and so many

people that have to fly and look at them, and so few days of flying weather and so few airplanes we can ride in, that if we get to look at herds more than once a year we have done very well. We do not have checking stations except on some of the larger herds.

We do not know what the ratio of calves:cows was in the harvest and we have not made summer classifications on many of these herds. This winter classification is something that has to be looked at very closely before we use it for the broad range of things that we are using it for today.

I have tried to point out a problem in the application of calf:cow ratios. What do you do in some of these other states? How do you use these ratios? Are there any questions?

Question: I was curious how you differentiated in that first example in the Porcupine area and the Yellowstone area that calves were actually stopping off and not following the adult animals. What do you use to measure this stopping-off affect?

Answer: We had separate units. On each segment there were groups of calves that were a mile or two away from any other elk. We had groups of calves in the Yellowstone area with 40 or 50 calves and 10 cows; you know they are not with their cows because there are too many. This is what we are using. We do not have any marking studies where both the cow and calf were marked. We feel that we have evidence to show that one segment of the herd is not two or three times more productive than another segment.

Question: In some areas of Montana you have herds with very low calf: cow ratios compared to other areas like up in the Flathead. What do you attribute that to up there?

Answer: As a general statement, I think our grass winter ranges east of the Continental Divide are more productive than the browse winter ranges west of the Continental Divide. There are exceptions both places, but in general I think that this is a valid statement. I also think some of the herds that Dick Weckwerth mentioned yesterday are not heavily hunted or cropped; they have a lower turnover rate and do not need a high recruitment rate.

Question: What might be the possibility that you are going to have an increased census error in these more severe topographical and heavier vegetated areas? Would this account for some of the difference in ratios between elk in open grassland and timbered areas?

Answer: Do you mean between Eastern and Western Montana, or in the information I just gave you?

Question: No, in this idea that browse winter ranges have lower cow:calf ratios. How much census error might be involved in that production of lower cow:calf ratios?

Answer: I think when you get through with your flight you have to look back and see if you saw elk where you thought you should have and if your groups are fairly consistent in the ratios, and if you feel you have an adequate sample I believe you have a ratio you could use. If you go out there and see tracks and no elk and you know you are having a bad time finding them, that's another story. We usually do not have that problem over here. But when we start finding elk in the timber we turn around and go back because we know we are going to have a poor flight. We only survey under good conditions, with new snow and cold temperatures whenever we can; when we get inconsistencies in the ratios like a range from 29 to 92, that is an indication that judgment has to be used as to what kind of a sample you have.

Question: I have a couple of comments and then a couple of questions. Do you fly winter counts in March?

Answer: We fly whenever conditions are proper for getting the best classification; in this part of the state it is normally late winter.

Question: You do not have trouble differentiating between calves and yearling cows?

Answer: Like I say, occasionally you do if you get poor flying conditions or poor observing conditions, but normally you are able to get elk broken up into small enough groups and strung out so that you get a good look at them and then there is no problem. But when you have to classify them going away or something, you have a problem. Yes, there are occasionally times when it takes a lot more time to be confident in what you've got.

Question: How many hours do you fly to get your samples?

Answer: In the Gallatin we can classify several hundred elk in 3 hours because they are in big groups. A flight is normally 3 to 4½ hours. That is the entire herd usually, or at least the major segment.

Question: Then you get one flight in the Gallatin then you leave it?

Answer: No, the Gallatin is a place where we make a dozen flights a year. But that is an exception. Most places there is one flight. That is part of the problem. We do not have time to look at it often enough to make sure that what you got

the first time is really representative of the population.

Question: Are you sure you sampled the whole herd and not different herds in both counts? This is one thing we are wondering about on the White River. Are our prehunt counts sampling the same elk that we count in our posthunt counts?

Answer: Yes. They are in the same place. These are late summer classifications and there are several segments all in one general area. There are maybe four or five winter ranges that accommodate all of these elk. The classifications cover the entire summer range and they cover the entire winter range. In the Gravelly the ratios don't vary appreciably. Each segment is very close to the other so I am more confident with those ratios than with anything we have.

Question: We looked at this group thing that you did to see if we could determine how many groups we had to count to come up with a statistically sound sample. We finally dropped the idea of groups and went to just a sample of at least 1000 animals and not worry about numbers of groups, because our variability, like you, did not make any sense. So now when we reach 1,000 animals we generally quit, rather than "X" number of groups.

Answer: We fly and count all we can and classify all the animals. Normally in the Gravellys it is probably 75 percent of the herd.

Question: Just one other question. You showed and you assumed the sex ratio of your calves to be 50-50. Well, we thought this until we started looking at our data and never in check station samples have we had more male calves than females. In fact last year there were 2½ times as many females killed as males. One year it was equal. Every other year we always kill more female calves than males.

Answer: We have never had that problem in Montana.

Question: I am just throwing up a question. Hasn't anyone had this problem except us?

Answer: We sex and age all the animals through check stations and have never had a variability of more than one or two percent to my knowledge.

Question: Since 1961 we had one year when the sex ratios were equal. Every other year we've always killed 2 to 3 times as many female calves as males. I would like to know why?

Answer: So would I! Does anyone else have anything to add to this discussion?

Question: Ray, do you have a difference between grasslands for wintering elk and browse winter range so far as productivity is concerned?

Answer: Yes. The Rio Grande is quite a bit lower than the White River, and it is the only real grassland we have. There is about 54 calves per 100 cows on the Rio Grande and close to 64 on the White River.

Question: And the White River is chiefly a browse range?

Answer: It's all browse ranges. Our browse ranges are where we get our higher productivity.

Question: Did anyone have anything on the variation of cow:calf ratios between ground counts, fixed wing, and helicopter? I cannot classify elk from the air and come up with any kind of a sample like I would get on the ground.

Answer: I do not know, in my experience anyway, of anybody in our Department that really does much classifying from fixed wing. It's either ground or helicopter. Someone here might want to point out an exception to this. I agree with you that it is pretty tough to get a classification with a fixed wing, although occasionally in places like the Gallatin and Sun River where you have herds out in wide open country which is basically undisturbed, and elk are in fairly large groups, you can circle for a long time and they won't even get out of their beds. You can make classifications that way, but most of the time it is pretty tough.

Question: I make most of my counts from the ground and find big variations from early counts to later counts. We started out with probably 60 or 65 calves per 100 cows and I end up with around 50. I throw these all together and average them; isn't that the best thing to do?

Answer: I don't know. It was intended to be the purpose of this section to point out some of these problems; you cannot make a classification and end up with a ratio and assume that it is going to give you all of these things. You just cannot use it for that unless you know more about your population. If that happened in the Gallatin I would guess that what might be happening is that the calves are wintering in a more easy place to winter and they are more visible earlier and later in the year, and other times the counts will start dropping your ratio. What the situation is in your area I do not know.

Question: I assumed it would be easier to identify them earlier than later.

Answer: Well, of course that's true, but on the ground if you get a good look at the profile of them they still should be identifiable.

Comment: Several years ago many people in the wildlife service did some work on cow:calf ratios compared with October sex ratios.

They were using fixed wing, experienced observers, aerial photography, and ground observations of the same herd. They found gross variations with the fixed wing data and very close approximations with the photography and the ground counts.

CALF:COW RATIOS IN THE LOCHSA ELK HERD

by

Dr. Richard Knight[1]

Coming from Montana to Idaho and taking calf:cow ratios has been a different experience. In northern Idaho where the largest herds are, calf:cow ratios aren't normally used as a part of management because of the problems of getting an adequare sample. For example, about 2 weeks ago Sam McNeil and I were talking about how much time would have to be spent flying in the Clearwater to get an adequate sample for a calf:cow ratio. We decided that we would have to average around 200 hours of helicopter flying a year to come up with a decent sample. This is under conditions where you are flying for 5 or 10 minutes without seeing anything, and when you do see something it is usually only 1, 2, 3, or 6 elk. Observing conditions are just not good.

Two weeks ago we flew 10 hours and classified 212 elk. This was not under ideal conditions. We feel that we should get about a thousand animals out of a herd numbering around 3,000. Since 1969 we have had trouble getting 1,000 animals even with abundant helicopter hours. I should point out this is a research project and that is how we had the time and special money to do it. It is not the kind of thing you would be able to afford for management very often.

I do miss the open grasslands of Montana for making calf:cow classifications. In addition to difficulty in seeing elk in the brushfields, they are more difficult to classify when found. When you have the visibility and the maneuverability characteristic of grasslands, you can work the animals quite quickly. Once you get a herd of 200, 300, even 800 at one crack as you often do in Montana, you can get them strung out and fly up the line with a tape recorder. In Idaho's brushfields, it can't be done. You get 2 or 3 animals milling around on a steep, brushy hillside. It's quite awkward to get an animal in profile on a steep, brushy slope. Quite often especially during summer the difficulty is insurmountable. Last summer we flew 25 hours and counted about 75 elk.

We do not have big game concentrated winter ranges. We've got about 50 river miles of winter range, with numerous side drainages that elk are scattered in and there is considerable variability from drainage to drainage and it switches from year to year. We do notice the thing Gene was mentioning, about the switch or difference in calf:cow ratios. From year to year; when we have a high calf:cow ratio year it may slip down to a lower ratio the next year. This may possibly be due to more yearling animals in the cow groups.

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[1]Research biologist, Yellowstone National Park, Mammoth, WY.

This year in January we flew 15 hours and classified about 600 elk; during February we have classified about 200 elk in 10 hours. The conditions were such, with patches of snow and brush and bare spots, that you almost went blind looking for elk. In January we had a calf:cow ratio of 33 calves per 100 cows with 600 elk sampled. This month we have a calf:cow ratio of 23 calves per 100 cows, from a sample of 200. I feel that the higher sample is more valid, but we will check it again in March or April. We really hope to get some worthwhile sampling yet, although if we do not get some snow it is going to be tough.

Interpretation of the calf:cow ratios is difficult. A high calf:cow ratio could indicate several things. In other words, you could have a high calf:cow ratio with a herd that is building, a herd that is stable or a herd that is declining. We interpret it as a function of how close the herd is to carrying capacity, and of mortality. The higher the mortality you have on a stabilized herd, the more calves you will need to keep it that way. Conversely, in the Lochsa we have a low calf:cow ratio that can be a little better interpreted. You would not expect a low calf:cow ratio on a building herd but you could have it either on a declining or stabilized herd, depending on the mortality rate.

So, by itself, the calf:cow ratio does not tell you very much. We currently have low calf:cow ratios of around 33-34 calves:100 cows. Ratios must have been higher at one time when the herd was building, just like the South Fork of the Flathead must have been higher at one time, but it is pretty low right now. We feel that this is a declining herd. I see a couple of "Smokey Bear" types up here and we've got to get them and some matches on the winter range; they realize this too. We have not been able to do this on any areas of significant size. The range is growing up and we are not getting it burned back to the point where it is really going to make a big difference to the herd; to the stage where it might have been 10 or 15 years ago.

We have a problem with pregnancy rates. From all the cows that are palpated when trapped, plus winter kills and road kills, we get a 70 percent pregnancy rate. This usually runs around 25 percent for our yearlings, which is not something you can expect.

About 2/3 of our 2 year olds are conceiving, and the older age classes, until you get to very old age classes, are usually up around 100 percent pregnant. Comparisons of pregnancy rates with calf:cow ratios leads us to wonder what happens to all the calves. We hope to get some answers starting this coming spring with a project designed to find out what happens to a calf from the time it is dropped until the time it reaches about 3 months of age. What little sample we do have in the summer time indicates that our calf:cow ratios are down to at least 35 calves per 100 cows by September. So we are losing a lot of calves right at the beginning of the summer or soon after parturition. We don't seem to be having late abortions, but we hope to have information on this out also.

SOME COMMENTS ON ELK MANAGEMENT IN ROCKY MOUNTAIN NATIONAL PARK

by

David R. Stevens[1]

I think most of the things I had in mind to discuss have already been covered one way or another, but I do have a few thoughts that could be of interest. As Dr. Pengelly said yesterday, we are beginning to test some of these hypotheses of natural regulation in the Park Service. You may think we are the only ones doing it, but it sounds to me like Dick Knight is testing a few himself in the Lochsa. I have also heard of several other elk herds here that are probably more naturally regulated than regulated by hunting.

In a national park we can manipulate a population more the way we think it should be done rather than being tied to a set hunting season every year. In Rocky Mountain National Park we are allowing the herd to build at the present time, only using hunting seasons outside the Park for any type of regulation. This probably means that we are getting a differential harvest of the population. The ones that are staying in the Park are mostly naturally regulated and not being harvested, but those outside are being harvested heavily. To study the effects of natural regulation, one of my main programs is a very intensive range condition determination. I probably have more transects in a small area than most management people can ever afford. This is mainly to determine whether we are getting some drastic changes in the vegetation because of the building elk population.

Other information needed is a complete classification of sex and age structure of a population in order to tell what the dynamics are. As you might know, this is more difficult to get on most populations than the cow:calf ratios. However, I think that it is needed. I cannot say that we are succeeding in getting true statistics, due to the differential distribution, mainly in the male segment of the population. The male segment is very difficult to get a true ratio on, at least in Rocky Mountain. Some of this variability has already been mentioned. Another thing which I do not think was mentioned, and which exists in most areas, is the density independent losses which mostly occur after winter classifications are made. If you are losing calves or old animals in the spring, you are changing the recruitment into the population at that time, after classifications are complete.

The cow:calf ratio in our population is fairly low. However, it varies considerably. Until this year it was going down like we expected. The effect of range condition, or the nutritional level, on the population (cow:calf ratio) has always been considered one of cause and effect.

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[1]Research biologist, Rocky Mountain National Park, Estes Park, CO.

We felt if we did not have high nutritional levels, then the cow:calf ratio should go down. It may be very insensitive to this, although probably the relationship does exist. While our population has been building, range conditions have not deteriorated measurably. They appear fairly stable. The increased forage needs are causing redistribution into more of the bottom areas and deeper snow areas. The upland sites, where the lower density populations have been maintained before, are receiving a fairly constant degree of use. What has happened is that in 1966 we had a cow:calf ratio of 53 to 100. This declined through 1969 where we had 26 calves per 100 cows. This maintained itself in 1971, and this year we jumped back up to 44. I am sure my range condition data is accurate. There could be some possible explanation for this in the differential harvest along the Park boundary. We are getting harvests outside the Park with calf:cow ratios of about 14 to 100, but it has been as high as 67 per 100 in 1966. However, generally it has been low, which would result in a high post-season ratio in the population. This year the ratio was (with one flight in January) up to 73 calves per 100 cows, which I think is simply an indication of this differential harvest on that segment of the population. It is going to be interesting to see how the population, and the fact that we are building up two segments, is going to react to the range conditions and changes. We are monitoring the range condition outside the Park as well as inside.

