



Response of White-tailed deer following a forest fire in the Long Pines, southeastern Montana  
by Keith William Wittenhagen

A thesis submitted in partial fulfillment of requirements for the degree of Master of Science in Fish and Wildlife Management

Montana State University

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Abstract:

In June of 1988 a forest fire burned 74% of the 27,862 ha of National Forest in the Long Pines of southeastern Montana and created a mosaic of burned and unburned timber and grasslands. An earlier study conducted in this area suggested that the diversity and security provided by the multi-aged ponderosa pine (*Pinus ponderosa*) stands before the fire were fundamental in maintaining high density white-tailed deer (*Odocoileus virginianus*) populations during all seasons (Dusek 1980). I observed post-fire whitetailed deer population characteristics and how they have responded to the new habitat complex. A total of 1,564 white-tailed deer observations were recorded for the Long Pines during the June-August 1993 and January-December 1994 field seasons. A more diverse habitat was created as a result of the fire. The amount of browse in the study area increased and food habit data suggested the whitetails diet was primarily comprised of browse making up 70% percent yearlong. The major difference in range use from Dusek's (1980) study was white-tailed deer use of more open areas (open ponderosa pine, bum, and agricultural) compared to more closed canopy use before the fire. Twenty-four percent of whitetail observations for all seasons were in agricultural areas. Dusek (1980) also found agricultural areas to be important in his pre-fire study. Agricultural areas received their greatest use during winter and late summer. The results of this study suggest that the fire improved the habitat and quality of white-tailed deer found in the Long Pines. Hunter use, success and opportunity in the Long Pines has virtually stayed the same. The overall hunting success rate for both nonresidents and residents was 71%. Thus, the combination of quality, success and opportunity, without having to obtain landowner permission, make this area unique and important.

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of requirements for the degree

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APPROVAL

of a thesis submitted by

Keith William Wittenhagen

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Signature *Paul Martin For Keith Wittenburger, deceased*

Date *April 3, 1987*

## VITA

Keith William Wittenhagen was born July 5, 1967 in Las Vegas, Nevada to Keith L. and Nettie Wittenhagen. In 1985 he graduated from Custer County District High School in Miles City, Montana and enrolled at Phillips University at Enid, Oklahoma. He received an Associate of Arts degree from Miles Community College in 1987 and enrolled at Montana State University of Bozeman. In 1990 he received a Bachelor of Science degree in Biology and started an independent study on ferruginous hawks for the Bureau of Land Management. He began his studies toward a Master of Science degree in Fish and Wildlife Management in January, 1993. He married Lori Hutchinson in July, 1993.

## MEMORIAL

Keith William Wittenhagen passed away on November 6, 1996, during the final preparation of this paper, as a result of a car-train accident. Keith enjoyed spending time with his wife and family, he loved to hunt and fish, and collect antlers with his dogs, Meeka and Molly. Keith was a member of the Rocky Mountain Elk Foundation, N.R.A., National Wildlife Association, Duck's Unlimited, he helped teach hunter's safety, and the Grace Bible Church.

This thesis is a tribute to Keith's knowledge, understanding, and dedication to wildlife management in Montana. Keith's passion toward hunting and wildlife management can be seen throughout the pages of this manuscript. Those of us who were privileged enough to know Keith will miss him, but more importantly Montana has lost Keith's keen insight into management issues and his gentle nature of dealing with people from all walks of life. He will be missed.

## ACKNOWLEDGMENTS

I would like to extend my appreciation to those who assisted me during the study. Thanks to Dr. Harold Picton for his guidance and assistance during the study; Drs. Jay Rotella and Carl Wambolt for review of the manuscript, and Dr. Tom McMahon for serving on my committee. Special thanks to the landowners and permittees in the Long Pines area for their hospitality and access to their land and/or allotments. A special thanks to Neil Martin and the secretaries at Fish, Wildlife, and Parks for all their help and guidance. The helpful staff at the U.S.D.A. Forest Service in Camp Crook provided assistance and information that was important to the study. Thanks to all the hunters who cooperated and took the time to fill out the questionnaire. A special thanks to Alan and Marilyn Hutchinson for providing room, meals, and shelter for my dogs. Thanks are extended to Dr. Dan Gustafson for providing assistance and guidance in computer imagery and statistical analysis. A special thanks to my parents for their support throughout my college years. Finally, sincere thanks to my wife for financial and moral support, and for having the patience of Job. This study was funded by Montana Fish, Wildlife & Parks. William J. Semmens completed the final detail editing of the manuscript following Keith's death.

## DEDICATION

This paper is dedicated to a friend, Jerry Wiseman, who passed away in the spring of 1995 in the Long Pines. Jerry like many of us loved the Long Pines. Every chance he had he went to the Long Pines. It seems fitting that Jerry moved on in the Long Pines. I'll come visit you in the Long Pines Jerry at some of your favorite spots.

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## ABSTRACT

In June of 1988 a forest fire burned 74% of the 27,862 ha of National Forest in the Long Pines of southeastern Montana and created a mosaic of burned and unburned timber and grasslands. An earlier study conducted in this area suggested that the diversity and security provided by the multi-aged ponderosa pine (*Pinus ponderosa*) stands before the fire were fundamental in maintaining high density white-tailed deer (*Odocoileus virginianus*) populations during all seasons (Dusek 1980). I observed post-fire white-tailed deer population characteristics and how they have responded to the new habitat complex. A total of 1,564 white-tailed deer observations were recorded for the Long Pines during the June-August 1993 and January-December 1994 field seasons. A more diverse habitat was created as a result of the fire. The amount of browse in the study area increased and food habit data suggested the whitetails diet was primarily comprised of browse making up 70% percent yearlong. The major difference in range use from Dusek's (1980) study was white-tailed deer use of more open areas (open ponderosa pine, burn, and agricultural) compared to more closed canopy use before the fire. Twenty-four percent of whitetail observations for all seasons were in agricultural areas. Dusek (1980) also found agricultural areas to be important in his pre-fire study. Agricultural areas received their greatest use during winter and late summer. The results of this study suggest that the fire improved the habitat and quality of white-tailed deer found in the Long Pines. Hunter use, success and opportunity in the Long Pines has virtually stayed the same. The overall hunting success rate for both nonresidents and residents was 71%. Thus, the combination of quality, success and opportunity, without having to obtain landowner permission, make this area unique and important.

## INTRODUCTION

The Long Pines portion of the Custer National Forest in the past has supported relatively stable, high-density populations of white-tailed deer. A substantial proportion of older bucks in this area has made the Long Pines popular and important to hunters.

Two lightning-generated fires in June of 1988 quickly spread and joined together to form the Brewer fire. On 29 June the fire was brought under control. The fire burned approximately 74% of the 27,862 ha of National Forest in the Long Pines creating a mosaic of burned and unburned timber and grasslands (Havig et al. 1988). An earlier study of whitetails in the Long Pines suggested that the diversity and security provided by the multi-aged ponderosa pine stands were fundamental in maintaining high density deer populations during all seasons (Dusek 1980). Dusek's work indicated that the ponderosa canopy was particularly important in the winter, because of its snow-interception and thermal qualities. This study was developed to interpret the response of white-tailed deer to post-fire effects in the Long Pines.

My primary objectives were to document post-fire white-tailed deer population characteristics, their relationships to a new habitat complex and to compare post-fire to pre-fire information. An additional added objective was to document some attributes of epizootic hemorrhagic disease (EHD) in whitetails in southeastern Montana.

## STUDY AREA DESCRIPTION

The Long Pines is a small range of hills located approximately 25 km southeast of Ekalaka in Carter County, Montana. The range is L-shaped, about 23 km long, 6 to 19 km wide, and rises 366 m above the surrounding plains to a maximum elevation of 1,256 m. Hills within the range are flat-topped, with some steep ridges, and V-shaped valleys. Unique sandstone outcroppings and rimrock structures are more evident since the fire. In addition to ponderosa pine being the predominant woody vegetation, there are various-sized grassland meadows, aspen (*Populus tremuloides*) groves, deciduous woody draws, shrub communities, canyons, and badlands scattered throughout the study area.

The Long Pines (total area = 27,862 ha) is included in the Sioux Division of the Custer National Forest. The study area, in addition to the National Forest land, included some surrounding private land (total area studied = 48,174 ha) (Fig. 1).

Major drainages in the area are Box Elder Creek to the northwest, Tie Creek to the south, and the Little Missouri to the east. Many drainageways extend across the prairie, but most lack standing water except during spring and after big thunderstorms. Permanent water sources include natural springs, stock ponds, and stock tanks. Soils in the Long Pines are well-drained and generally clay "gumbo", silt, or rocky in steeper areas. The surrounding terrain is level to rolling prairie comprised of mixed grasses, sagebrush (*Artemisa* spp.), and several varieties of agricultural plantings.

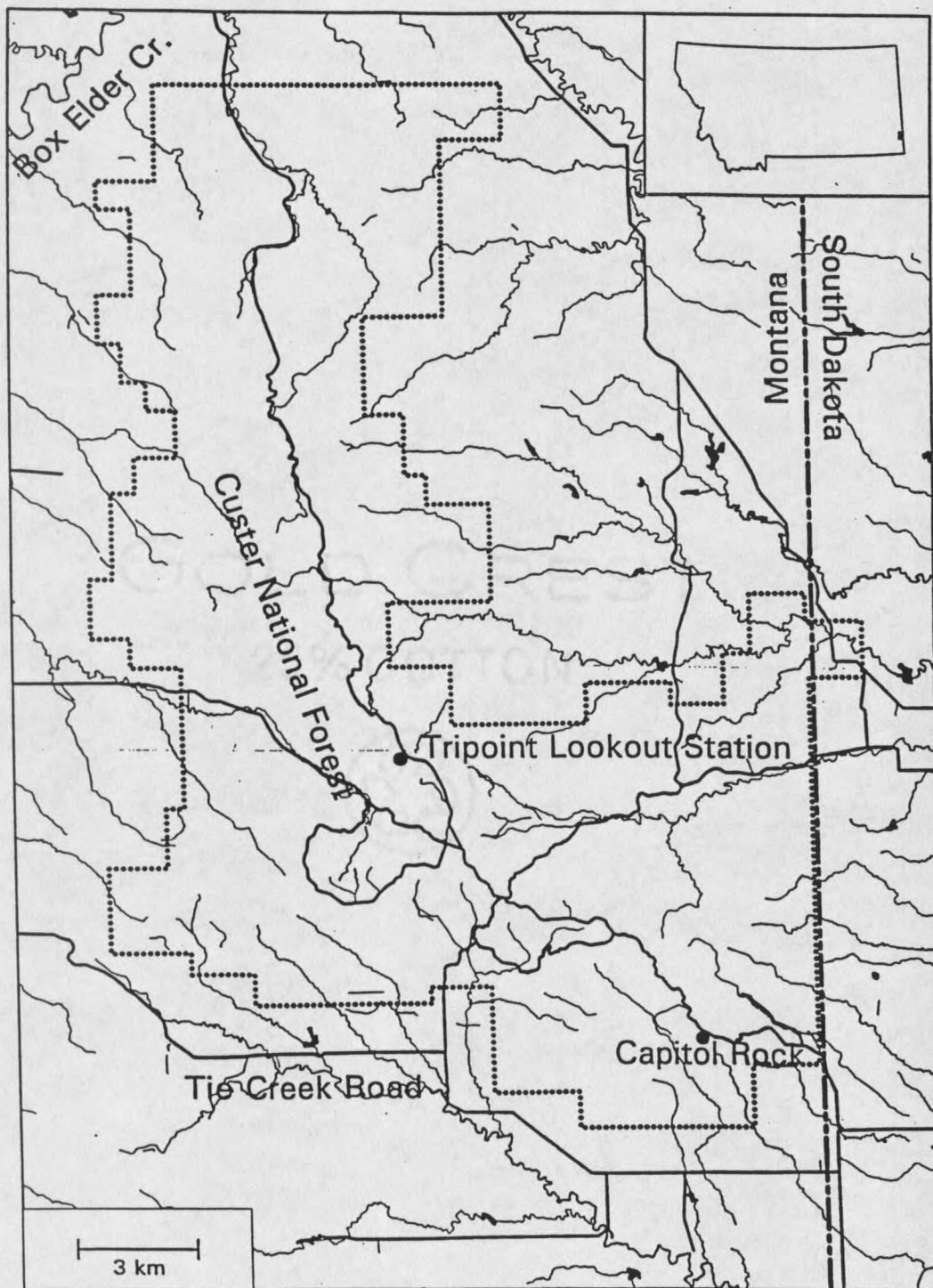


Fig. 1. Map of the Long Pines study area showing main roads, streams, and forest boundaries.

### Vegetation

The Long Pines, according to Pfister et al. (1977), is classified as a ponderosa pine climax series. There are five habitat types and five phases under this climax series that describe the Long Pines. The predominant habitat types in the Long Pines are ponderosa pine/common chokecherry (*Prunus virginiana*), ponderosa pine/common snowberry (*Symphoricarpos albus*), ponderosa pine/bluebunch wheatgrass (*Agropyron spicatum*), and ponderosa pine/little bluestem (*Andropogon scoparius*).

The bluebunch wheatgrass/green needlegrass (*Stipa viridula*) habitat type occurs on more productive sites, such as non-wooded draws and open north-facing slopes. Needle-and-thread (*Stipa comata*), rather than green needlegrass, was the co-dominant on most of the grassland communities sites during Thompson's (1993) study. On drier, less productive sites the little bluestem/threadleaf sedge (*Carex filifolia*) habitat type existed, but was not as common as the bluebunch wheatgrass/green needlegrass habitat type (Havig et al. 1988).

The green ash (*Fraxinus pennsylvanica*)/common chokecherry habitat type dominated moist draws, drainageways, and springs throughout the study area. Quaking aspen stands occurred throughout the study area but especially in draws that burned. Growth of aspen has been phenomenal since the fire (6 years). Stands continue to sucker and increase in height with some trees exceeding 5 m.

### Post-Fire Conditions

A mosaic of burn intensities occurred during the Brewer Fire, which significantly changed plant communities and stand distribution. Severely burned areas totaled 34% of the burn, moderately burned areas covered 28%, and lightly burned areas accounted for 38% (Havig et al. 1988). In stands where understories of chokecherry and aspen existed, and where woody draws were burned, regeneration of these species has been excellent. Young ponderosa pine are coming back well as a result of extensive planting and natural regeneration. In the severely burned areas, invading species including spreading dogbane (*Apocym androsaemifolium*), horseweed (*Conyza canadensis*), and woolly plantain (*Plantago patagonica*) still exist; however, other seral components are now more abundant. Most grassland communities are well adapted to fire. Grassland communities in the Long Pines sustained little permanent damage as a result of the fire and have recovered well.

### Land Use

Major land uses within the Long Pines are logging, cattle grazing, and recreation. All of the National Forest land is grazed. A few (3) allotments are in a rest-rotation grazing system allowing certain pastures to be rested from livestock grazing on a yearly basis. Most of the recreational use is by hunters. Hiking, camping, picnicking, bird-watching, and motorcycle/all-terrain vehicle riding are also common uses. Private land in the study area is used primarily for livestock and production of small grains.