One thing I also might mention is the effect predation might have on some of these populations where we are not getting a harvest. If you are getting a fairly high cow:calf ratio, you may be getting more culling in the population due to predation than you expected. This would allow for a recruitment into the population and a higher survival of calves. This might be something to look into if you suspect this type of situation.

Question: What percentage of your herd is migratory and what techniques do you use in measuring range conditions?

Answer: To the first question, we are dealing with a herd we believe is approximately 1,200; about 700 of them winter in the Park. This varies with the winter severity. This year we probably had a higher percentage leave. My counts within the Park have not been too accurate to date. I have not been able to use a helicopter. Gene talked about one of the ways of getting a good count is to wait for proper snow conditions and cold weather. We have to fly when we can. The winds and flying conditions on the east slope of the front range are pretty bad as far as being able to time your flights. By using helicopters, however, we are able to get pretty good counts when we can fly.

As far as range conditions, I am utilizing two techniques to measure annual utilization on the range, agronomy cages

on the grass sites and percent leader use estimates on the willow, sagebrush and bitterbrush sites. We do have some older permanent exclosures that are quite interesting, too. To determine changes over longer periods in condition and trend, I also run line intercept and Daubenmire plot transects. Those that have been in five years are scheduled for a rerun this year and I hope will give us some idea of really what the range is doing. Annual measurements can be very disillusioning. I feel that these longer term cover and condition trend measurements are going to tell us considerably more.

Question: Why do you feel that the cow:calf ratios are higher on the harvested segment of the herd?

Answer: These are post-season cow:calf ratios so we are getting the effect of differential harvest of the older animals.

Question: Does this account for all of this?

Answer: I think so. There is a possibility that we might be getting better range conditions outside the Park, and we do have a segment of the population that always migrate to the same areas. We may actually have a higher production because of the harvest. This is a real possibility which we hope to be able to test.

SOME COMMENTS ON CALF/COW RATIOS FROM THE WHITE RIVER HERD, COLORADO

By
Ray Boyd[1]

On our browse ranges I flew 17 hours in December and classified 2,300 head of elk. I could spend 17 months up there and probably never get that many from the ground. There is no way we can classify elk on the ground in the White River. The terrain is not so rough, but many times I am classifying elk from here to that wall. We can get right next to them. So if we had to make a decision between ground counts and aerial counts in the White River we would take the helicopter as long as we could keep getting our number of hours; we could not begin to touch our sample sizes by going to ground counts. We fly at a different time of year than you here in Montana. Again, I guess I am lucky because this is a research project and I can spend whatever time I need with the helicopter. We fly the White River three times a year -- twice on a research flight and once for management. It was a management flight last month when we counted 4,400 head of elk which is our regular winter trend. I fly an average of 14 hours in September for pre-season counts and average about 15 to 17 hours for post-season counts. We sample better than 1,000 head pre-season and average better than 2,000 head for post-season counts.

Question: Have you found any indication that you get a change in your calf ratio pre-season to post-season because of hunter selectivity?

Answer: Our post-season count is always higher, but not that much higher. This year I counted 65 calves per 100 cows pre-hunt in late September. In early December I got 69, which is about what you would expect with the removal we had of antlerless elk.

This is consistent - you always get a few more in post-season counts. The hunters select against the calves; they are going to kill more cows as Gene brought out, so this is going to raise your ratio.

For 7 years we have been making some cow/calf counts in July; we sampled better than 1,000 head on the ground last July and came up with a calf ratio that makes no sense at all compared with what we find in September. We are getting 50 percent more calves per 100 cows in September than we find in July.

Comment: Al Schallenberger and I (Dick Knight) were just discussing what we would rather do on the Sun River where you have good visibility

[1]Research Biologist, Colorado Division of Wildlife

from the ground, and we agreed that if given a choice of helicopter or ground observation, we would choose classification from the ground where you can get a sample of 2,000 to 3,000 head of elk in the winter.

Comment (Allen): We use ground classification where ever we can, but the helicopter is necessary in more remote places or where time is a factor. On the west side we have small groups of elk scattered all over; on the ground to get any kind of a sample it would take you forever, if you could get there in the first place.

Comment (Knight): In the Lochsa we just couldn't do it; you can't see them from the ground.

Question: Does the hunting pressure of today promote a later breeding of our elk? You mentioned you'd rather see these elk in July. In the last 2 years on the Bitterroot Game Range, I have seen baby elk after the 4th of July. Is this any sort of an indication of a later breeding date, that these elk may still be so small that you are not able to observe them at that time? Is there anything like this going on in other places?

Answer: I do not think it has changed the peak of the rut in Colorado, because we do not have early hunting seasons. We have an early archery hunt, but there is no early rifle season open in mid-September. I do not think we get that much disturbance. I think the calves are little but they are laying down and we just do not see them. We may classify a bunch of elk in a park early in the morning and think we have everything, and then go in there on horseback and chase everything up; and "wow", there's a lot more calves than we originally saw and it is too late to classify. I think they are laying down and we just cannot see them in the summer.

Comment (Allen): I do not think it is too unusual to have some elk breed later, such as the yearling age class. They would have a calf one month later. I am not aware of any place where hunting has interfered with the main rutting period.

Comment (Hartkorn): I think that when we first get out of school we figure there isn't much we don't know or can't do, and that classifying elk is easy. Then after we have been out for quite awhile and we have a bunch of elk in an elk trap, we take a quick look and say there are 4 calves and 5 cows and we run them through the chute. We find there are 5 cows, 2 yearlings and 2 calves; we lose our confidence in classifying them.

Comment (Allen): We have some evidence from checking stations where we have weighed elk that we have some pretty darn small yearlings and it would be real easy to mis-classify them the spring before, especially if you are making a late classification.

HABITAT USE AND BEHAVIOR OF ELK IN RELATION TO HUNTING

By
Kenneth J. Coop[1]

Relationships between elk *(Cervus canadensis)* and its habitat have been studied in many areas, but there are still certain facets of the relationship that need further understanding to effectively manage the species and/or its habitat.

During the summers of 1969 and 1970 and the fall of 1970, intensive information was collected on elk and their use of habitat in the Little Belt Mountains of central Montana (Coop 1971). Research emphasis was placed upon the periods prior to, during and directly after the hunting season. During the fall of 1971 and 1972 further data were collected, compared with and used as a check against the earlier information.

The study area was divided into four vegetative zones (Kirsch 1962), two of which were used heavily by elk prior to and throughout the hunting season (Englemann spruce-subalpine fir and Douglas-fir). The other two (ponderosa pine-grassland and ponderosa pine) were used during hunting, but to a lesser extent during the first part of the season, with use generally increasing as the season progressed.

Based upon the tree crown density, the zones were divided into three main habitat types: open park (0-15% tree crown density), broken park (16-75%) and timber (76-100%). Use of habitat types were based on observations of elk associated with these three types, primarily within the spruce fir and Douglas-fir zones (Fig. 1). Note the similarities and differences between the zones for the same time periods. After hunting started (October 18), an almost immediate shift in use occurred to the more timbered areas, especially during daylight hours. Timber was dense in the case of the spruce fir zone and less dense in the Douglas-fir zone. After the first two weeks of hunting, observations of elk associated with open and broken parks increased in the spruce fir zone, while in the Douglas-fir zone use shifted from the broken park type into the open park and denser timber type. The shift and variances in the use of habitat types within zones was felt to have been related to the location and type of area, with reference to hunter activity, pressure and access.

Timber characteristics recorded for the timbered areas used for escape cover in both zones indicated an average of 450 trees per acre, with an average crown density of 85 percent. Density of escape cover actually used increased after hunting in some areas of the spruce fir zone to approximately 95 percent.

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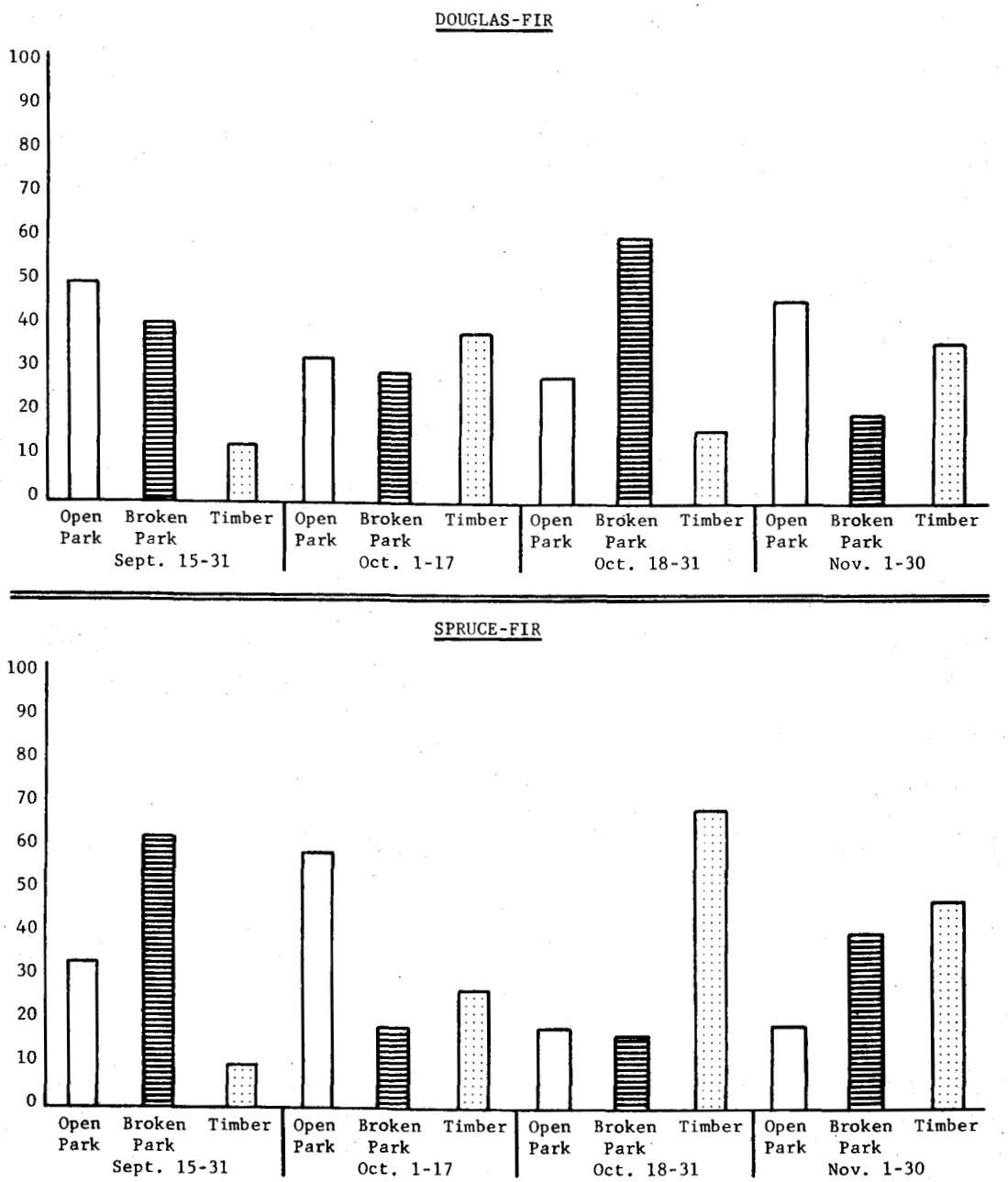

Figure 1. Percentage of use for the three main habitat types by month for fall - September 15-November 30, 1970 - in the spruce-fir and Douglas-fir zones.

During the hunting season of 1970, hunter groups representing 1,450 hunters were interviewed. Besides checking for kills, information was obtained on whether or not elk had been observed and if the hunters had hunted from roads, in the field, or a combination of both. A total of 94 percent of the groups which saw elk spent at least some time in the field. More elk were seen and killed by hunter groups that hunted in the field exclusively than the other two types of groups combined. This indicates that access (roads and trails) into adequate habitat areas can lead to increased kill if the hunters are willing to leave the roads and actually work in particular areas, while hunters unwilling or unable to leave the road or trail systems actually add very little to the kill.

It is felt that the activities (hunting, vehicle harassment, etc.) associated directly with roads are more of a factor regarding elk use of a particular area than is the mere presence of a road or roads and their general use. Elk were often located within one-fourth to one-half mile of an access road or trail during hunting.

All of the following statements are either keyed to, affected or determined by an area's topography, habitat patterns and density of timber types, which includes the quality and quantity of available escape cover. Elk were resistant to high levels of hunting in rough topographical areas, with adequate densities of timber and were also resistant to hunting pressure in fairly even topographical country, when the vegetative habitat was sufficient. Somewhat narrow or small areas of adequate timber densities and habitat patterns allow elk to remain in one area, while the lack of adequate habitat often caused elk to leave other areas. The amount of hunting pressure necessary to force elk out of an area is not known, but it appeared to be in direct relationship to the quality and quantity of the area's habitat.

Just what constitutes adequate quality and quantity of habitat for each specific type of area or region is not known, as it will vary depending upon certain conditions for any given area. This points out the serious need for additional information on habitat use, characteristics and preferences by elk from a wide selection of elk habitat areas.

These statements are based on recorded observations which occurred during each of three hunting seasons:

1. Elk use of areas was related to but not necessarily determined by hunter access, activity and pressure.

2. Hunting was not observed to force animals into a mass downward movement, and in some instances contributed to elk moving up or remaining on higher summer range (Knight 1970).

3. The main distribution of elk during hunting seemed to fall primarily into belts either above or below the applied hunting pressure. Most road access for hunters occurs either along the tops or bottoms of drainages or both.

4. Although elk did not necessarily vacate areas accessible by roads, observations indicated that hunting pressure and access can and did affect the degree or time of use of an area by elk. Presence of a road or access into an area is not necessarily an indicator of hunting pressure, as many people either only drive the roads or get no more than a few yards away from their vehicles.

5. Elk groups were often observed to use and stay within certain areas, establishing patterns of use in direct relationship to applied hunting pressure in the area. Elk will leave such an area if necessary and may or may not return, depending upon location and amount of remaining hunting pressure in and around the original area.

6. Movement, use and feeding in open type areas (natural and artificial) often occurred at night and appeared to be related to weather conditions as well as hunting pressure.

7. Primary permanent movement onto elk winter ranges was delayed or affected by hunting. The escape habitat on the Judith River Game Range is not sufficient enough to allow elk to remain there under intense hunting.

8. Elk often moved onto winter ranges within a few days after the closing of the season and did not leave these areas before dawn, as was the case during hunting.

9. Elk harvests in the Little Belt Mountains over the last three years have been less than desired in spite of an abundance of hunters, roads and trails. The existing patterns and types of roads in relationship to existing elk habitat has not been shown to be detrimental. In conjunction with the above, one must also consider present hunting regulations and the weather conditions during the covered time period.