### Climate

The climate of the study area is continental and semi-arid. Summers are hot and dry, while winters are cold and dry. Rain gauges and a digital thermometer, that recorded the maximum and minimum temperature for the day, were set up within the study area to verify if one weather station (Ekalaka or Camp Crook, SD) was more appropriate for weather information. The Long Pines weather resembled the Ekalaka weather more closely. The mean annual precipitation for Ekalaka is 42.37 cm, one-half of which falls during the months of May, June, and July. During this study the annual precipitation was 59.84 cm in 1993 and 53.70 cm in 1994 (NOAA 1994).

The summer of 1993 was cool and wet, with precipitation 28.53 cm above normal and temperatures averaging 10.39 degrees Centigrade (C) below normal for April through July (Fig. 2). In May alone 22.94 cm of precipitation was recorded at the Ekalaka station. The Ekalaka station reported temperatures for January, March, and April of 1994 to be near normal with the only exception being February. Mean temperatures for February were 12.83 degrees C below normal (-9.45 degrees C). Precipitation for that same period was 4.57 cm above normal (8.46 cm). Spring (April, May, and June) temperatures were near normal; however, precipitation amounts were down 5.13 cm from normal (20.40 cm). Summer temperatures and precipitation for 1994 were near normal. Fall (October, November, December) temperatures were near normal, but precipitation amounts were

10.95 cm above normal (5.97 cm). October precipitation was 11.12 cm above normal (2.84 cm); and most of it fell in the form of rain (NOAA 1994).

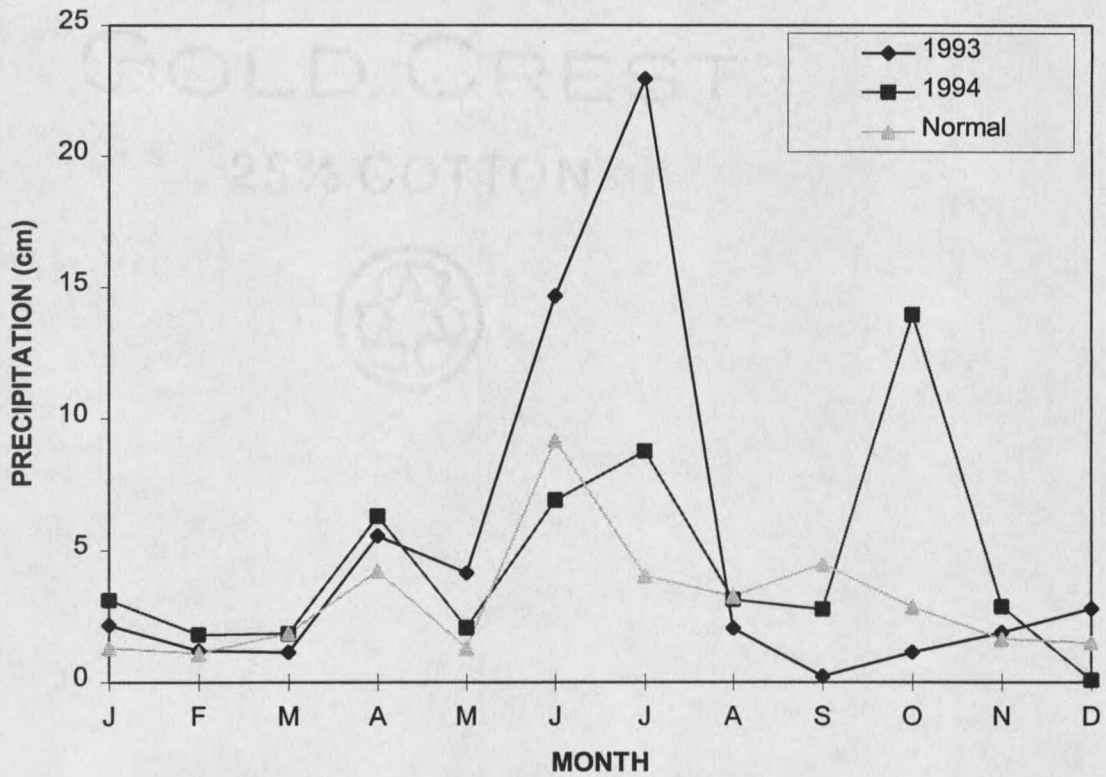


Figure 2. Monthly precipitation in the Ekalaka area for 1993 and 1994.

## METHODS

Distribution and Range Use

In the summer of 1993, I initiated a study to evaluate habitat use and requirements of the whitetail deer population after a large forest fire. Field dates were: June-August 1993; January-December 1994; and brief periods in the fall of 1995.

To determine range use and habitat relationships, regular and systematic observations with the aid of a 12-36X spotting scope and 9X binoculars were made during morning, afternoon, and evening periods from aerial and ground reconnaissance. More than 90% of my days in the field from March through October were spent ground searching. These searches allowed me to obtain several different types of information. Seasonal and annual trends were estimated primarily from vehicle survey routes and optimal vantage points.

The number of white-tailed deer observed in different land-use categories were multiplied by a correction factor to get an adjusted "actual -use estimate". Due to the lack of available information, this correction factor used previously on mule deer was used on whitetails for this study. The observability indices were based on the following assumed observability rates used by previous researchers (Swenson et al. 1983) for both species of deer in southeast Montana: 30% in dense pine, 33% in moderate density pine, 35% in scattered or open pine, juniper breaks and badlands, 40% in creek riparian and

50% in sagebrush grassland, grassland and dryland agriculture (Mackie et al. 1981, Swenson et al. 1983). This gave an estimate of the actual use of the land types.

Because of weather conditions and inaccessibility to most of the study area during January and February, most of the observations were made from the periphery of the study area, mainly the Tie Creek road. Aerial flights along with snowmobile trips into the study area supplemented otherwise limited observations. In addition to visual sightings of deer, tracks helped define deer use of the study area. March conditions were more favorable, and I was able to spend more time hiking in the core of the study area. At that time I was able to record how the white-tailed deer had used and were using the habitat.

White-tailed deer were recorded using Universal Transverse Mercator (UTM) coordinates as to species, time of observation, activity, location (habitat type and general surroundings), and when practicable by sex and age class (Table 1). Deer were classified as male, female, or fawn during summer and as adult or fawn during the winter (1 deer = 1 observation). Activities were categorized as feeding, bedded, or traveling.

Aerial surveys, using a Piper Supercub, were flown for complete coverage of the study area during the winter, spring, and summer of 1994. Observation flights were made to document whitetail distribution and use in both the burned and unburned areas of the Long Pines, as well as to locate areas for ground surveys. Surveys began approximately 1/2 hour before sunrise and were completed within 2 hours after sunrise. Flight paths generally followed drainages. This method provided the best visibility of all terrain.

More than one pass was made for complete coverage when the width of the drainage or dense vegetation required closer inspection to determine presence of deer.

Night surveys provided additional information on deer use and numbers. Night observations were aided by a 1 million candle-power spotlight and binoculars. Major roads were divided into sections, each section was assigned a number, and survey sections and times were randomly chosen (without replacement).

Table 1. Deer-use categories used in surveys

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<b>Agriculture</b>	Any form of crop grown but mainly small grains and alfalfa.
<b>Open</b>	Non-timbered land containing grass, forbs, and/or shrubs.
<b>Riparian</b>	An area of land directly influenced by permanent water included in this area ephemeral streams and washes.
<b>Ponderosa Pine</b>	
	Dense      1,197+ trees per ha.
	Moderate    502 trees per ha.
	Open        Up to 66 trees per ha.
<b>Burn</b>	Visible fire damage resulting in the death of vegetation (trees included) after the fire (regenerating forest under 1.5 m).

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Spring surveys were used to ground truth wintering areas for winter use. The distribution of pellet groups, dead animals, and shed antlers indicated whether an area was used or not.

### Food Habits

Feeding-site examinations were performed to confirm plant identifications made during the fecal analysis and to provide an evaluation of the completeness of the fecal-analysis results. Feeding deer were observed, and a starting point was randomly selected within their area. Starting from this point a transect was run. An outward spiral pattern was walked within the area of use. Each plant in this transect was examined for signs of use. The transect was terminated when use on a total of 100 plants was recorded. These data were treated as indicating presence or absence of use of a plant species.