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ELK USE OF BURDETTE CREEK

By

L. Jack Lyon[1/]

This study basically involves an elk herd that winters in Burdette Creek, about 30 miles west of Missoula. We are interested in what happens to the distribution and reactions of that herd when an adjacent drainage, which was previously unroaded, is opened up and logged. I will describe part of the distributional reaction caused by the logging operation in another session. This presentation will describe some other kinds of information we are able to get out of this study relating to habitat preferences and places where elk are and where they are not.

The study method is a little involved, but this is a part that may be of interest because I think it is a different technique than anyone has used before. The survey method for elk distribution involves counting elk pellets, an old technique that is being used differently here. Our transect lines are on every 500 foot contour line. Elevations range from 3,500-6,500 feet. Our technique involves dropping a man off with a contour map and an altimeter, having him drop down to the appropriate contour and then just walk on the contour working a belt transect 4 feet wide and recording each pellet group as he comes to it. Pellet groups are aged as fresh, new, old or very old. For each 40 over the whole area I've got some distance walked within the 40 and some number of pellet groups seen. I can also produce for each 40 a slope, aspect, elevation, cover type, distance to water, distance to the nearest road and a variety of other things that may be affecting animal use on that 40.

We can assign a Y variable (number of pellet groups per 40) and set this up as a regression equation where the slope is one variable and the elevation is another, and so on. You run into a rather major problem as soon as you start this. You could very easily have a 40 on one side of the drainage that has all of the characteristics that a 40 on the other side has except one - there aren't any elk on it. Everything else could be alike. Elk being habitual, they appear in a certain place at a certain time of the year and this is the way things are. I cannot readily set up a regression equation and compare all of the 40's over the whole area because some of them just aren't used by elk.

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The alternative to this is an analysis in which I examine nine 40's at one time. If an elk showed up at all, he could just as well have been on any one of those nine 40's. So I can calculate a mean number of pellet groups per length of line walked over the whole sample area (360 acres in this case). Then I can look at the observation on the center 40 by itself and note that in most cases it is different than the mean for the whole area. This difference then is due to some cause. Whatever it is, elk either prefer this 40 over the other 8 that are available, or they stay out of it compared to the other 8 available.

If I categorize variables, I can add up all the deviations for all 40's that were at 4,500 feet and come up with some kind of a sample that should tend towards zero if there is no real preference for 40's at 4,500 feet as compared with those at 5,000. They should all sort out to be basically zero. If the differences tend to be positive for all samples of this type then the type will produce a positive number. The summary end product is a positive or negative value saying how the animal used this particular 40 in relation to the others that were available to him in these small pieces of his environment.

For the whole area then, if I just move across and take another set of 9 and look at the central 40 in relation to the ones around it, each year I'm dealing with something in the neighborhood of 1,000 observations. Each observation by itself is a pretty low estimate of what elk are doing; but with a large sample I think I'm getting some pretty good information.

The patterns I have to show you this morning unfortunately do not include all the things I would like to have, because most of them are still in the computer. The main thing these results do is confirm that the technique is showing animal use in a pattern which is consistent with what we already know. I have set up a matrix in which I have eight aspects and six elevations (table 1). In each cell of the matrix there is a positive or negative value describing elk use of all units that fit into that particular cell. The thing that shows up here is a string of high positive numbers at the 4,500 foot level on east, southeast, south, and on the southwest slopes. These numbers get smaller as you go up or in either direction. Obviously this is a winter range at 4,500 feet. We would expect winter ranges on the south and southwest slopes, but it isn't what we got.

This in itself made me real happy about the technique for describing animal distribution and habitat patterns. You'll notice that the largest numbers are on the southeast slope - which is, in fact, the winter range within Burdette Creek because the main drainage runs

Table 1.--Elk pellet deviation from zero, by aspect and altitude, 1970

Altitude	North	NE	East	SE	South	SW	West	NW
6,500	-.92	-.63	-.59	-.49	-.50	-.55	-.90	-.75
6,000	.02	.05	.02	-.18	-.10	-.18	-.22	-.11
5,500	.07	.12	.20	.14	.11	.02	-.08	-.09
5,000	.03	.20	.24	.07	.02	-.01	-.16	-.26
4,500	-.11	-.39	.40	.71	.52	.38	.16	.09
4,000	-.46	-.56	-.39	-.12	-.16	-.30	-.43	-.57

southwest. Bisecting side drainages from the north create just about all the southwest slope there is, but these small drainages are so narrow and shaded that snow does not melt out. As a result, our elk are using southeast slopes as winter ranges because that is what is available. Southwest is not available in this particular winter range.

The other thing that shows up in the matrix is a pattern of larger numbers on east and northeast slopes about 1,000 feet higher--at the 5,500 foot level. We believe this to be summer range preference for areas that face east and are in the neighborhood of 5,500 feet. Again this is entirely consistent with what we know about these animals. In another study in this overall project, Bob Ream's study in the Sapphires, the animals with radios on them show a preference during the summer for east facing slopes in just about the pattern that is shown by these pellets.

Another analysis that is available at this time pertains to elk use of different 40's in relation to the distance to free water (table 2). I got a real difference between the first two years of the study which I think is significant, although I have not been able to tie it to exact weather conditions as yet. The first year of the study, 1970, was a year in which there were some hot periods which apparently kept the animals from using certain parts of their range. To me at least, this was a surprise. I don't think that anyone really felt water was a significant limitation of the environment in Montana. In 1971 a different distribution pattern of rain during the summer resulted in no elk preferences at all, with the possible exception that they were using something they did not use the year before.

Another thing that showed up the first year was a definite avoidance of roads (table 3). A pattern here of the closer to a road the less the animal use, and the further away the more animal use. There are some complications here which I hope to take out in future years. You'll note that 1971 indicates a breakdown in the relationship. I think this is a function of the new roads put in as a part of the timber sale. The 1970 data describe a pattern of use in relation to a road network that has been in for a minimum of 10 years, and in a lot of cases 20 years. There are many older roads that have been there a long time. They are not very good roads, but they have been there. The 1971 analysis takes into account a whole series of new roads without separating drainage patterns, and what I have then is one drainage with a whole lot of new roads in it in comparison with some other drainages that haven't been changed at all. Moreover, I suspect that the elk haven't had time to change their patterns of response either.

Table 2.--Elk pellet deviation from zero, by distance from water

Distance (Miles)	1970	1971
1/6	.02	-.01
1/2	-.05	-.00
1 1/8	-.35	.14
2 5/8		

Table 3.--Elk pellet deviation from zero, by distance from roads

Distance (Miles)	1970	1971
1/6	-.10	-.02
1/2	-.04	-.02
1 1/8	.02	.03
2 5/8	.04	-.05

In addition, there is a real question about the relationship of existing roads to topographic patterns. My distributional map shows low elk use along all the very large ridges in the study area. Many of these ridges also have roads. It seems a fair question to ask whether the low level of elk use is caused by the road or the ridge.

Question: Do your observations include timbered south slopes or open south slopes?

Answer: In this case they include all south slopes. I have not yet divided the area by cover type in this analysis. I had hoped that I would have a division available, but I've had some trouble with the card reader.

Question: You said you used pellets to define use. When you say use are you just talking about animals being there or are you saying that the animals fed there?

Answer: No, all I'm saying is that the animal was there. There are quite a few problems in defining use of a cover-type with pellet groups, because elk may eat in one place and go off somewhere and chew on it. In this particular study at least, I don't think it's so much of a limitation, because you at least have this one thing going for you, if the pellets are there the animal was too.

Question: So often we see the word "use" defined as resting, feeding, ruminating, plants consumed, amount consumed, and these are all related to feeding.

Answer: I'm trying not to make any assumptions of that nature in this particular study and have also attempted to set these data up so no one can turn it into animal unit months or numbers of animals. My main reason for that is that while it is possible to do it, I hate to see this kind of hanky panky done with this kind of information. The pellet counts are holdovers, at least the very old pellets hold over for more than one year. The problem with building pellet counts into animal numbers is that various kinds of built-in errors are cumulative. By the time you go through number of pellets/acre, plus or minus; 13 thirteen groups per day, plus or minus; and all the rest of it, the estimated number of animals has such a large error it's meaningless anyway. I can come up with a lot better guess than those type of figures.

SOME PRELIMINARY COMMENTS ON ELK USE OF THE LONG TOM CREEK STUDY AREA

by

Eugene O. Allen[1]

Before our last speaker I am going to take about 5 minutes to run through some preliminary findings that we are finding in one phase of this cooperative elk logging study that I'm involved in. We are only into it one year and the findings are a little bit preliminary, but I think there are some generalizations that are showing up that you may be interested in.

The elk in the study area are part of the Fleecer Mountain winter herd. These elk for the most part leave this area in the summertime and some go as far as the Pintler Mountains (30 miles). A good portion of them stop in Long Tom Creek, our study area. It's a pretty lush area with alot of wet areas and is very heterogeneous.

Many different types are in close association, with small parcels of one type butting up against another type. There are numerous wet or moist creek bottoms, dry grassy slopes, Douglas-fir in small quantities, quite alot of lodgepole. The bulk of it is spruce, fir, and whitebark pine. These range from very open old mature stands to very dense young stands. Alot of wet parks both with and without trees in them. Some parks are as large as 80-100 acres.

There has been some clearcutting activity in the adjacent drainage and elk coming from the winter range do use this area early in the summer; by the end of July they have pretty much left it. They use these areas in large numbers (80-120 head in a group). Most of the use in clearcuts appears to take place in old parks that were cut through. These are fairly large clearcuts and are about 6-7 years old.

The primary study technique involves eleven foot routes, each one ranging in length from 3 to 9 miles with about a 6 mile average. As these routes are walked they are divided up into segments; every time a different vegetative type is encountered it's a new segment. The data are recorded by these segments. Any instance of elk presence or use is recorded; this includes pellet counts, actual observations, beds, wallows or what have you. The routes average about 76 segments so you can see the interspersion of types in this area is quite high.

There will be 14 clearcutting units imposed over the area during the next 3 years. We will continue the study during and after logging to see what impact this particular practice has on elk. Lodgepole is about 20 percent of the cut, spruce about 40 percent, and whitebark pine about 20 percent.

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[1]Chief, Research Section, Montana Fish and Game Dept., Bozeman, MT.

Very briefly, some of the findings. There is a fairly strong negative correlation between cattle use and presence and elk use and presence. Probably 2/3 of the segments that we recorded elk use in occurred in only 20 percent or less of the units; these units were not used by domestic cattle at all, and it appears that there is a distinct relationship between the presence of domestic cattle and the absence of elk. We will do more work on this to try and pin down a little closer just what the aversion is, whether it is mostly social or mostly use of forage and related competition.

Elk in this area seem to use large meadows early in the summer going to smaller ones as they disperse later in the summer. It was interesting to note that Bob Beall said that elk, when they bed, associate with the largest tree in the area. I think we can generally say the same thing. It was not uncommon to find elk bedding in water or in a bog 4 to 6 inches deep, usually in the shade of the largest spruce tree around. Other characteristics of elk bed sites include: an affinity for a high degree of wetness; a broken park in a mature spruce stand with most trees over 40 feet tall; and most beds found within 100 feet of another habitat type, usually timber.

For use of the area in general, there was an affinity shown for: small broken parks in the spruce type; small trees (reproduction); little or no downfall; and areas high in wetness degree. Most of these characteristics simply describe the small broken parks which elk apparently preferred during summer and early fall.

WINTER HABITAT USE IN THE SAPPHIRE MOUNTAINS OF WESTERN MONTANA

by

Robert Beall[1]

The Threemile Game Range lies in the foothill portion of the Sapphire Mountains, due east of Florence, Montana. There are approximately 10,000 to 15,000 acres in this area that are available for elk winter range, 6,000 of which are owned by the Montana Fish and Game Department. The area is characterized by westerly drainages with rather steep heavily timbered north slopes occupied by Douglas-fir and Western larch, and south slopes having open ponderosa pine and Douglas-fir stands. The weather in the area is not as severe as some of the Western Montana winter ranges that were discussed yesterday in that the feeding areas do not depend upon wind conditions to keep the slopes snow free. Temperatures are moderate enough and the solar insolation great enough that south slopes and open grassland areas are kept relatively free of snow providing an available food source.

The gross habitat use in this particular area is governed by snow conditions. As snow depths increase, elk use shifts downslope. I have observed elk in this area over three different winters. Snow conditions were quite different in each of the three years. In 1970, snowfall in November and December was sufficient to push the elk to the lower areas of the game range. However, in January 1971, an extended warm spell accompanied by rain, melted most of the accumulated snow on the game range proper. While falling as rain on the lower range, the moisture came as snow above 6,000 feet, thus presenting an effective barrier to movement upslope. The lack of snow depth allowed comparatively free movement up to the 6,000 foot level.

In 1972, snows were again received in November and December, but a January storm, similar to the weather system in 1971, came as snow rather than rain. The total moisture for the two years may be comparable but the ground conditions were very different, with snow depths over two feet commonly recorded in 1972.

1973 was a record dry year for the Northwest. Very little snow was received in November, December or January. Snow depths in January, at 6,000 and 7,000 feet were less than 1 foot. The same elevations in previous years had 4 to 6 feet of snow. The weather remained mild throughout the winter with no appreciable snow depth ever accumulating. The ground conditions were similar to 1971, but the snow barrier at 6,000 feet was absent.

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In 1971 and 1972, heavy use was made of a portion of the southern end of the game range. A large part of Sections 4, 5 and 6 seem to supply an adequate food source, and extensive bedding sites. The use of this area in February 1971 was more general than in 1972, probably because of the less restrictive snow conditions. In 1972, a very narrow belt of travel from bedding to feeding areas was used, while this was not so apparent in 1971. Approximately 60 percent of Section 6 is planted to mixed grasses and alfalfa, and is a major feeding area, with 40 to 80 elk traveling to the area each night. The differences in the use of this section between February 1971 and February 1972 again can be attributed to snow depths. In 1972 the elk moved further west downslope even to the extent of utilizing a small remnant of bunchgrass in Section 7. With little snow in 1971, the elk appeared unwilling to travel that far from cover for food.

In 1973 use of the feeding area in Section 6 was minimal. The lack of snow depth at higher elevations allowed elk to utilize portions of the winter range not normally used. The areas that received the greatest use were between 5,200 feet and 5,800 feet, with some elk utilizing areas above 6,000 feet. The intensely used areas of 1973 were considerably higher in elevation than the majority of elk use areas of 1971 and 1972. The open field in Section 6 averages 4,400 feet in elevation, while the south slopes used for feeding in 1973 averaged above 5,200 feet.

Comparing the amount of use for other portions of the range, it can be seen that there are some obvious differences between years. Primarily, this can be directly attributed to the difference in snow depths. With the much greater snow depths in 1972, elk were forced further downslope for adequate bedding sites, utilizing some areas that were used little or not at all in 1971 and 1973, and avoiding other areas used in 1971 and 1973.

While snow depths did affect where elk used the habitat, it did not affect how they used the habitat. Specific habitat use seems to be a function of ambient meteorological conditions and solar and thermal radiation conditions. Elk appear to seek the most moderate area that they can find under any given weather condition.

Several general patterns of movements and habitat selection related to radiation conditions were noted. Each winter, there was an extended cold spell late in December or early in January, with daytime temperatures frequently well below zero, and clear skies common. Within these periods, elk were observed to move to feeding areas shortly before dusk, feed for several hours in the open, and then bed down for a period in the open fields.

After approximately an hour, they would move to adjacent timbered north slopes and bed again. They would feed again during the dawn period and then frequently bed down on nearby open south slopes in direct sunlight. After a period of several hours they would move upslope to bed on open timbered south slopes or open ridge tops.

During these same periods, elk were frequently observed feeding in the evenings on open south slopes in direct sunlight. As the sun went down, and the shadows moved up the slope, the elk were observed to move up with them, thus staying in direct sunlight. When the shadows completely covered the slope the animals dispersed, and appeared to feed at random.

This behavior indicates that when the first feeding period was over, the elk were able to bed in the open under the cold clear skies. Conceivably, the thermal energy generated by the movement in feeding was sufficient so that the elk were "confortable," while bedding in what should be excessive cold. However, after a period of time, the heat drain was enough to cause the elk to select a more favorable bedding site, and they moved to the timbered north slopes, where the effective radiometric temperature would be the highest. Following the second feeding period, they again moved to the warmest environment for bedding--the sunlit open south slopes. As the sun angle increased, and the ambient air temperature warmed to some extent, and the need for less radiation, or possibly more security moved the elk back into more timber.

The feeding above the shadow line on cold evenings appears self-explanatory. Under very cold conditions, the sunlight would feel very "comfortable," and the animals would make efforts to stay in this "comfort" zone. When the shadows cover the entire slope, there would no longer be any area warmer than the next and the animals' position would be determined by the simple presence of food. If the food source was basically uniform all over the slope, it would be expected that no further pattern would be discernible.

As with the cold periods, there were extended warm periods each year in late January or early February. Although warm periods are not uncommon in the Bitterroot Valley, it would be best to term these as unseasonably warm periods, to distinguish them from warm periods in the high thirties and forties. When these unseasonably warm periods occur, daytime temperatures are in the fifties, and nighttime temperatures are rarely below forty degrees.

During these periods, the thermal and solar radiation conditions were quite high for winter values, and elk movement was reduced to a minimum. Bedding sites were normally on north slopes within dense timber stands during the day, and either north slopes or dense timber stands on ridge tops with a slight north aspect during the night. Elk moved very little during night hours, frequently traveling only a few hundred yards before bedding down again. Adequate feed was available in the form of grasses and sedges under the trees, where most of the snow was gone, and from Douglas-fir branches.

The only logical explanation for this behavior is that the weather was too warm for "comfort." With the temperature overly high and the elk's coat an effective insulator, the animal would have difficulty dissipating the heat generated by muscle activity. The best solution would be to stay in a cool environment, and restrict muscular activity as much

as possible. The north slope timber stands would be a cooler, more uniform environmental situation than stands on south slopes.

If normal winter weather conditons were defined to bracket temperatures between 0° and 35°F., a general pattern would be as follows: daytime bedding locations are located in dense timber stands on ridge tops with a slight north aspect, or near the top of north slopes. Travel to feeding areas is normally two to three miles, with feeding periods at dusk and dawn. Nighttime bedding sites are generally on open timbered south slopes, or if the feeding area was in a level open field, the elk would bed within the feeding area. Night bedding sites appear to be selected for proximity to the feeding site rather than protection from the cold.

This pattern was generally followed through the better part of each winter. There was some fluctuation from south aspect to north aspect depending on meteorological conditions, but the vegetation type chosen was surprisingly consistent. With few exceptions, elk appeared to prefer to bed in small dense clumps of mixed Douglas-fir and ponderosa pine. This type of habitat is very prevalent on all the ridges, and can be found on the north, top, or south side of each ridge, thus presenting numerous aspect choices.

In evaluating the position of these beds within the timber clumps, an interesting relationship was found. In the colder periods, (0° to 10°F), the elk tended to bed on the south side of the stands during the day, and the north side at night. In the warmer periods (25° to 35°F), the opposite was true, with elk bedding on the north sides during the day, and the south sides at night. In the periods between 10° and 25°F, the elk chose to bed on the west side of the stand day and night.

While the average DBH of the trees in these stands approached five inches, the bed was usually associated with a tree eight to fourteen inches DBH, with the bed frequently one foot or less from the tree. These larger trees, having greater surface area and mass, would be reflecting and transmitting more energy than the smaller trees, thus possibly creating a more uniform environment. That is, they would be expected to change less with varying weather conditions, than smaller trees. It is also possible that the selection of the larger trees in the stand reflects some psychological need to be near an object.

The compass position of the bed from the nearest tree was also recorded. It was found that the same condition that exists with the bed position in the stand also exists with the bed position in relation to the tree. During warm temperature ranges, elk tend to bed on the north side of the trees during the day, and south side at night. During cold temperature ranges, the reverse is true. For the intermediate ranges, the bed position is commonly on the west side of the tree.

An overall picture for daytime periods would show elk bedding on south aspects on the south side of the timber stands and on the south side

of the selected tree during colder periods, rotating to west aspects and west sides of stands and trees during intermediate periods, and then to north aspects and the north side of the stand and the north side of the selected tree during warm periods.

In the spring of 1972, a large logging crew entered the game range, and over the summer selectively logged approximately 1,000 acres. An immediate displacement, several miles south, of radioed elk was noticed. However, after approximately three weeks of logging activity, a gradual shift back to normal use patterns was noted. The Threemile elk appeared to become habituated to the logging activity, and it would be difficult to say that the actual operation had any detrimental effect on the population.

There were some detrimental effects in the post-logging situation, however. The Threemile elk tended to use small clumps of dense timber for most of their bedding, and commonly bedded near the largest trees within these stands. These larger trees were removed by the loggers and the slash left within the dense stands. Thus the most preferred position in the stands was removed, and the slash precluded the use of other positions.

The area logged received light to medium elk use in the winters of 1971 and 1972. Use during the 1973 winter was virtually non-existent. The only observed elk sign throughout the logged areas during the winter months was occasional sign of elk moving through the area. Very little feeding sign was found, and then only in connection with traveling, and no bedding sign was found at all.

This reflects a reaction to a drastic change in the habitat. Choice bedding sites were removed, and lower level bedding sites made inaccessible by slash. Travel was hindered because of slash, with most travel restricted to the logging roads. While elk could easily exist within the area, there was better and less restrictive areas to the north and south, and these were selected over the logged areas.

It is doubtful that the small amount of money collected by the State Forester's Office ($1.00/thousand board-feet) will allow any slash cleanup beyond problem areas near roads. This means that the remainder of the area will have to wait for decomposition rather than mechanical removal of the slash. According to the posted sign, a pine thinning south of the range was made in the fifties. The needles are gone from the slash, but the rest remains. Decomposition is slow in this relatively dry environment, and elk avoidance could last for twenty or thirty years unless better cleanup is enforced.

Question: "You said snow depth had an effect on the distribution of the elk. Did you keep an average of what snow depths had the greatest effect?"

Answer: In 1971 and 1972, the north end of the range was used to some extent during the early part of the winter, but during February and March it was not used at all, following a noticeable shift of activities to the south. In 1973, however, the shift to the south end of the range did not occur, with a few elk occupying the north end of the range the entire winter. Mr. Reuel Janson, Game Manager for Region One, Montana Fish and Game Department has noticed this shift several times in past years.

Several explanations were offered for this shift in our second Annual Report (Ream et al. 1972) including insufficient bedding sites, improper juxtaposition of bedding and feeding sites, lack of sufficient food source, and snow depth. More complete analysis of the area excluded all possibilities except snow depth.

The general relief runs from east to west, with north and south slopes repeated several times. The major feeding areas on the north end of the range are north-northwest of the bedding areas. This means that in order to travel from the bedding sites to the feeding sites, the elk must cross several ridges with corresponding north slopes.

As the winter progresses, the lack of solar insolation on these north slopes allows the snow depth to continually increase. When the snow depth approached 18 inches, the elk began moving lower to areas of lesser snow depth. This occurred at shallower snow depths when a heavy crust was present. Ultimately, the animals' reluctance to cross these north slopes forced them towards the south end of the range.

The situation is considerably different on the south end of the range. The major feeding area is west of the bedding areas, and the elk can travel on the ridge tops and south slopes to the feeding areas. Solar insolation keeps these areas relatively free from snow, enabling easy travel.

This does not imply that elk are unable to travel in snow depths greater than 18 inches, for elk were observed to travel through soft snow depths in excess of three feet. However, the energy expenditure apparently is such, particularly with a crust, that the animals are reluctant to travel through deep snow.

In 1973, with little snow accumulation throughout the winter, the north to south shift did not occur. This was the first time the shift was ever noticed not to occur by myself or Fish and Game officials. Approximately 20 elk remained on the north end throughout the winter. This is comparable to the numberof animals that normally use the area in December. This lack of movement in 1973 strongly supports the theory that snow depths control the movement and the time of movement. With no snow depths to impede movements, elk remained on the north end throughout the winter, indicating that all other environmental and habitat conditions were suitable.

Question: "What constitutes ideal elk calving habitat or is it recognizable?"

Answer: I do not think that is recognizable. We have had elk calve on open rangeland in brush draws, beside a clearcut on the top of the mountain, and in many different habitat types in between.

The only apparent pattern that I have noticed is that when an elk is about to calve, she locates a nearby area with sufficient protective cover for the calf. There is no indication that Threemile elk seek a "calving ground."

SUMMER-FALL HABITAT SELECTION AND USE BY A WESTERN MONTANA ELK HERD: PRELIMINARY RESULTS

By
Les Marcum[1]

The director of the Sapphire Range Elk Study, Dr. Ream, will discuss the methods we are using this afternoon, so I will only say that in summer and fall we depend quite heavily on locating radioed elk. Most of the locations are obtained by aerial tracking, using a small fixed-wing aircraft (Cessna 182). We find the elk at least twice a week, and collect information on the relations of elk to habitat type, slope, aspect, elevation, distance in relation to logged areas, roads, water and so forth.

I am working in the area previously described by Bob Beall, and in the mountains to the east of the winter range. Most of our summer-fall locations fall within an area of approximately 100 square miles. Elevations range from 4,000 to almost 8,000 feet above sea level. The area is characterized by low elevation ponderosa pine *(Pinus ponderosa)* and grass types, Douglas-fir *(Pseudotsuga menziesii)* types slightly higher, and subalpine fir *(Abies lasiocarpa)* types at the higher elevations.

The western foothills of the study area were extensively logged in the 1930's and again in the 1960's by high-grading. Until the recent purchase of the Threemile Game Range by the Montana Fish and Game Department, most of this area was under small private ownership. Most of the higher elevation lands are National Forests, with a few sections in corporate ownership. Logging, primarily by clearcutting, was initiated in 1965 on National Forest lands within the study area. Welcome Creek is the only major uncut drainage in the study area.

Using a few selected slides, I will characterize summer-fall habitat use by Sapphire elk. Also, I would like to note that my comments pertain to preliminary and incomplete analyses of the 1971 data, and some subjective observations of things we noticed in 1972.

We have had several cows that calved at low elevations. During early June, they use brushy draws, dense ponderosa pine stands, and adjacent grassland openings. Also, quite a few cows calved at intermediate elevations, near the upper portion of the winter range. These animals were often found in semi-open Douglas-fir types, but were usually near heavy cover.

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[1]Graduate student, Forestry School, University of Montana, Missoula.

By late May or early June, most of the bulls had moved from the winter range to higher elevations. They are often found on ridges, and in or near small grassy openings in June. As summer progresses they usually occupy the upper 1/3 of south or southerly slopes. They do prefer mature stands of timber; I won't refer to them as climax stands, but as advanced seral stages with small patches of reproduction. Bulls tend to remain at upper elevations once they've reached them, at least until the rut.

The majority of cows and calves are found at intermediate elevations from the end of June to the middle of July. Some of them have been there since calving. They seem to prefer mature open timber stands. The Douglas-fir/pinegrass *(Calamagrostis rubescens)* type received the most intensive use that we noted on the study area during this time of year. Elk also used north slope Douglas-fir/ninebark *(Physocarpus malraceus)* types in late spring and early summer. In the Sapphire study area, elk make substantial use of ninebark for forage during this time, which is somewhat surprising since this plant species has been rated as very unpalatable to elk during other times of the year.

Towards the latter part of July and early August the cow-calf groups increase their use of the upper elevation slopes. In the Sapphire Mountains, the subalpine fir types are now mostly occupied by lodgepole pine *(Pinus contorta)* stands. Both the cow-calf groups and young bulls seem to travel more than the larger bulls during this time of year. They feed extensively on sweet vetch *(Hedysarum occidentale)*, and on beargrass *(Xerophyllum tenax)* blossoms when they are available. Some use is made of young beargrass leaves. In 1971 we had some hot weather during the last part of July and through August, and the elk used the subalpine fir/type extensively. They feed mostly on *Menziesia ferruginea* and *Arnica latifolia* in this habitat type.

Clearcuts in the area are somewhat large and not very old. The oldest was cut in 1965. We observed some use of logged areas, but fewer than one percent of our locations were on clearcuts. Since we obtain our locations primarily by aerial tracking, there is some question as to the use of clearcuts by elk at night. However, Tom Stehn carried out a study on the daily movements of radio-collared elk in the Sapphire Mountains during the summer and fall of 1972 which did include night-time tracking. He also found that only approximately one percent of his locations were on clearcuts. Although feeding on clearcuts by elk is minimal in the study area, they do seem to travel at night through these areas without hesitation.

Some workers contend that clearcutting increases spatial diversity or increases "edge", which it no doubt does in many areas. However, we have observed that in mature timber stands elk tend to use small openings, often less than an acre in size, where there is a definite change in the composition of the understory vegetation compared to the area immediately surrounding the opening. It seems possible that clear-cutting in some instances may decrease the amount of "edge".

In late August and September there is a noticeable increase in the use of wet situations, mostly creek bottoms or drainage heads. This coincides with the time when bulls are seeking out harems. I'm not sure if this use is mostly related to rutting behavior, or if it is primarily a use of these areas as a food source. In any case, there is quite an increase in the use of drainage bottoms through the first 2 or 3 weeks of September.

In our area, for the last 2 years, there has been a bull season about the third week in September, and habitat use by elk at this time may be somewhat influenced by that. However, they do seem to continue to use the same habitat types, but perhaps move further from roads. We have observed several things in relation to elk habitat use with respect to hunters and roadless situations. Dr. Ream will make some comments pertaining to these observations this afternoon.