Fecal pellets were periodically collected from randomly selected deer locations within the study area during all seasons, except fall, for analysis of fecal content. Only pellet groups considered fresh (moist appearance and texture) were collected. For each fecal group encountered 10 pellets were collected. The pellets were then cleaned of foreign debris and air dried in paper bags. Pellets were analyzed by season: January, February, and March = winter; April, May, and June = spring; July, August, and September = summer; and October, November, and December = fall. A random sample was then taken from the combined sample, ground up, and submitted to the AAFAB Composition Analysis Laboratory at Colorado State University for analysis.

### Physical Attributes Of Individual Deer

Hunter harvested deer were the only deer collected during the study. Field-dressed animals were weighed and aged according to tooth replacement and wear (Severinghaus 1949). On older deer the primary incisor was pulled and sent to Matson's Laboratory for cementum age determination to determine if my assessment of the animals age was correct. If the animal supported antlers; main beam length, circumference around the base, inside spread, and number of points were recorded.

### Causes Of Mortality

Ground searches during all seasons allowed me to assess mortality. Locations of dead deer, and, if possible, sex, age, the cause of death, and species were recorded. During spring surveys, bone marrow from the femurs of dead white-tailed deer were evaluated for fat consistency. Gelatinous marrow indicated a low amount of fat left in the marrow, and starvation was considered the probable cause of death (Cheatum 1949). I concentrated my efforts in areas, depending on the season, where I knew deer to frequent based on my work experience and knowledge of the area. In the winter and spring I concentrated in wintering areas. In the summer and fall I concentrated my efforts along drainages, because (EHD) infected animals generally seek water before death.

*Winterkill* - I assumed that bucks shot and not recovered in the fall had antlers whereas bucks that died as a result of winterkill had shed their antlers. Nutritionally

stressed animals often die in March, April, and even May. It is at this time that the animal has depleted its fat reserves and any inclement weather will probably lead to death.

*EHD* - EHD (a virus transmitted by biting midges of the genus *Culicoides*) information was collected in the fall of 1994 as well as the fall of 1995.

### Hunter Use Of The Long Pines

Hunter use of the Long Pines during the fall of 1994 was analyzed to better understand hunter use and harvest. Deer hunting during the fall was the only type of hunting considered.

Questionnaires were given to all individuals encountered, in the field, hunting in the Long Pines. Questions included: origin of hunters, periods of use, number of hunters, harvest information, their opinion on the effects of the fire, and the single most important factor attracting them to the Long Pines. The hunting season was arbitrarily split into 3 parts; first two weeks, middle two weeks, or the last week. Hunters were asked to denote which period(s) they hunted. Only national forest lands in the study area were considered.

### Vegetation

I used data collected by the U.S.D.A. Forest Service, a vegetation-monitoring program conducted since the fire. Plot sampling, habitat types, series, and phases that

were used by the Forest Service follow Pfister et al. (1977). Scientific names of plant species follow the terminology by Scott and Wasser (1980). Complete descriptions of the vegetation in the study area are given in Hansen and Hoffman (1988) and Thompson (1993).

Three different classifications for tree densities were determined by the number of trees per ha (Table 1). Ten areas for each tree-density classification were sampled. The number of trees in a (9.14 X 9.14 m) area was recorded and converted to achieve the approximate trees per ha classification. The average of the ten areas for each tree classification was then used. Open density ponderosa pine was defined as up to 66 trees/ha, moderate density ponderosa pine was defined as 502 trees/ha, and dense ponderosa pine was defined as 1,197+ trees/ha.

## RESULTS

Distribution and Range Use

During the study period, a total of 1,564 white-tailed deer observations were recorded. Twenty-four percent of the 1994 field observations for all seasons were in the agricultural type, followed by; burn (22%), open density ponderosa pine (18%), open grassland (16%), moderate density ponderosa pine (10%), riparian (9%), and dense ponderosa pine (1%). The corrected "actual-use estimates" for those same types were 19, 25, 21, 12, 12, 9, and 2% respectively. The most common observed activity in all seasons for whitetails was traveling followed by feeding and bedding.

*Winter* - As previously mentioned, temperatures were near normal and precipitation amounts were above normal for the winter of 1994 in the Long Pines. However; mean temperatures for February were 12.83 degrees C below normal (-9.45 degrees C), and 20 of the 28 days were below normal. Precipitation amounts for January and February of 1994 in the Long Pines were 4.90 cm. This was 2.51 cm above normal (2.39 cm). During that period it snowed 26 out of the 59 days.

A total of 485 observations of white-tailed deer were made during this season. White-tailed deer employed three different strategies for surviving winter. Whitetails on the southern and eastern borders of the national forest bedded on mostly open, south facing slopes during the day, and used agricultural areas at dusk. Some deer stayed in the national forest and utilized the available resources in a situation similar to yarding. Other deer migrated to areas outside the study area; Conservation Reserve Program (CRP)

lands, the Little Missouri River drainage to the southeast, and the Box Elder drainage to the west. Whitetails that migrated to CRP areas did so in the fall and did not return to the forest until the spring.

Over 85 white-tailed deer were trapped by local residents during a three year period in the early 1990's near Capitol, MT (13 km away). The deer were tagged with ear tags used on cattle and some (3+) of these deer were observed as well as harvested in the Long Pines in the fall. These incidental efforts by local residents substantiated my observations that some deer chose to migrate to other areas.

White-tailed deer that utilized the national forest during the winter bedded in areas that ranged from dense pockets of ponderosa pine to areas of downed trees in burns. Forty-four percent of winter observations for white-tailed deer were in agricultural areas. As previously mentioned both whitetails and mule deer, would leave the national forest in the evening and head for the agricultural areas (haystacks included) that border the national forest. Deer would leave the agricultural areas in the morning and head back to the national forest, although some did choose to stay in nearby riparian areas during the day. Excluding the agricultural areas, open (66 trees/ha) density ponderosa pine and burn areas were used the most (17% and 14% respectfully). Moderate density (302 trees/ha) ponderosa pine and open grassland were also used frequently (10% a piece). While dense (1197+ trees/ha) ponderosa pine areas only made up 4% of the observations (Fig. 3). The adjusted "actual-use estimates" for those same areas were 36, 20, 17, 12, 8, and 2% respectfully.

*Spring* - By the third week of March grass and forbs were beginning to grow.

With the sprouting of new vegetation, deer began to leave the wintering areas and disperse. Average group size per observation diminished from 12 to four. A total of 444 white-tailed deer observations were recorded for this season. Deer were more visible at this time because of their feeding in more visible areas (along the side of roads and open meadows) longer into the morning. Does isolated themselves in May to fawn. The first fawns began accompanying does in late June. Males occupied "bachelor" groups, the yearling whitetail deer, mainly males, were observed in areas where whitetails were not frequently seen (Fig. 3).

Thirty-five percent of the spring observations of white-tailed deer were in open ponderosa pine. Open grassland, burn, riparian and moderate-density ponderosa pine represented 22, 16, 14, and 12% of the observations respectfully. Few (1% combined total) deer were recorded in agriculture and dense ponderosa pine. "Actual-use estimates" for those same areas were 38, 16, 17, 14, 14, and 1% respectfully.

A total of 232 shed antlers were found during the 1994 field season. Sixty-nine out of the 232 were antlers that were shed that year (fresh sheds). The survey crews working for the USDA-Forest Service were finding sheds, about an equal amount of fresh sheds compared to my findings for that same period, in the burned areas. So, I concentrated most of my efforts in unburned areas. As a result, most all (>90%) of the sheds I found were in forested areas, mainly open and moderate density ponderosa pine.