Towards the end of September and through October the majority of the elk tend to make greater use of the upper slopes. They move back into semi-open mature timber stands, and are often found in this type of cover. They also use old burns, seral-shrub fields, and grassy south slope openings, although the availability of these types in the area is relatively small. We also get some elk use of lower areas in the fall. Perhaps 10 to 20 percent of the animals may be on the same area they use in the winter. This is before the general hunting season opens.

When the hunting season opens, the early kills tend to be made in the open mature timber stands or in small openings. As the snow gets deeper, and tracking gets better the elk move into denser timber stands, and most later kills are made there. The majority of the animals stay at higher elevations through the hunting season, although there are some that remain at lower elevations. This last year a rancher closed his land, which lies adjacent to the Threemile Game Range, to hunting. There were several elk that stayed on his land through the hunting season. Also, as the snow depth in the mountains increased, there was a tendency on the part of some of the animals at higher elevations to move to open forests and adjacent grassland areas at lower elevations. However, these movements occurred during the week, and on weekends these animals often moved back to higher areas of dense vegetation. This appeared to be a response to increased hunting pressure on weekends.

About a week after the hunting season was over in 1971 about 90 percent of the elk were back on the winter range. This year, however, the snows came late and they are quite dispersed, even now.

EFFECTS ON ELK DISTRIBUTION IN BURDETTE CREEK

by

Dr. L. Jack Lyon[1]

Because visual aids, including a map and several graphs, were used in this presentation, the tape recording produced a virtually unintelligible manuscript. The following version has been revised by the author as a summary of material presented.

I explained earlier this morning how the study in Burdette Creek - Deer Creek is being conducted. Burdette Creek is a large winter range area. Deer Creek lies immediately to the northwest. Deer Creek is the area being logged. The basic question in the overall study is what effect will the logging operation in this drainage have on elk distribution over a fairly large adjacent area?

For this presentation, the pellet information has been reduced to the number of pellet groups per distance walked in each "forty" and then scaled 0 to 9 on a grid system. The grid, then, represents a map of the study area with 0's where elk use was very light and 9's where use was heavy.

On the grid for 1970, several interesting points can be made about the prelogging distribution of elk. First, the numbers in Deer Creek are mostly 0 and 1--which means that the drainage really wasn't very heavily used in the first place. Another point of interest is the concentration of high numbers in Burdette Creek and Lupine Creek slightly to the south. These are the heavily used winter ranges. Finally, you'll note what appears to be a band of zeros running more or less diagonally across the northeast quadrant of the grid. This coincides with a road that runs along the high ridgeline in the middle of the study area.

Two things seem to be involved here, and I haven't been able to separate them although I hope to do so this year. You will note that the band of zeros has other branches going out along the highest ridges in the area. I think there are two factors involved. One of them is that this road really does have an effect on animal use. They go across and then stay away from it. The other factor is topographic and could be extremely important for management. If elk really do avoid certain kinds of topographic situations we can define those places as road locations which will have the least effect on animals.

In Deer Creek, road construction took place during the winter of 1970-71 and the following summer. The first logging took place on the north side of the drainage. Elk pellet counts for 1971 show a movement out of Deer Creek down this ridge toward Wall Canyon, to the top of the ridge into

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[1]Research biologist, Intermountain Forest and Range Experiment Station, Missoula, MT.

Burdette Creek and in the area around Wig Mountain. Note that the rises in elk use almost completely surround the Deer Creek drainage except that there was no increase in Ed's Creek to the east. I attribute this to the fact that an access road was constructed out of Deer Creek to the ridge between Deer and Ed's Creeks.

By the second year, logging had shifted to the south side of Deer Creek. Roads had been punched to the top of the Deer Creek - Burdette Creek ridge--and this is what I think is fascinating. You can see that animal use in 1972 has moved out of the ridge area. Use in the bottom of Burdette Creek has gone up--and it's even started to rise in the three areas further south. There's apparently a movement of the Deer Creek elk for at least 4 miles, or, more logically, a pressure from the disturbance which keeps pushing the herd so that differences in distribution can be detected up to 4 miles away.

THE CHESNIMNUS ELK STUDY

by

Richard Pedersen[1]

This study was instituted by our Northeast Region Management Section. It involves one of our highest used elk units in northeast Oregon, the Chesnimnus unit. The Chesnimnus has a summer range area of 202 square miles and almost an equal amount of winter range, 208 square miles. The unit is located adjacent to the Idaho-Washington border in the NE corner of the state approximately 360 miles from Portland. Most of the hunters come from the Willamette Valley.

The Chesnimnus unit, a high density road area, has 2.4 miles of road system per square mile of elk habitat. "Off road" travel by 4-wheel drive vehicles, motor bike, ATV, etc., cause additional harrassment problems and soil damage to non-roaded areas.

This unit is a large plateau-like land mass bisected by canyon systems. Timber, composed of yellow pine, larch, and white-fir forms a mosaic pattern interspersed with grassland openings.

The unit was closed by a Forest Service order with signs posted at the closure points throughout the unit. It was closed three days prior to the opening of elk season and remained closed until 3 days after the season. When the access roads were closed the hunters camped in rather confined areas. This area was unique in that it could be completely closed off with the exception of three check points, and everyone going in or out could be personally contacted.

Check points were operated 24-hours a day the first year. During the second year, the check points were closed from 10:00 p.m. to 5:00 a.m. Few people traveled between the hours of 10:00 p.m. at night and 5:00 a.m. in the morning. An aircraft was used to patrol the unit and Vic Coggins said the visual sighting of the aircraft plus the publicity releases telling the hunters of the closure was a great deterrent to violation of the closed areas. It is Vic's opinion that without aircraft patrol more violations would have occurred.

This study occurred in three parts. In 1968 the commission ran a questionnaire survey in this area and contacted 652 persons, about 28 percent of the hunters utilizing the unit. Some of the interesting facts learned at that time, this was prior to any road closure and no mention of closing the roads; only 560 people had tags to hunt elk. There were 583 rifles distributed among the 652 people. Seventy-three percent of the parties contacted, and there were 195 parties contacted, had 4 x 4 vehicles; 27 percent had 2-wheel drives; and 29 percent of

[1] Research Biologist, Oregon Game Commission, La Grande.

the people were utilizing 2-way radio communication. Persons contacted were asked a series of three questions about existing roads. Are there too many? Just right? or, Too few? Forty-six percent answered "too many", 54 percent answered "just right". As I said, there are 2.4 miles of road for every square mile of elk habitat in this unit. There is no place that an elk can go and be more than 1/2 mile from a road.

Should more roads be closed?[1] Forty-five percent answered yes to that. Leave as is? -54 percent. Build more? -1 percent. Eighty-eight percent of the hunters came from the Willamette valley. And this goes back to what I said about this unit being 360 miles from Portland or 6-1/2 hours driving time. Only 2 percent of the hunters were from Wallowa County, the county in which this unit occurs. The time hunted, and I thought this was interesting because Ray Boyd made a comment about keeping an elk hunter in the woods longer than 4 days is impossible, 90 percent of the elk hunters left the unit at the end of the 5th day. Sixty-seven percent of the hunters left at the end of the 4th day. That was in 1968 when the questionnaire was conducted. In 1970 we manned the checking stations, contacted the people, and told them a road closure system would be in effect in 1971. In 1970 we checked in and out, 3,986 hunters who shot 432 bulls; 415 of these were yearling bulls; only 17 bulls were 2 years old or older. The known illegal kill (cows) was 35 with a crippling bull loss of 2.

In 1970, prior to closing roads, the cow:calf:bull ratios ran 46 and 21 pre-season; 55 and 1 post season. Post-season compositions are taken in January and February. This herd has been averaging 3 bulls per 100 cows post-season for 10 years.

Vic was interested in spreading the bull kill over several days, as opposed to shooting all available bulls in 48 hours. He was also interested in improving the quality of the hunt. I even hesitate to use the word "quality" after the last 2 days. Vic rapidly concluded that you cannot distribute the harvest any appreciable amount by closing roads. In 1971 there were 3,400 hunters, a decline of 500 hunters from 1970. The 1971 season was unusual, in that a bad winter came early and curtailed hunting activity. Only 271 bulls were bagged; again 254 of these were yearlings and 13 were 2 years old or older. In 1972, the second year of the road closures, there were 4,590 hunters, an increase of 500 hunters over 1970. They bagged 510 bulls, 478 of these were spikes and 32 were 2 years old or older. So we were right back in the same situation; shooting the available bulls and not extending the season very much.

One of the interesting facts that came up during this 3 year study was: 87 percent of the hunters were in favor of the road closures, yet in 1970, 54 percent said "leave as is". In 1972, the second year of the road closure, 93 percent of the people were in favor of it, four percent opposed and 3 percent did not give a damn. In 1971 there were 19 citations issued. All citations were taken before a Magistrate in Enterprise, and all were prosecuted, for off-the-road travel. In 1972, eight citations were issued and I think this exceeded everyone's expectations.

[1] A few roads were closed prior to this study - not related to access problems.

Most of us were expecting an increase in violations.

Post-season compositions remained about the same over the period of 1970-73. We made no gains in the bull carry over.

The cost of such a program was $2.22 per hunter. The state's contribution to that was $1.21. This included flying time, checking station operation, but not the normal working hours that our field biologists would have put in had the study not been going on. I believe this also included the cost of signing.

Question: Did you allow these people to go in and retrieve their game or were these roads closed for good?

Answer: When this road was closed it was closed to access by anyone for any reason, other than by foot, horseback or bicycle; you could not go back there with any motorized vehicle at all. There were people that showed up with horse drawn carts by the second year and I think there was a tremendous increase in horse use this past year.

We are getting some comment on the horse use. Now people that walk say, "keep the horses out". I think Vic said there were actually 350 head of horses counted this year in the unit.

Question: You stated that your road system was, I believe, about 1/2 mile between roads and there was not great escape cover. When you put this closure in effect were there any extensive areas that were not accessible by road? And how large?

Answer: What we tried to do was leave one main arterial road open in the form of a large loop around the center of the unit. Anything from that road was closed and yes there were some rather extensive areas in there that were roaded but not open to road travel. I might add that the timber in that country is rather open. There are not many doghair thickets. It is a mixed yellow pine-Douglas-fir type so the screening value in there is not good.

Question: Do you have data on the distribution of the kill throughout the season?

Answer: Yes, I do. I think there was something like 97 percent of the bulls shot within the first 12 hours.

That was prior to the road closure and I think it changed to something like 94 percent after the closure.

Question: These are the Blue Mountains, right? Do you harvest any cows in there?

Answer: Yes, there were 200 permits. Hunters took 57 cows the first year and 130 or 140 cows the second year.

Question: Do you have a problem with people who owned horses and these people taking advantage of the situation and charging $50 to $75 to drag an elk out?

Answer: The first year we thought there would be quite a number of packers come into the area and there were some. But, they starved to death. No one would hire them. The people banned together and helped each other pack the game out. The next year packers did not show.

EFFECTS OF LOGGING ON ELK IN THE SAPPHIRE MOUNTAINS

by

Dr. Robert Ream[1]

Beall and Marcum already talked to you about the Sapphire study so you know a little bit about it. When I talk about the effects of logging on elk I am really talking about a number of different things and a number of different effects. First of all we have the management decision itself about whether or not we are going to go into a drainage. This has to be considered in view of the pattern in adjacent areas. If it's the only unroaded drainage in an area where there are other drainages that have roads, the effect might be quite different than if it is in a drainage in an area with lots of unroaded drainages. But first of all we have to make that decision. Then after the decision is made to road a drainage, the effects still are quite different. First of all we have the activity associated with road building itself and the logging and cutting of timber and hauling timber out of the area. This could have an effect on the elk in the area but it would be a temporary effect. Secondly, after the logging show is done we have the aftermath, the clearcuts themselves and the effect they might have over a period of years on the elk population. In our particular area I do not think the clearcuts themselves are either beneficial or harmful to elk. Marcum pointed out that there does not seem to be a substantial increase in the amount of forage produced in the cut as opposed to the area as existed before cutting. Again this is in our area and it will vary in other areas. I think with drier sites there might even be less production and on the more moist sites there might be more production, but I do not think there is a beneficial or a detrimental effect.

Whether or not we leave the roads open after the sale is completed, might also be of importance from several standpoints. One is the management factor; if there is logging activity in the area the elk might have the tendency to move out. Second, is the possible impact on the elk harvest. Finally we have the human element, and that is the change in style of hunting. I would carry that even further to the change in quality of hunting which we were talking about yesterday, when we have extensive road systems in the area.

We have from the beginning relied quite heavily on the use of telemetry for looking at the problem. I felt that when we were looking at the effects of logging we needed to pay considerable attention to movements of animals. After we got radios on the elk we did some tracking from the ground. Last summer Tom Stehn, a master's student, studied daily

[1]Associate Professor of Wildlife Management, Forestry School, University of Montana, Missoula.

activity patterns and daily movements of these elk. Most of our tracking has been aerial tracking and we have tried to fly two or three times a week during the summer and fall months when the animals are actively moving and are away from winter range area. We essentially know where they are when they are on the winter range but it's the period after the 1st of June that we are most concerned about.

During the summer of 1971 about 30 percent of the time we actually made visual observations of the animals we were tracking. I would say 50 percent of the time we probably had quite precise locations on the animals. If we didn't spot them we could plot where they were within a few acres. The remaining 20 percent was somewhat less accurate because of the terrain. The maps that Marcum showed you earlier showed in red some of the roads and cuts in the area. Going north they have logged out a series of ridges running east towards Rock Creek. They are not visible from Rock Creek but they are in that drainage. On the north end is an area that has also been logged quite heavily, Schwartz Creek and Eight Mile Creek. Just beyond that is Missoula. The area we are talking about here is only about 20 or 30 miles south of Missoula.

The first year we were finding out basically about movements of individual animals and the variation of movements within the population. Cow Elk A traveled farther away from the point of capture than any of the others last summer. She crossed Rock Creek and went into an area on the other side of Rock Creek for most of the summer. In August she made one movement clear back over to the winter range area and a couple of days later was back over on the other side of Rock Creek. There was no explanation for this movement. We did observe this with a couple of other animals, including a bull.

During the summer of 1971 there was very active timber harvest going on along some of these long ridges towards Rock Creek. We can plot movements of animals for individual months, or for all summer. The only locations in the sale area occurred either in early June before harvest was going on actively or in late fall. During the summer of 1971 there seemed to be some avoidance of the area where they were actively harvesting timber. One other thing I might mention is one major drainage here, Welcome Creek, is unroaded, and the head of 3-mile Creek on the Bitterroot side is as yet unroaded. We did have a number of animals (cows) that essentially stayed on the Bitterroot side of the Divide the whole summer. They did not go very far from their winter range area.