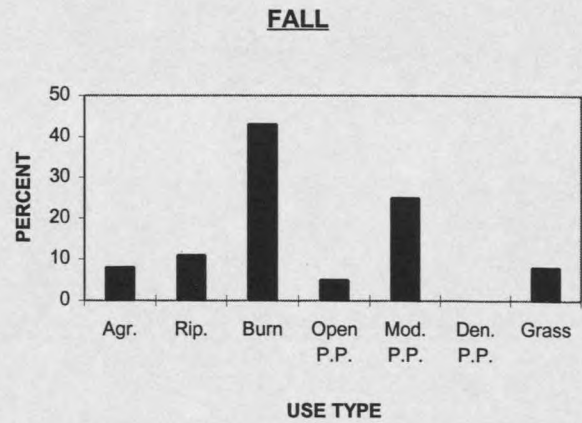
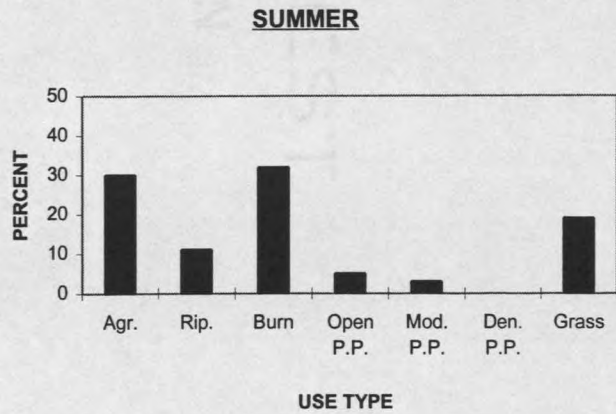
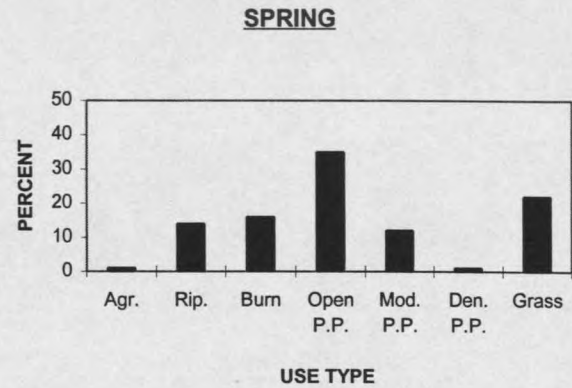
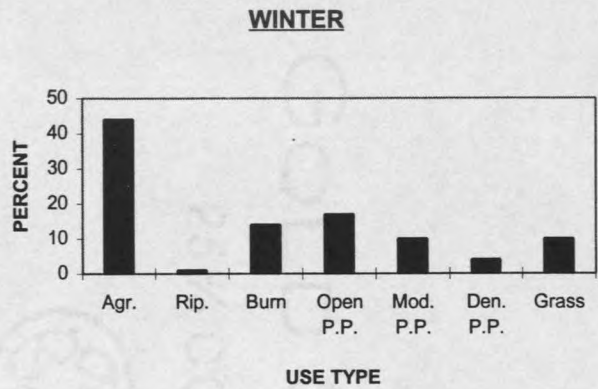


Fig. 3. Seasonal white-tailed deer land-use by percent in the Long Pines as observed during fieldwork in 1994; winter n = 485, spring n = 444, summer n = 373, and fall n = 155.

*Summer* - Fawns made up 12.4% (n=17) of the July observations of whitetails. In August fawns made up 12.2% (n=21) of observed. Males often occupied different areas than the females; however, these areas often appeared to be of the same quality. A total of 373 white-tailed deer observations were made during this season. Burned areas made up 32% of the summer locations of white-tailed deer followed by agricultural areas (30%), open grassland (19%), and riparian areas (11%). "Actual-use estimates" for those same areas were 38, 25, 16, and 11% respectfully. Does, fawns and bucks used the agricultural areas all summer, but use increased from less than one percent in June to over 50% in August as the vegetation in the hills dried up. By the end of August most of the lush vegetation was gone except for the alfalfa fields and riparian areas. Not many deer (30% of the observations for August) were observed in the national forest portion of the study area at this time (Fig. 3).

*Fall* - September was warm and dry like August. However, October was unusually wet in 1994. Normal precipitation for October is 2.84 cm; however, 13.97 cm was recorded mostly in the form of rain. This along with moderate temperatures encouraged new grass growth (fall green-up). The deer moved back to the forest, where feeding represented 45% (n=29) of the observations made in all density classes of ponderosa pine in October.

Once the hunting season started, deer observation time decreased. My observations, supported by those of hunters, showed that 43% (or n=66 for Oct. & Nov.) of the white-tailed deer were observed in the burn areas (Fig. 3). Six years after the fire

>90% of the dead trees have had either their limbs or trunk broken off. Burned areas that contained more downfall, such as areas that would have been classified as moderate to dense density ponderosa pines before the fire, were the most desirable for deer at this time. These areas were difficult to walk in with any stealth and provided hiding and thermal cover. Thus, the areas with more downfall provided high security.

Moderate density ponderosa pine, especially bordering burned areas, made up 25% of the fall observations, while riparian, agricultural, open grassland, and open ponderosa pine made up 11, 8, 8, and 5% respectfully. A total of 155 white-tailed deer were observed during the fall. "Actual- use estimates" for those same areas were 45, 28, 10, 6, 6, and 5% respectfully.

### Food Habits

Species that made up 80% of the feeding site exams during the summer did not show up in the fecal analysis (Table 2). I attribute some of the differences to biased sampling of feeding sites and fecal pellets. It was difficult determining a fresh instance of use (fresh bites on vegetation) in the fall and winter. Thus feeding site exams during these seasons often contained less than 100 instances of use. Feeding site exams with less than a 100 instances of use were not included in the percentages listed in Table 2.

Browse, forbs and grasses accounted for 70, 17, and 13% of the yearlong (excluding fall) diet of white-tailed deer, respectfully, according to fecal analysis (Table 2). Feeding site exams showed more use of forbs in the spring and summer than fecal

analysis, and fall feeding site exams showed that browse use increased throughout the fall.

*Winter* - Contents (Table 2) of fecal pellets averaged 90% browse, 6% forbs, and 4% grass. Juniper (*Juniperus* spp.) and ponderosa pine made up 43% and 42% of the browse respectively. Yucca (*Yucca glauca*) made up 4% of the 6% that was forbs. *Agropyron* spp. and sixweeks fescue (*Vulpia octoflora*) were the major grasses used according to fecal analysis.

Feeding site examinations suggested that alfalfa (*Medicago sativa*), wheat (*Hordeum vulgare*), *Alectoria* spp. and to a lesser degree Oregon grape (*Berberis repens*) and Kentucky bluegrass (*Poa pratensis*) were of more importance than was indicated by fecal analysis.

*Spring* - The percentage of browse (55%) in fecal samples for spring (Table 2) was lowest for any season. Green grass became available in late March and was a major item used at that time, 35% of the spring samples. Oregon grape was also a major food item used at this time, it made up 43% of the browse use. Some forbs were available but they did not receive much (8%) use according to fecal analysis.

As previously mentioned forbs only represented 8% of the whitetails diet for the spring period according to fecal analysis. However feeding site exams found use of yellow sweetclover (*Melilotus officinales*), fireweed (*Epilobium angustifolium*), and western salsify (*Tragopogon dubius*) were in fact used more than indicated by the fecal exams especially during June.

Table 2. Seasonal food habits of white-tailed deer in the Long Pines as determined from 3 composite fecal samples (fecal analysis = FA) and 20 feeding site exams (FSE).

Plants	Winter		Spring		Summer*		Fall
	FSE n=5 +/-	FA n=30 %	FSE n=5 +/-	FA n=30 %	FSE n=10 +/-	FA n=30 %	FSE n=5 +/-
<b>BROWSE:</b>							
<i>Artemisa cana</i>	-		-	1.94	-		-
<i>A. frigida</i>	-	.49	-	.68	-		-
<i>A. tridentata</i>	-	2.34	-	3.48	-		-
<i>Berberis repens</i>	+		+		-		+
<i>Juniperus</i> spp.	-	42.50	-		-		-
<i>Pinus ponderosa</i>	+	42.35	-	3.33	-		-
<i>Prunus</i> spp.	+		+	.56	15%	1.75	+
<i>Ribes setosum</i>	-		+		17%		-
<i>Rosa woodsii</i>	-		-		+		-
<i>Salix</i> spp.	-	2.04	-	.68	-	5.85	-
<i>Sheperdia argentea</i>	-		-	.68	-	55.28	-
<i>Symphoricarpos</i> spp.	-		-		5%		+
<b>FORBS:</b>							
<i>Allium textile</i>	-		-	.79	-		-
<i>Anemone patens</i>	-		+		-		-
<i>Apocynum androsaemifolium</i>	-		+		4%		-
<i>Astragalus</i> spp.	-		-	1.84	-	.50	-
Composite	-		+	1.40	-	2.02	-
<i>Epilobium angustitolum</i>	-		+		16%		-
<i>Eurotia lanata</i>	-	.49	-		-		-
<i>Lactuca</i> spp.	-		-		5%		-
<i>Lupinus</i> spp.	-	.70	-	.79	-		-
<i>Medicago sativa</i>	+		+		+		+
<i>Melilotus officinales</i>	-		+		36%		+
<i>Oxytropis lamberti</i>	-		-		+		-
<i>Potentilla concinna</i>	-		-	.61	-		-
<i>Pterospora andromedea</i>	-		+		+		-
<i>Rhus trilobata</i>	-	.50	-		-	33.10	-
<i>Tragopogon dubius</i>	-		+		2%		-
<i>Yucca glauca</i>	+	4.13	-	.79	-		-
<b>GRASSES:</b>							
<i>Agropyron</i> spp.	-	1.19	+	10.71	-		+
<i>Bromus</i> spp.	-		-		-	1.50	-
<i>Buchloe dactyloides</i>	-	.70	-		-		-
<i>Carex filifolia</i>	-	.65	+	.68	-		-
<i>Hordeum vulgare</i>	+		+		+		+
<i>Poa</i> spp.	-		+		-		+
<i>Stipa</i> spp.	-		+	1.24	-		+
<i>Triticum aestivum</i>	+		+		+		+
<i>Vulpia octoflora</i>	-	1.22	+	22.87	-		-
Other				1.40			
<i>Alectoria</i> spp.	+		-		-		+
Seed	-	.70	-	2.08	-		-

\* Summer FSE (combined for the period) with percentages represent exams that had enough instances of use (n=500).

*Summer* - Contents of fecal pellets averaged 63% browse and 36% forbs (Table 2). Buffaloberry (*Sheperdia argentea*) made up the greatest percentage of any browse plant. Sumac (*Rhus* spp.) and willow (*Salix* spp.) to a lesser degree, also made up a good percentage of the diet according to fecal analysis. Forbs received their greatest use at this time, while grass received its lowest use.

Feeding site exams suggested that forbs received greater use. Yellow sweetclover, spreading dogbane, fireweed, western salsify, and prickly lettuce (*Lactuca serriola*) all were major items that were consumed, but again these items did not show up in the fecal analysis. Feeding site examinations suggested that fireweed and western salsify made up a greater percentage (16% and 2% frequency of occurrence respectively) of the deer's diet than is shown by fecal analysis. Chokecherry and western big leaf snowberry (*Symphoricarpos occidentalis*) also appeared to have received more use than indicated by fecal analysis.

*Fall* - As previously mentioned it was difficult obtaining enough instances of use in the fall and time restrictions meant that few (5) feeding site exams were conducted. Fecal samples were not obtained for fall due to the termination of field observations.

Because of the above normal precipitation, in the form of rain, green grass was readily available and used during the month of October. Browse use increased from a 4% frequency of occurrence in the feeding sight exams in September to 61% in November. Oregon grape, chokecherry, and snowberry were major items in the whitetails diet.

Agricultural areas (alfalfa, wheat, and barley (*Triticum aestivum*) fields) continued to be used, making up 8% of the fall observations.

#### Physical Attributes Of Individual Deer

Data obtained from white-tailed deer examined in the field during the fall of 1994 and 1995 were used to evaluate several parameters, including: age, sex distribution, carcass weight, and antler measurements.

Ages were obtained from 85 white-tailed deer from hunter harvested deer taken from the study area. One hundred and fifty-five additional whitetails (Table 3) found dead from natural causes, primarily epizootic hemorrhagic disease (EHD), were also aged. Thirty-seven of the 85 field-dressed hunter harvested whitetails were weighed and recorded (Table 4). Ninety-five percent of the harvested white-tailed deer were between the age of 0.5 to 4.5. Ninety-two percent of the 155 whitetails that died from natural causes were also between the age of 0.5 to 4.5. Older aged deer ( $\geq 5.5$ ) did show up in the harvest, but most (88%) of the older deer recorded died in the spring of 1994 as a result of winterkill. As expected, antler characteristics among males  $\geq 2$  years of age indicated that mean basal diameter, mean length of the main antler beam, and inside spread all increased with age up to age 5 (Table 5). As the sample size ( $n$ ) decreased for the older age classes ( $\geq 5$  year of age), all of the antler characteristics were more variable and this was probably a function of sample size. It was not clear from the data (Table 5) whether 1 antler characteristic was more a function of age than another ( $R^2 = 0.30$ ).

Table 3. Cause of mortality of white-tailed deer found during the study in the Long Pines, 1992-1994, and 1995.

	Male	Female	Fawn	UNID.
Winter-kill <sup>a</sup>	9	2	3	3
Shot <sup>b</sup>	4	0	0	0
EHD 94 <sup>c</sup>	5	0	0	0
EHD 95	61	69	37	0
Unknown	4	3	1	7

<sup>a</sup> deer that were nutritionally stressed or predated on as a result of winter conditions.

<sup>b</sup> deer that were shot but not recovered by hunters in the fall.

<sup>c</sup> epizootic hemorrhagic disease, see text.

Table 4. Mean field-dressed weights (kg) of 37 white-tailed deer harvested and examined in the Long Pines, fall 1994.

Sex/Sample Size	Assigned Age	Mean Field-Dressed Weight	Departure From Sime et al. <sup>a</sup>
F/4	0.5	23.6	-4%
M/3	0.5	23.6	-12%
F/3	1.5/10	36.4/3	-9%
M/2	1.5/2	40.0/2	-15%
F/3	2.5/7	35.5/3	-19%
M/2	2.5/2	59.5/2	+3%
F/12	3.5/16	45.9/12	-1%
M/3	3.5/10	63.6/3	+2%
F/2	4.5/7	39.6/2	-8%
M/1	4.5/6	71.8/1	-2%
F/1	6.5/1	44.5/1	-5%
F/1	13.5/1	43.6/1	-

<sup>a</sup> From Sime et al. (1994) northwestern MT averages for 1992-94.