In 1972 we had similar information but the Sapphire sale was completed in the fall of 1971. There was no activity there in 1972 and the spur roads going out on the ridges were closed off. The main road system was open and they did, later in the summer, open a couple of spur roads to do some brush piling work, but there wasn't the intense activity of the previous summer. We had another cow that exhibited almost the same pattern as Elk A did the summer before. She crossed Rock Creek and stayed in one of the steep drainages on the other side and spent the entire summer there. One bull was followed for two years in a row. His transmitter went for 21-22 months, so we got 2 years data out of this individual.

In 1972 movements were quite similar to 1971 with the exception that we did have some locations that were considerably further south and in the area where there had been logging activity the summer before. We also had several animals that Stehn was studying daily activity patterns with. They stayed on the west side of the Divide for a good part of the summer, and came out onto some of the ridges that had been cut. We actually had locations of one in some of the clearcuts. She spent a good part of the late summer out on some of these very steep ridges overlooking Rock Creek. She was using some of the area that had been logged earlier, but again there was very little activity in the area.

Besides completion of this sale, in the future we will have several other opportunities to obtain this kind of information. One of them is a sale that is planned around the head of 3-mile Creek. We have had a considerable amount of activity both years in that area. The other area where there is a sale planned this coming summer is in Carron Creek at the head of Welcome Creek. This has been sold but I am not sure whether or not it is going to start this coming summer or not. Here again we have had quite a lot of activity in this area and it should provide us with some opportunity to observe differences.

I might mention one animal that took off and went clear up to Missoula. The 6th day of June Les Marcum and Bob Beall located her on the game range at 3-Mile point and the 7th of June another student could not find her from the air and I could not locate her the next day either. But on the way into Missoula I had the receiver on and all of a sudden got her signal over Missoula. I figured someone harvested her and had the radio at home or else it was a transmitter back at the University; it turned out to be neither case. She was standing on a hill looking right over the town and we could pick her up from the Fish and Game Headquarters. She apparently dropped her calf on an open ridge near Missoula. She spent quite a bit of time in an area with a considerable amount of roads. However, when hunting season came we observed her and others go into relatively unroaded, inaccessible parts of the Sapphire Range. During the early bull season, she was within 1/4 mile from a road where there were trucks and pickups going back and forth almost continuously and she stayed there for several days. When the traffic eased up she went clear over into the Welcome Creek drainage, which was unroaded and she stayed there.

We have observed this sort of thing during the hunting season. Last fall Les Marcum observed that animals, when we had a lot of early snow, were trying to come back to the game range, and would do so during the week and then the hunting activity would pick up on the weekends and they'd go back over the ridge onto the other side where it was less accessible. During the week again tracks were seen coming across the Skyline road going back onto the Bitterroot side heading back to the winter game range.

I guess that covers the main points and I will try to answer all the questions I can. One thing George Stankey didn't mention yesterday; we are looking at hunting quality in conjunction with the study and we have

found that hunters do perceive the environment that they are hunting in and they have attitudes about roading and about crowded hunting conditions. There are differences in attitudes between successful and unsuccessful hunters. The successful hunters, those that were willing to get out and do a little walking, also seemed to be more sensitive about solitude and crowded conditions and appeared to be looking for solitude and were more perceptive about the environment around them.

Question: Do you intend to continue your study in these areas you are studying now to see how long it takes the animals to come back if they do come back into these areas?

Answer: Yes we do plan to. We originally started out as a 3 fiscal year study starting July 1, 1971 which would mean that we have about 1½ years to go. That is about all the funding we have or I think we have now. And then I would like to continue on a couple of years after that at a reduced level, perhaps with one student following movements of the animals. We will just have to see how things go and how funding goes. Also, I think more important perhaps is how the land use patterns in that particular area go.

Question: How many bulls have you collared?

Answer: Four the 1st year and one of those was retrapped and reradioed last year and one had his transmitter work for 2 years.

Question: Have you had any problem with the neck swelling?

Answer: No, we don't seem to. The one going for 2 years has had a harem and he seems to be doing OK. We have had a problem and are using a different kind of a collar. We've been using an acrylic material. We have had three of these, 2 the 1st year and one this last year, that have broken off. It is pretty tough stuff and in one case Les Marcum went in and picked up the collar on the ground and it looked like that animal might have been in a fight with another bull. The ground was all torn up around it.

Question: With your knowledge of the area and the changes that occur vegetatively in there, what do you anticipate the impact of clearcuts on elk would be in 25, 50 or maybe 100 years from the time the area is cut?

Answer: Well first of all, our rate of succession is much slower than you would think. Some of the pictures that Les showed this morning had cuts that had been made 8 or 10 years earlier and the reproduction was pretty sparse and very small. The cuts along the Divide I would say aren't going to have any effect or will have very little effect 10 years,

25 years, or 50 years from now just because they don't produce much in the way of forbs and grasses. Beargrass is one of the most common plants on these sites and it's just not utilized at all by elk. So I do not think there is going to be much effect at least at the higher elevations.

Question: Throughout the course of the discussion reference was made to the fires in the late 1800's and early 1900's and that these are areas where elk concentrate on. I was wondering if you thought there might be some type of a relationship between these clearcuts maybe 80, 90, or 100 years from now and fires?

Answer: These fires that were talked about are winter range situations; they were mostly at lower elevations and they have a bit more moisture in the Fish Creek area than we do in the Bitterroot Valley, even though it isn't very far away. The winter range in our area is, I think Bob Beall mentioned earlier, primarily a grass winter range and they come down on it and utilize grass as their main food source in winter. I guess that is the difference between the two areas. We do not get browse production such as they do. There are some patches, but small and insignificant as a primary food source.

EFFECTS OF LOGGING AND USE OF ROADS ON ELK BEHAVIOR AND DISTRIBUTION

by

A. Lorin Ward[1]

The data presented was collected in cooperative studies being supported by the Bureau of Reclamation, University of Wyoming, Wyoming Game and Fish Commission, and the U. S. Forest Service. Telemetry is used to monitor elk behavior in relation to multiple uses, such as timber harvest, cattle grazing, recreation and vehicle traffic on the Medicine Bow National Forest within 100 miles of Laramie in southern Wyoming. Clearcutting has been in progress for about 20 years and the area has been grazed by livestock for many years. Elk populations have increased considerably in this area over the same period.

Transmitters were monitored on 7 cow elk on the south end of the Medicine Bow Range during the summer of 1972. These elk were part of a herd of about 150 that were using the area near the trap site. Seven hundred elk were counted over the entire winter range from French Creek south along the North Platte River to the Colorado state boundary. The telemetered elk stayed within a two-mile radius of the trap until spring and then dispersed. Two cows trapped the same day spent the summer about 15 airline miles apart.

There were four separate logging operations within the summer range of the telemetered elk and their associates. Two of the operations were at about 10,000 feet elevation in the spruce fir type and two were at about 9,500 feet elevation in lodgepole pine.

Information on elk distribution and activity was obtained from telemetry tracking, both on the ground and aerially, and by visual observations. Most of the data were obtained in the early morning or late evening when the elk were feeding. A total of 1,754 elk was seen (many of which were seen several times). Of the 572 elk classified, 62 percent were cows, 31 percent calves, 4 percent spikes, and 3 percent bulls. Telemetered elk were seen alone on only three occasions. The largest group (52 cows, 29 calves and 3 small bulls) was seen in a subalpine park on July 21. The average number of elk seen with a telemetered cow was 17.

Elk preferred to stay at least one-half mile from people involved in timber harvest operations. This was demonstrated by data from the telemetered elk and their associates, and by time-lapse camera records taken at elk feeding sites near timber harvest operations. In previous studies on the Pole Mountain District east of Laramie, elk had demonstrated this same preference to maintain a distance of at least a half mile from people involved in out-of-vehicle activity.

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[1]Principal Wildlife Biologist, Rocky Mountain Forest and Range Experiment Station, with central headquarters at Fort Collins, in cooperation with Colorado State University. Research reported here was conducted at the Station's Research Work Unit at Laramie, in cooperation with the University of Wyoming.

The elk are using many of the older clearcut areas for feeding sites, particularly, those where good stands of common dandelion, lupine, spike trisetum and sedges have become established. The challenge to elk habitat managers who live in wooden houses and want to continue to use wood in the future, is to develop programs to benefit wildlife in connection with timber harvest operations. Timber managers have found clearcutting is the best method to harvest some stands of timber. We should be managing vegetation production on these areas between tree-growing cycles so that wildlife species can be benefited. Under good management or multiple use plans, the clearcuts should be made available for full potential of wildlife use.

There were four different logging road systems being used to move timber. Elk were continually moving across active logging and recreation roads where over 2,900 vehicles were registered on a counter. Most of the vehicles moved during daylight and the elk at night, however. Traffic on a heavily used road did not disturb elk feeding in a meadow, if the elk were screened from the vehicles with about 100 yards of lodgepole pine trees. The elk definitely showed more aversion to the timber harvest operations than to the traffic.

Question: Did you have any common use of those areas by sheep and elk or was that at different time periods?

Answer: The sheep allotment was not used the year we had telemetered elk. The time-lapse camera in Nelson Park the year before registered over 124 hours of elk use and over 5,300 hours of domestic sheep use during daylight hours. Most of this use was for grazing. Elk grazed during early July and sheep during August. They were never seen together.

Question: On your number of incidences of elk near roads, I had a question. I think we've noticed roads to be easy places for elk to travel and they do use them but most of our use of roads has been at night. I wondered when you found them next to the road; was it in the early morning hours or what?

Answer: Since more elk were seen on early morning flights, we made 20 of the 22 flights at daylight. Most of the elk seen on or near roads were observed early in the morning. There were a few instances when telemetered elk were fixed but not seen in the timber near roads during the middle of the day.

Question: Do you have some observations of cattle management and activities of the elk?

Answer: Yes. Cow 2 and her associates--at least 30 elk--stayed in a cattle allotment with 250 Herefords all summer. The elk could have moved 1 or 2 miles and been away from cattle, but they did not. A slide (overlooking I-80 on Pole Mountain) shows Angus cattle and elk grazing within a few feet of each other. I-80 carried over 8,500 vehicles per day when the photo was taken. The cattle and elk were grazing as a truck passes within 1/4 mile.

EFFECTS OF A ROAD CLOSURE IN THE LITTLE BELT MOUNTAINS

by

Joseph V. Basile[1]

I will open my remarks by relating a little incident that happened the last time my mother-in-law was a house guest of ours. I was preparing Sunday breakfast and I asked her how she wanted her eggs. She said, "poach one and scramble one". I could see she was in her usual good mood so I decided to go along with the old bat. I poached one and scrambled one and I thought they turned out pretty well. I set them down beside her and said, "How is that Mom"? She said, "You idiot, you scrambled the wrong one"!

But I do have a reason for telling it and that is that the objective of this particular study, this phase of the overall elk logging study was studying the effect of road closure on hunter distribution and on elk distribution and elk harvest. I have all the hunter and elk distribution data compiled, and what little attempt I've made at interpretation has got my own mind pretty scrambled. But I am not even going to bother to give you any of that today. What I do have to present is just a little bit of side information that I think is of interest because it does contrast somewhat with a very similar type study now going on in the Upper Ruby that Gene will describe right after my little talk.

I think you might keep this in mind to see some of the differences. The area we are talking about is essentially the same as the one that Ken Coop described a little earlier, although his takes in a little more of the area north of the hatched line (Fig. 1); mine takes in more to the south of what he had described. The hatched line essentially shows the study area. The lines within show those roads that were left open during this last hunting season. We have three years of data - the first 2 were under unrestricted access where the entire study area was open to use of the many roads that were currently there. Last year, the third year of the study, the extreme east and extreme west portions were still unrestricted. The middle portion between the heavy lines was in the restricted area, where there were 45 miles of road permanently closed within that heavy line boundary, and an additional 25 miles that were closed only to hunters. Now, these latter were special service roads that still remain open for loggers or Forest Service administration purposes. These 70 miles of closed road comes to 42 percent of the boundary and interior roads within that restricted portion only. We will still have about 96 miles of roads that are open in the restricted area. But about half of that is actually boundary road.

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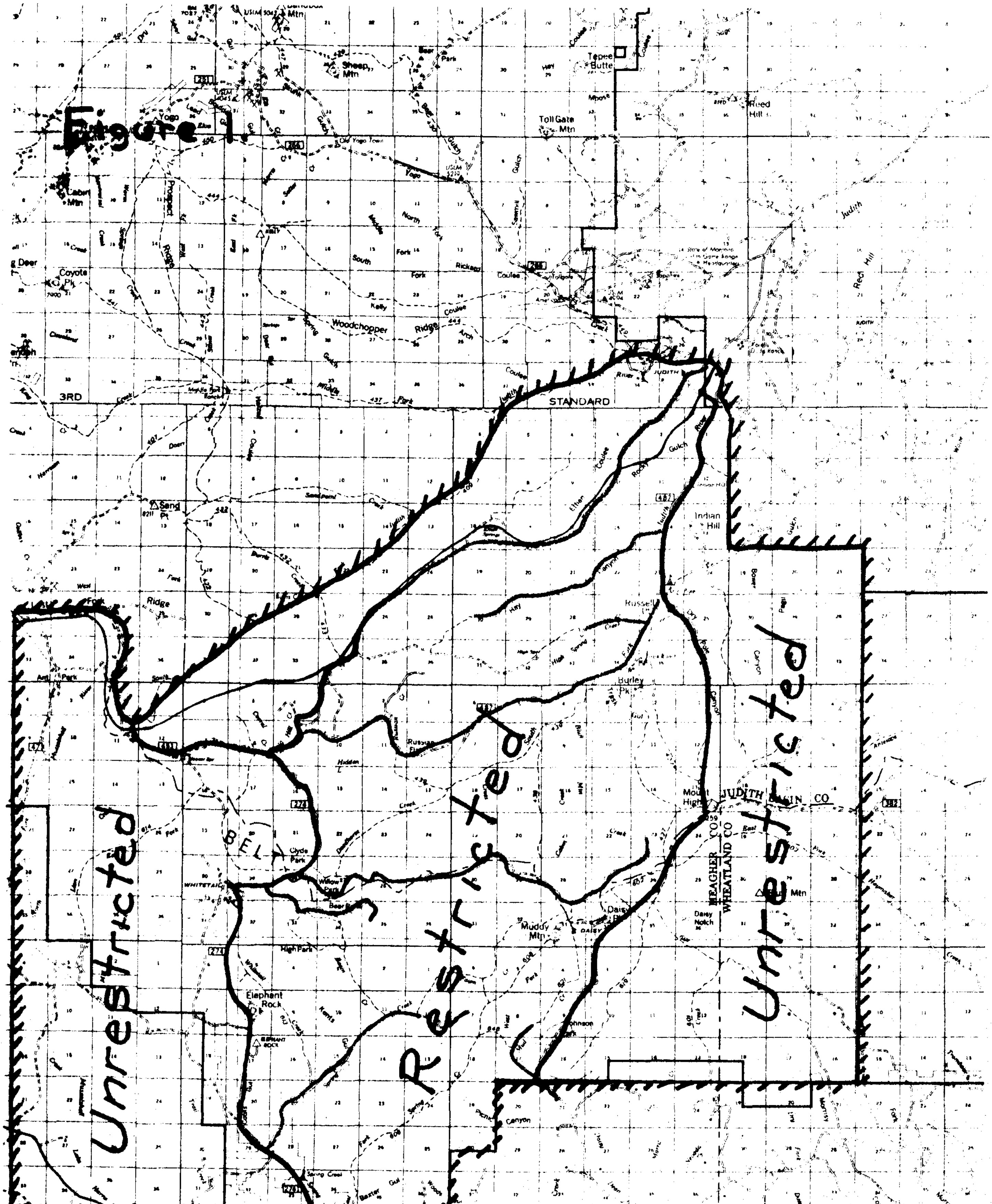
[1]Research Biologist, Intermountain Forest and Range Experiment Station, Bozeman, MT.

Figure 1


Unrestricted
Restricted
Unrestricted
STANDARD
MEAGHER CO
WHEATLAND CO
JUDITH BASIN CO

To give you an overall picture of the hunting pressure involved, the heavy line here (Fig. 2) separates the area of total unrestricted from the time of partial restrictions of the roads. You can see that, overall, there is really no effect in the number of hunters involved. There was lots of advanced publicity about the roads to be closed and this apparently didn't scare anyone away. They still come in ample numbers.

We go to the last column of elk killed and again you can see practically no difference on the elk kill between the seasons in which roads were partially closed and those in which they were entirely open. We did get a difference in the number of elk seen by approximately 50 percent. This partially reflects the number of hunters afield, which I will get into a little later. If you look at the number of elk seen per hunter you can see they average about a half; in other words, one out of every 2 hunters have seen an elk the first 2 seasons. That figure jumped to about 3 out of 4 hunters during the third season which was the season of partial road closure. That was about the overall affect.

Here we have a picture of the accumulated percentage by weekends in the three various seasons (Fig. 3). One on the left showing the number of hunters and the accumulated percentage as the season progresses and the one on the right showing the same thing for the number of elk seen. I put this on (Fig. 4) to show that it's a strikingly similar pattern in all three years for both of these categories; even in the third year with the partial road closure, this didn't give any deviation at all from our normal picture in the area. The heavy line here is the hunters and the dashed line being the elk seen. You can see how closely parallel these lines are to one another which would seem to indicate that the number of elk seen is simply a function of the number of hunters afield. This I would like you to remember, because I think you'll see quite a different pattern in Gene's data from the Ruby River country, which seems to point out the fact that it's difficult to make blanket statements about hunter-elk relationships. This (Fig. 5) shows essentially the same thing, except instead of putting it on a cumulative basis, which made it a little difficult to visualize at times, I just spread it out with the actual percentages by weekends of the three particular seasons involved. Again you can see the similarity of lines and the pattern as the season progresses between the number of hunters and their elk sightings. This would certainly seem to indicate that there is no migration of elk out of the area during the season. This was one of the fears on the part of many people - that all this heavy clearcutting and associated road building with it and the access this provides along with the harassment factor would push the elk out of the area in a very short time. In this particular area we have no evidence of that happening. I think Ken Coop pointed out the same thing this morning. However, I think Gene's story following mine will show a very different picture.

There was some indication, if we can go by the reports of the hunters, as to where they had seen their elk or seen any elk, that the elk tend to "hole" up in the timber more toward mid-season than they did early in the season. This I think has to be accepted with a certain degree of caution. I do not know to what extent the hunters can separate (many of

	Hunters	Elk Seen	Elk Seen Per Hunter	Elk Kill
1970	2,131	993	0.47	27
1971	2,417	1,376	0.57	53
1972	2,226	1,736	0.78	46

Figure 2

FIGURE 3

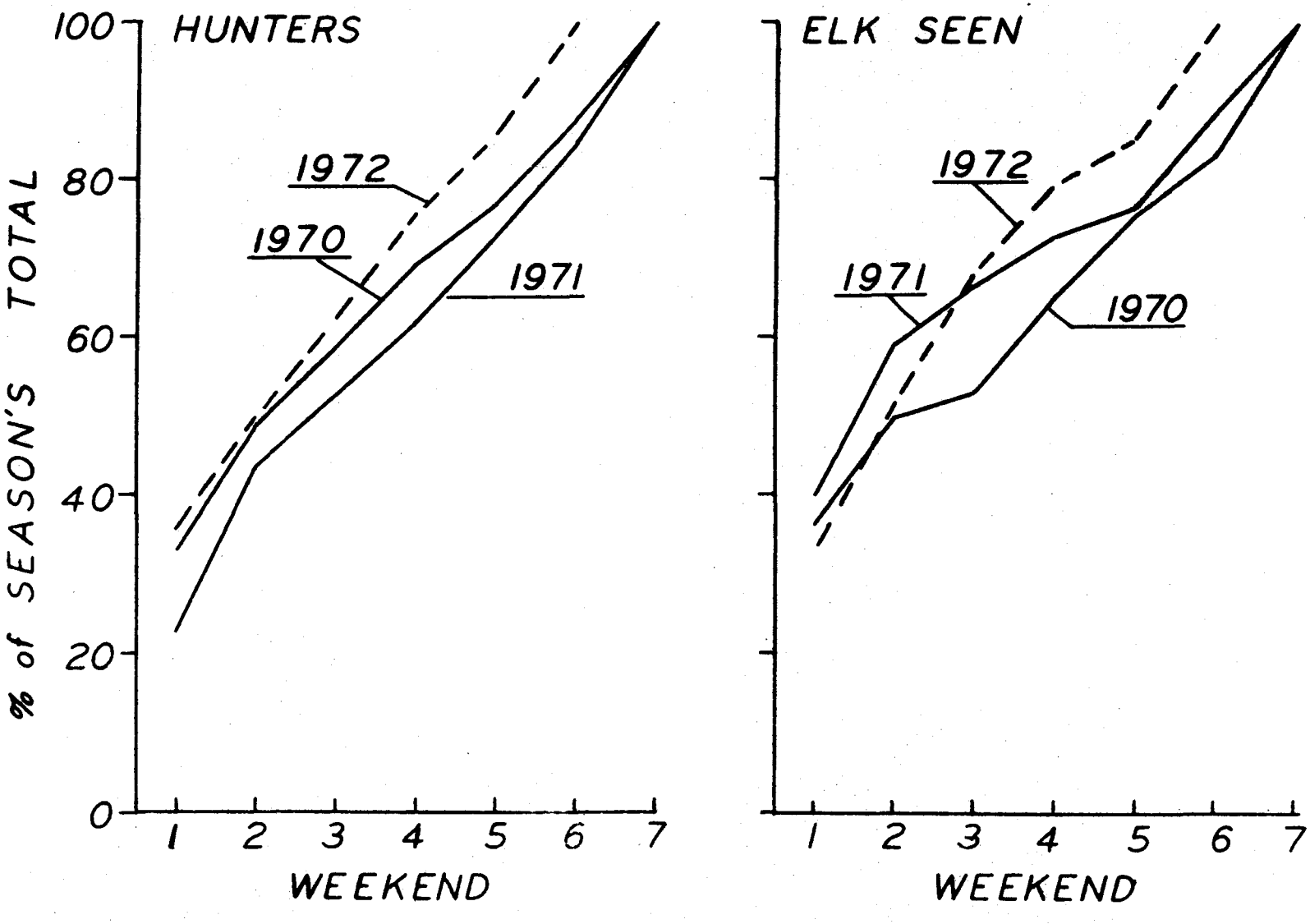

HUNTERS
ELK SEEN
% of SEASON'S TOTAL
100
80
60
40
20
0
1972
1970
1971
1972
1971
1970
1 2 3 4 5 6 7
WEEKEND
1 2 3 4 5 6 7
WEEKEND

FIGURE 4

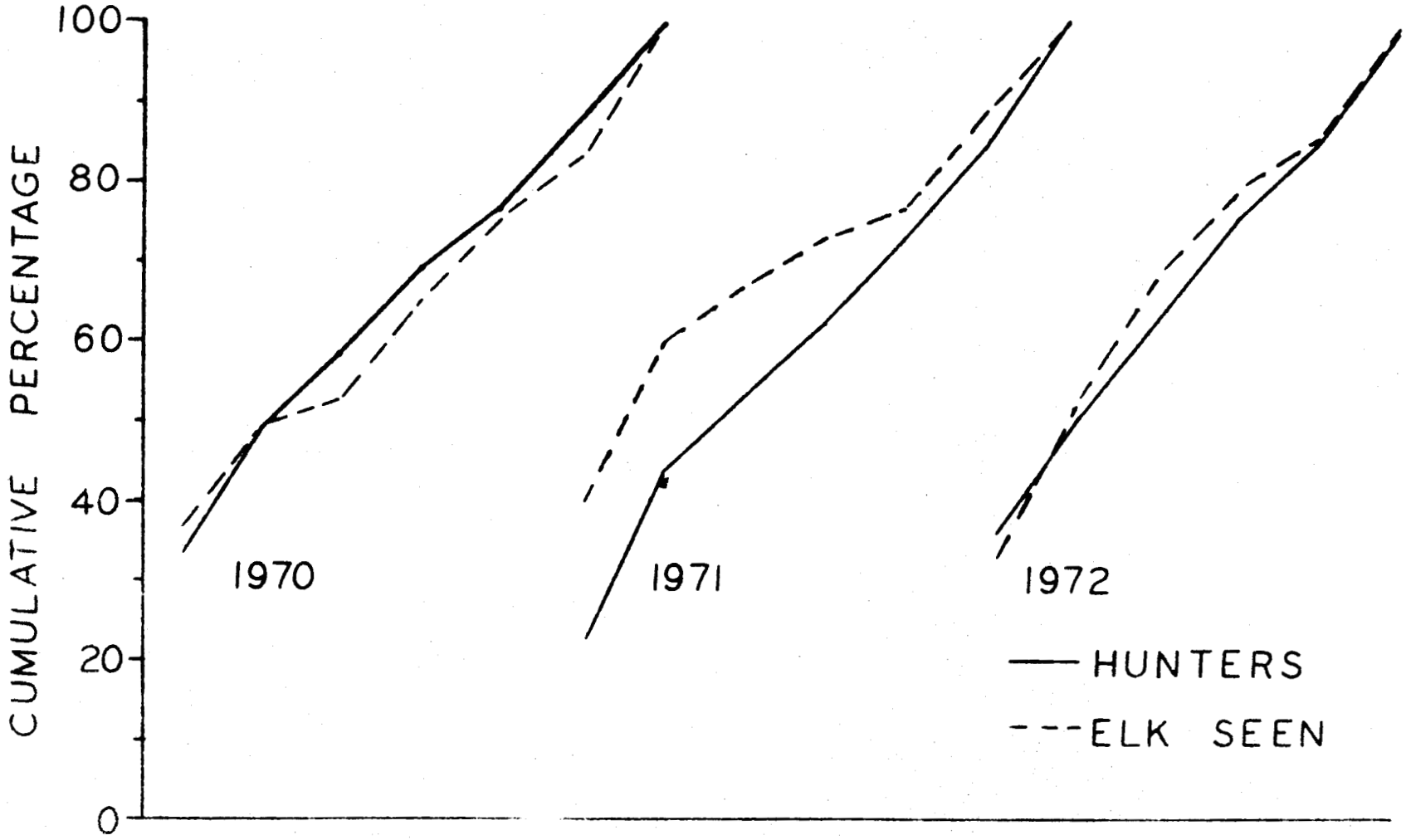
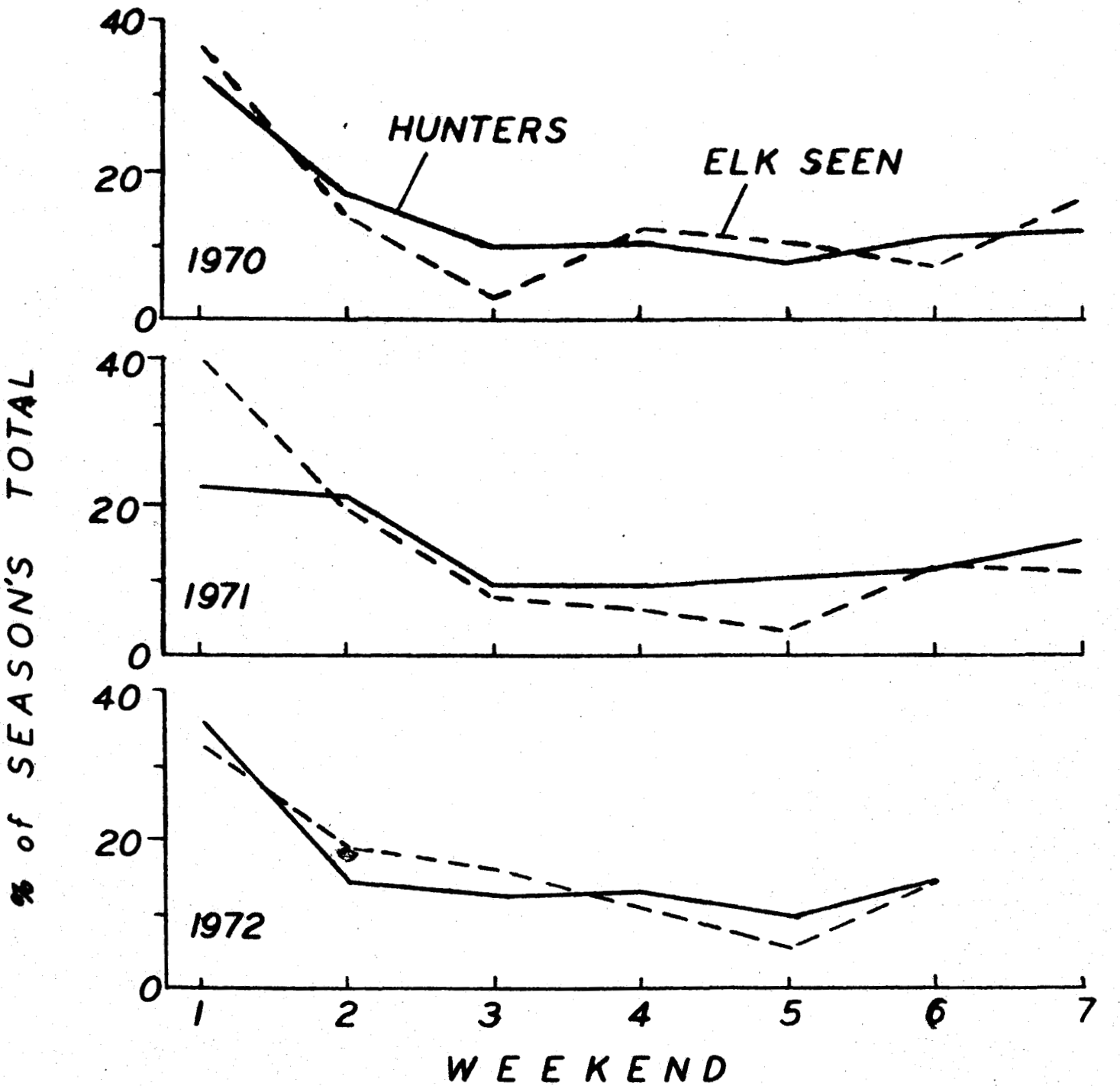

100
80
60
40
20
0
CUMULATIVE PERCENTAGE
1970
1971
1972
HUNTERS
ELK SEEN

FIGURE 5


40
20
0
HUNTERS
ELK SEEN
1970
40
20
0
1971
40
20
0
1972
% of SEASON'S TOTAL
1
2
3
4
5
6
7
WEEKEND

them, anyway) a clearcut from a timbered area. I do not mean to really knock the hunters. I think you reach a certain point wherein some of the cuts in this area are 20 years old and have reproduction that will stand 15 to 20 feet tall. I do not know at what point we can quit calling it a clearcut and start calling it timber again. Some of the timber in here is dense, with reproduction up to 10,000-12,000 stems per acre. It is not just an open ball park. Now, in the early stages of reproduction, the first 5 or 6 years, seedlings are only knee high and there is no doubt you can call it a clearcut. When regeneration is up over your head and higher than you can reach standing on your buddy's shoulder, is it still a clearcut or is it timber again? I do not know what the answer is myself. So some of this may be subject to some of these sorts of cautions. If we accept clearcuts are reasonably recognizable, then I think this (Fig. 6) is rather interesting. This vertical hatching area here which represents a clearcut shows really a rather mild use of it; much greater use of the natural openings rather than the clearcuts. Again, whether this might reflect time of day these sightings were made, or if this makes a difference in the overall picture, I don't know.