## Aged White-tailed Deer

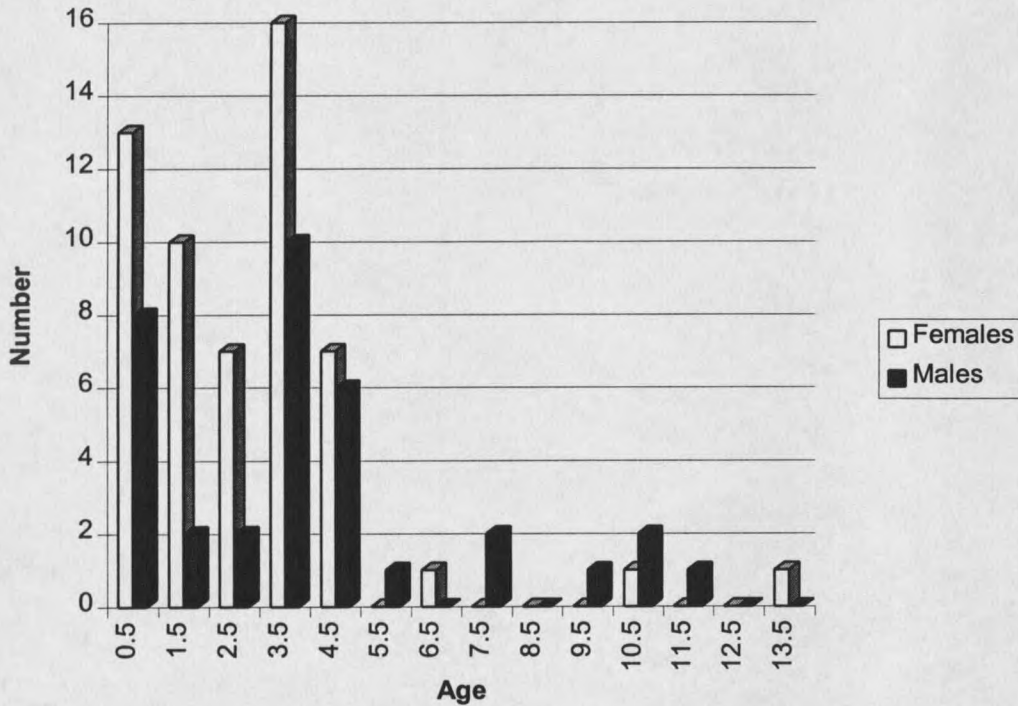


Fig. 4. Age composition of 91 white-tailed deer that died from all types of mortality in the Long Pines, 1992-94.

Table 5. Number (n) and mean of antler beam diameter, beam length, and inside spread in cm of white-tailed deer examined from all types of mortality in the Long Pines 1994-95.

Age	Beam diameter		Beam length		Inside spread	
	n	mean	n	mean	n	mean
2	29	8.84	30	37.87	15	32.72
3	63	10.49	66	47.52	33	38.63
4	32	11.33	31	53.70	15	43.26
5	8	12.12	8	54.66	4	42.55
6	4	13.03	4	51.61	2	40.97
7	4	12.73	4	54.94	2	42.09
8	-	-	-	-	-	-
9	2	13.36	2	50.98	1	44.15

### Causes of Mortality

A total of 41 white-tailed deer were found dead during the 1992-1994 study. Forty-one percent of the dead had succumbed to winter conditions. As previously mentioned, winter-killed animals, those that died as a result of poor nutrition, were identified by their bone marrow consistency. Some of the unknown mortality could have been the result of predation.

A separate data set was collected on whitetails that died of EHD in the summer and fall of 1995 in the Long Pines. The 1995 EHD epidemic in the Long Pines was widespread and had a more severe impact than the one that occurred in 1994. A total of 167 whitetails were found, of which 123 were aged. One hundred and thirty of the 167 were at least one year old (69 females and 61 males). I was not able to determine the sex of the fawns. The age structure of the EHD killed animals (Fig. 5) of 1995 differed (chi-square test;  $P < 0.05$ ) from the age composition of the 1992-94 study (Fig. 4). The EHD group differed in containing proportionately fewer yearlings and 5+ age animals than the 1992-94 sample.

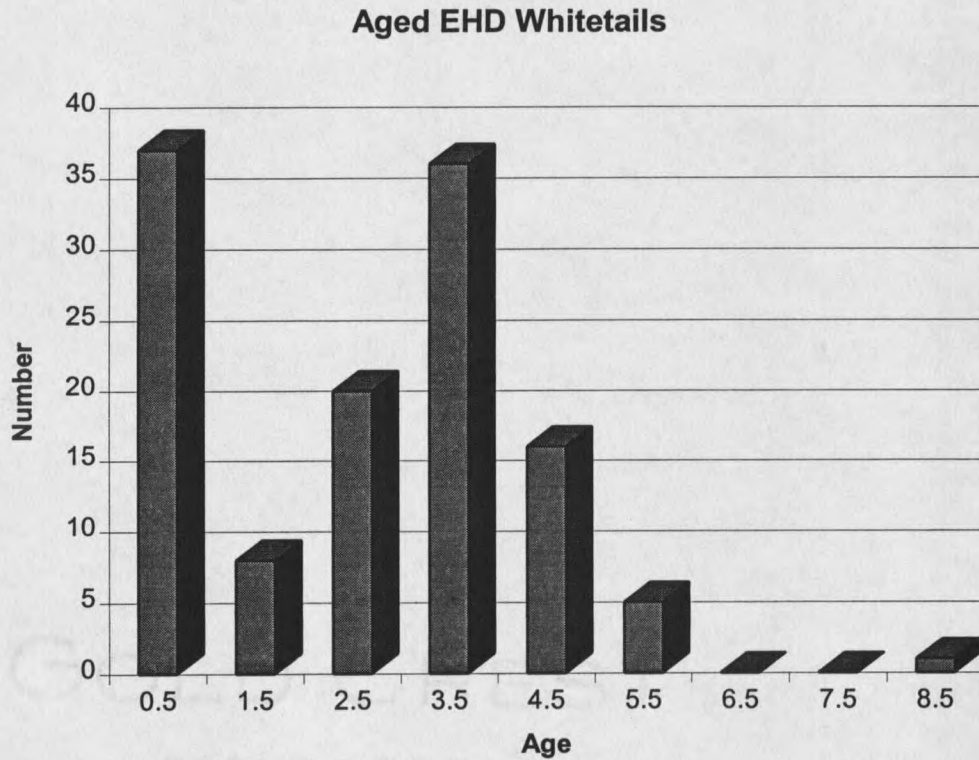


Fig. 5. Age composition of 123 EHD killed white-tailed deer in the Long Pines, 1995.

#### Hunter Use Of The Long Pines

The deer season (rifle) opened 23 October and extended through 27 November, 1994. During the hunting season, 44% of 278 questionnaires were returned. The number of hunters per party averaged 4.8 with only negligible differences observed between resident and nonresident hunting parties.

*Hunter Origin* - In spite of the relative remoteness of the Long Pines from human population centers in and out of Montana, almost 100% of the hunters responding were from outside of Carter County, and 89% were from outside Region 7. Seventy-six percent of the 125 responding people were nonresidents (Table 6). Of the 24% responding residents about half were from Region 7 (southeastern Montana). Of hunters from within Region 7, 50% were from Fallon County, which neighbors Carter County to the North. Baker, the Fallon County seat with a population of about 2,500 people lies within 97 km (60 mi.) of the Long Pines. Residents of Carter County accounted for less than 1% of all responding hunters. Carter County residents were underrepresented in the returned questionnaires. Carter County residents ranked the highest among those that did not return questionnaires.

Nonresident hunters came primarily from the Midwest (Table 6). Thirty-two percent of all nonresident hunters responding to the questionnaire came from Minnesota.

Table 6. Origin of 125 hunters responding to questionnaires distributed during the fall hunting season of 1994.

Origin	Percent of Responding Hunters
Residents:	
Region 7	11
Outside Region 7	13
Nonresidents:	
Upper Midwest	57
Other States	19

*Timing of Hunter Usage* - Data from questionnaires indicated the greatest proportion of all hunters (61%) hunted the first two weeks of the deer season (Table 7). Seventy percent of responding nonresident hunters hunted the first portion (first two weeks) of the deer season, 21% hunted the middle portion (middle two weeks), and 9% hunted the last week. Of the responding resident hunters, 40, 43, and 17% fell within the three respective categories (Table 7).