This (Fig. 7) is a picture of the road hunters alone, and shows the difference that the partial road closure seemed to make. The 1st two years there is a rather remarkable constant - 16.7 percent for both years of the total hunters in the area who reported no time in the field at all but strictly stuck to their vehicles. They were patrolling the roads looking for elk. Road hunters dropped from about 1 in 6 hunters in the 1st two years to about 1 in 10 hunters in the year of partial road closure. The ratio of elk seen by the road hunters was about 1 in 20 of the total elk seen in those first two years, and about 1 in 200 for the road closure season. If we look at the number of elk seen per hunter, again a constant 0.15 in the first two years, with a drop to 0.03 in the third year. By comparison, field hunters saw 0.53, 0.68, and 0.86 elk per hunter in the first, second, and third years, respectively, so the field hunter is definitely seeing the animals, where the road hunter isn't. The percent of elk kill gives the same picture. Actually, of all the elk taken in the last three years, only one was taken by a road hunter.

I might just make one other comment based on a question I just heard here.

Where do the road hunters go when you close the roads? I do want to mention that looking at this years data and comparing it with the 2 previous years, the two areas on either side of the restricted areas, or the two that are still in an unrestricted category, had no increase in the percentage of hunters using those particular areas this third year over the two previous years. So they weren't going out into the unrestricted area any greater than they were earlier.

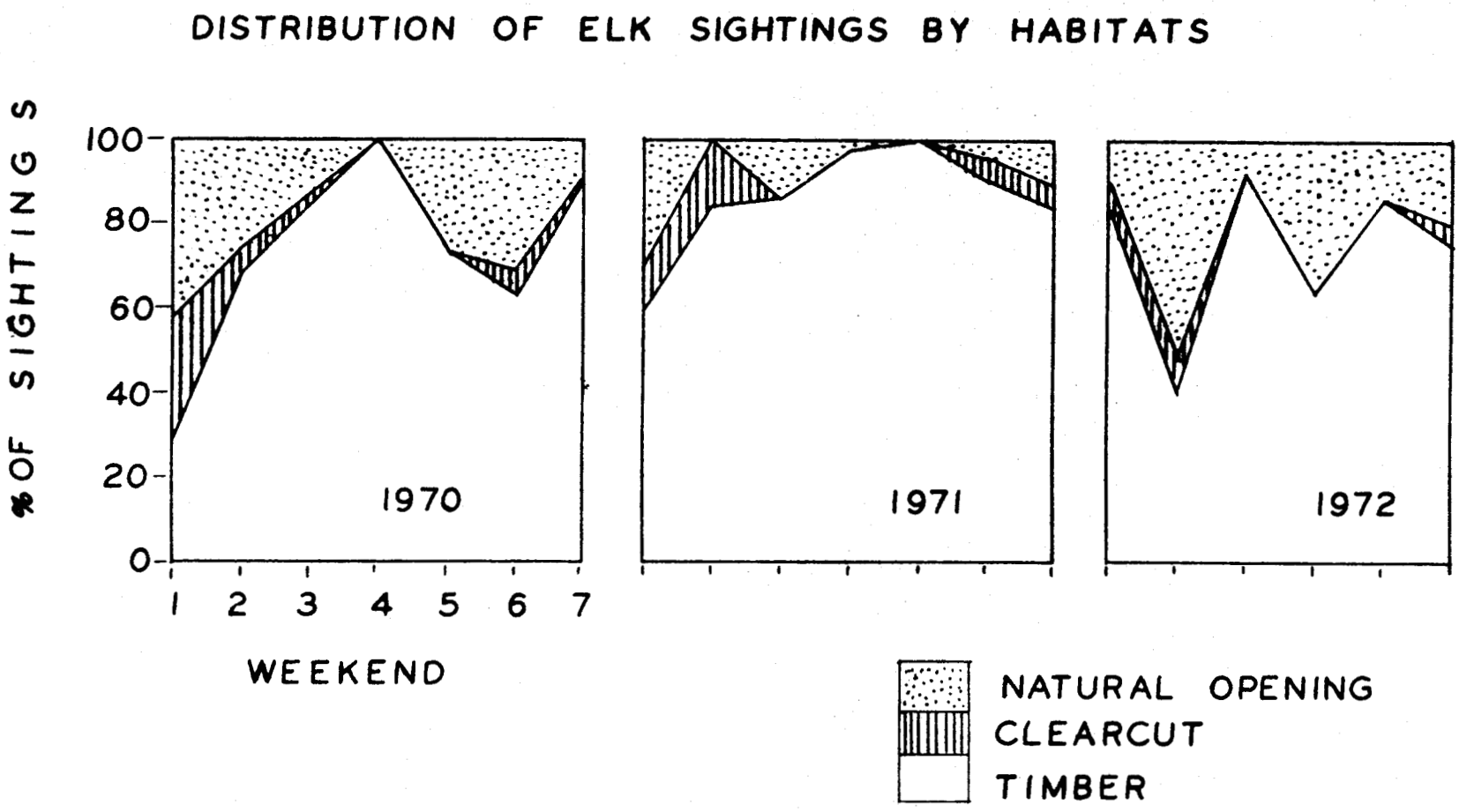

DISTRIBUTION OF ELK SIGHTINGS BY HABITATS
% OF SIGHTINGS
100
80
60
40
20
0
1970
1971
1972
1 2 3 4 5 6 7
WEEKEND
NATURAL OPENING
CLEARCUT
TIMBER

FIGURE 6

ROAD HUNTERS

	% of Total	% of Elk Seen	Elk Seen Per Hunter	% of Elk Kill
1970	16.7	5.5	0.15	0.0
1971	16.7	4.2	0.15	3.8
1972	9.9	0.4	0.03	0.0

FIGURE 7

EFFECTS OF A ROAD CLOSURE ON ELK DISTRIBUTION AND HARVEST IN THE UPPER RUBY

by

Eugene O. Allen[1]

I'm engaged in a study similar to the one Joe Basile just described, except it's a completely different type of area. This area is exactly the opposite of a heavily timbered solid canopy situation - it's more like an open area with trees rather than trees with parks. A portion of the Gravelly herd spends the summer and fall in this area. It is characterized by very scattered timber and open, gentle terrain; because of the nature of this terrain and scattered timber, before road restrictions you could drive a 4-wheel drive vehicle into every square mile. I assume there was probably no elk that could have been more than 1/2 mile from where a person could have driven a vehicle if he had wanted to. We have a large elk population in this area during a normal fall, and on opening day of the hunting season three years ago, 30 to 40 elk were harvested out of one small drainage. This is an either sex permit area with open bull hunting.

The study area is about 110 square miles and is divided in the middle by a car type road with a car type boundary road surrounding the area. For two years information was gathered from this area with no restrictions; this year the upper portion was closed with only a few spur roads and the boundary road left open; the spur roads went into the area from 1/2 to about 2½ miles. With heavy snow the upper portion of the road is impassable. There is little access above the lower portion after the first week or two of the hunting season in a normal year. There was a great deal of effort put into patroling and enforcement of this closure and only one citation was issued for this entire season. There were very few violations, which we attribute to a very intensive I & E program for the previous two years.

The number of elk harvested from the closed unit dropped considerably the third year. It dropped the second year of the nonrestrictions also, and that drop came on opening day because of bad weather, which made it for all practical purposes a road closed area. Joe mentioned that one of the differences between the Judith and the Ruby was whether or not the closure would lengthen or extend the time that elk stayed in the area. Dick Pedersen said that in the Chesnimnus the closure did not lengthen the time or spread out the harvest; the harvest came approximately in the same length of time both years.

We had a 6 week season the first 2 years and this year was one week shorter. Ninety-three and 73 percent of the elk harvested from this upper unit were harvested the first 8 days in 1970 and 1971, respectively; this year it was only 50 percent. This year 50 percent of the elk were

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taken the last 3 weekends while only 4½ and 14 percent were taken the last three weekends the first two years. This is an indication that elk stayed in the area in good numbers the entire season this year, where in prior years, for all practical purposes, elk were gone after the first week and most of them after the first 3 days.

The number of road hunters, people who did nothing but road hunt, actually went up. This is in the entire study area and not just the upper unit. I think the reason is that most people, before it was closed, would do a lot of driving and some walking. Rather than do all walking this year they chose to do all driving around the outside and on the spur roads. In previous years some of these people would have been field hunters because they would have spent some time in the field. It is significant that road hunters last year saw a proportionate number of elk while this year the number of elk they saw was way down. The first 2 years under no restrictions, opening day road hunters saw more elk, killed more elk and had higher success than the foot hunters. This is because, in a vehicle they can cover more ground and see more country and most of the elk opening day are seen and killed running between patches of timber. With more opportunity to visit more patches and open places, they would naturally see more elk and they did. After opening day their advantage drops way off.

The number of hunters in the study area dropped off the second year because of the bad weather opening day. The rest of the season was almost exactly the same both years. This year it was way down and was down during the entire season. Hunters, although they said they were interested and in favor of this road closure, did not show up to take part in the hunt on foot. The percent of the season hunters in both units of the study area stayed approximately the same.

Average hours walked per hunter has increased each year and the average number of elk seen per hunter per day has decreased each year. I think that this is explainable by the fact that most elk in this area are seen in open areas. The fewer the number of hunters, the less these elk are harassed and the less they move around between patches of timber. I'm inclined to believe that in this area the number of elk seen and harvested per hunter is a function of the number of hunters. The more hunters that are there to move these animals around, the more people are going to see elk and the more elk they are going to kill. The fewer the number of hunters in the area the more effort a hunter is going to have to expend to get an elk; this is just the opposite of what you might find in another type of situation.

We also did some telemetry work here. We put four radios on just before the hunting season both in 1971 and 1972. In 1971 all of the radioed elk were still in the study area on opening day. When the season opened, three of them were killed by hunters within 3 days after the hunting season opened; all of them were killed outside of the study area. There is an indication that elk were leaving the area shortly after the season opened. There is no security in the type of terrain and timber cover there for elk under the existing hunting pressure and elk did leave this area early in the hunting season. This year the 4 transmitters were put

on 2 or 3 weeks before the hunting season and they stayed in the area until people started moving into the area to scout it just prior to the opening of the season. The season opened on Sunday and by the Friday before two of the elk in this area had moved out; two remained in. The 2 radioed elk that were in the study area when the hunting season opened remained in the study area; one remained through the season and the other was killed about two weeks before the end of the season. The other two also stayed the entire time where they had moved to just prior to the beginning of the hunting season.

I think the indication is that restricting road travel in this area did in fact reduce the number of hunters that hunted the area; it extended the period of time elk stayed in the area; the elk harvest was approximately the same but spread out over the entire season instead of the first 3 or 4 days. This is almost exactly the opposite what Joe found in the Judith area and it is directly related to the more gentle terrain, scattered timber, and the fact that the area wasn't secure for elk until the road closure. The road closure apparently has made it more secure, because more elk stayed longer. The Judith, in spite of heavy hunting pressure, had a higher security level. One of the things we are going to work at is to try and come up with some kind of an index - somewhere between the Ruby and the Judith there is a point in security level based on terrain and timber cover that does offer security for elk under given hunting pressures. If we could determine this point it might make it easier to make recommendations for certain types of timber operations that do open up canopies and create more interspersion of cover types.

Question: Gene, I've got a question for Dr. Ream. What size clearcuts are they using in that drainage and what are their plans for road closures?

Answer: Most of the spur roads in that area in the future will be closed off. The main logging roads will be maintained. I don't know the exact ages of the clearcuts.

RESOLUTIONS

Approved by the 1973 Elk Workshop

presented to the

Western Association of State Game and Fish Commissioners

July 12, 1973

1. WHEREAS: The elk is an important game mammal in the western states, and

   WHEREAS: Increased elk numbers in suitable areas would be desirable to provide more animals for hunting, and

   WHEREAS: Lack of adequate winter range is often the limiting factor for elk populations;

   NOW THEREFORE BE IT RESOLVED that public agencies managing elk winter ranges be urged to set aside important or key areas solely for use by elk, and that these agencies make every possible effort to acquire tracts of privately-owned elk winter range lying within the boundaries of the land unit concerned, i.e., National Forest, BLM District, or other designated unit of public land.

2. WHEREAS: Land managing agencies tend to give low priority to wildlife needs when planning land uses, and

   WHEREAS: Wildlife resources are becoming increasingly important on public lands;

   NOW THEREFORE BE IT RESOLVED that land managing agencies be urged to give wildlife, particularly elk, equal consideration with timber harvest, livestock grazing, and other uses of public lands.

3. WHEREAS: There are larger tracts of public lands to which public access is unavailable because of land ownership patterns, and

   WHEREAS: There is need for public access to these lands for recreational purposes, including elk hunting;

   NOW THEREFORE BE IT RESOLVED that agencies administering public lands be urged to enforce existing laws and regulations providing for travel by the public across private lands which control access to tracts of public land.

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