Table 7. Hunter use during three periods of the hunting season by resident and nonresident hunters as determined from questionnaires from fall 1994.

	First Two Weeks Deer Season	Middle Two Weeks Deer Season	Last Week Deer Season
Residents (40) <sup>a</sup>	40 <sup>b</sup>	43	17
Nonresidents (90)	70	21	9
All Hunters	61	28	11

<sup>a</sup> Number of hunters responding to questionnaires, some hunters hunted more than one period as indicated by questionnaires.

<sup>b</sup> Percent of sample.

*Harvest and Hunting Pressure* - Bag limits for Region 7 have been two antlerless deer (over the counter doe tags or "B" tags for one whitetail and one mule deer) for nonresidents who do not draw an "A" tag. An "A" tag allows the resident or nonresident to harvest either an antlered whitetail, antlered mule deer, antlerless whitetail, or an

antlerless mule deer. For 1994 there were 17,000 nonresident big game combination tags available through a drawing. Included in the big game combination license is an "A" tag. Nonresident "A" tags were also available through three other drawings; 1) 2,000 open draw, 2) 2,000 outfitter, and 3) 2,000 landowner. The last one would not be applicable to nonresidents hunting the national forest portion of the Long Pines. "A" tags along with doe tags, mentioned previously, were available to residents over the counter.

The number of deer hunters in Region 7 has increased by 61% from 1986 (16,792) to 1994 (27,427) as estimated by the statewide Montana Fish, Wildlife, and Parks Deer Hunting and Harvest Report (Lonner 1994). The number of white-tailed deer harvested during that same time period has increased by 13%, while the number of mule deer harvested has increased only slightly. Whitetail Deer numbers in Region 7 have continued to increase since 1988. Whitetails in the Long Pines have continued to increase as well during that same period. In 1987 whitetails in Region 7 experienced high mortality as a result of a major EHD outbreak. As a result the whitetail deer population in the Long Pines experienced a drastic decline. The 1988 Brewer Fire suppressed the already low population, but the whitetails have continued to increase in numbers since that time.

Nonresident success rates were; 87% for whitetail males, 75% for whitetail females, 56% for mule deer males, and 69% for mule deer females (Table 8). Resident success rates were; 52, 75, 50, and 92% respectfully. The combined deer success rate for

nonresidents was 73% and was 66% for residents. The overall success rate for both nonresidents and residents combined was 71%.

Table 8. Deer harvest for the Long Pines from 1994 as determined from questionnaires.

	WT Does	WT Bucks	MD Does	MD Bucks	Overall Success (%)
<b>Nonresidents:</b>					
Species Hunted (139)	56	15	52	16	
Species Harvested (102)	44	13	36	9	
% Success	79%	87%	69%	56%	73%
<b>Residents:</b>					
Species Hunted (53)	12	21	12	8	
Species Harvested(35)	9	11	11	4	
% Success	75%	52%	92%	50%	66%

*Effects of the Fire* - Hunters were asked what their opinion was on how the fire has affected the deer in the Long Pines. Answers ranged from, "it has drastically reduced the number of whitetails" to "there are more deer, they have better habitat and bigger racks." Out of 69 opinions 46% thought it (the fire) had some type of negative effect, 41% thought it had some sort of positive effect and 13% thought it did not really have that much effect.

*Unique Recreational Values* - The quality of experience in the Long Pines was the most common response (33% of the responses) to "the single most important factor

attracting you to the Long Pines". Quality of experience was also the most common response (29% of non-resident responses) by non-residents followed by abundance of game (23%). Quality of experience, abundance of game, and proximity to home were the most popular responses by residents, 46, 19, and 15% respectively.

## DISCUSSION

Distribution and Range Use

White-tailed deer were numerically the most abundant big game species occurring in the study area. Sixty-four percent of the deer observations were white-tailed deer, while mule deer made up 36% of the observations. My observed number of white-tailed deer closely resembled the corrected "actual-use estimates" for those same areas. The "actual-use estimates" did increase the percentage of observations in the burn and open density ponderosa pine areas while those for agriculture and open grassland decreased. Some evidence (carcass, shed antler, and scat) of the occurrence of a small population of elk was observed.

*Winter* - Because 3 different strategies were employed by whitetails in this area, it was difficult to assess how many deer used the migration strategy and actually left the study area during the winter. However, deer that chose to stay within the study area used agricultural areas (agricultural use strategy), open density ponderosa pine and burn areas that bordered agricultural areas the most. Some deer did choose the energy-conservation strategy staying less active, minimizing movements and utilizing the habitat immediately surrounding them. These areas were located in moderate-density ponderosa pine areas that bordered burn areas.

These results were similar to those of Kamps (1969), who reported that whitetails heavily used grain fields during the winter in mountain foothill areas of central Montana,

and Selting (1994) who documented that whitetails preferred CRP lands over other land types in southeastern Montana.

In contrast to these results Pauley et al. (1993) reported that white-tailed deer used timbered areas with dense canopy coverage and low snow accumulation when the snow depths exceeded 40 cm. Also in contrast to these results, Dusek (1980), who studied whitetails in the Long Pines in the late 70's, reported that whitetails rarely moved from timbered sites. Dusek described these timbered sites as dense ponderosa pine-mesic shrub sites. Ozoga (1968), Moen (1968) and Dusek (1980) stated that white-tailed deer prefer relatively dense stands of conifers for wintering areas because such areas offer thermal cover reducing loss of body heat. It is true that such areas offer thermal cover; however, thermal cover can be obtained from different topographic features and the notion that overhead thermal cover is critical to whitetails is not true in this study area. Parker and Gillingham (1990) reported that the effects of vegetative structure on temperature, wind speed, and solar radiation benefited wintering mule deer using CRP lands. Nutritious forage along with the other previously mentioned benefits of CRP provide ideal wintering areas. The use of this type of habitat in winter is common in eastern Montana.

*Spring* - A major shift in habitat use was evident from winter to spring. Because mean February temperatures were below normal and precipitation for that same period was above normal, the changes in temperature for March (mean temperatures more than twice those for February) exaggerated the transition between winter and spring. As snow

dissipated in the uplands and vegetation began growth, deer began to shift their use from agricultural areas, which received their lowest yearly use during spring, to open density ponderosa pine, grassland, and burn areas. Open grassland type areas received their greatest yearly use during spring. Dusek (1980) reported similar findings, except for increased use of agricultural areas instead of decreased use.

*Summer* - Burned, agricultural, and grassland areas made up the majority of summer observations. However, it should be noted that many of the observations were made either during early morning, late evening times, and/or at night. If more observations had been made during the day, riparian and conifer use may have increased. That is not to say that burn areas were not being used for daytime bedding areas. Deer were also observed bedding in burned areas under downfall during the daytime.

Agricultural use, especially alfalfa, progressively increased in use throughout the summer. This was probably due to its remaining greener longer and the lack of available succulent herbaceous forage on adjacent upland areas. In addition to extended succulence, alfalfa has relatively high crude protein, low acid detergent fiber, and low neutral detergent fiber levels in late summer/early fall (R. Ditterline, unpubl. data cited in Selting 1994). This is beneficial to both bucks and does. The bucks are finishing antler development and the does have been lactating throughout the summer, and need to build up fat reserves for the coming winter. Dusek (1980) similarly reported increased use of riparian and ponderosa pine-mesic shrub sites from spring. He also reported that whitetail use of agricultural areas increased throughout the summer as mentioned

previously. Kamps (1969) also reported increased use of agricultural areas during late summer.

*Fall* - Burned areas received greater use than all other types during fall. Other areas that received substantial use during this season included moderate density ponderosa pine and the riparian type. As previously mentioned, use of burned areas by whitetails was partly due to the lack of hunting pressure some of those areas received. The security cover and the fact that all the whitetails needs can be met in a relatively small area make these areas desirable. For the hunter, the challenge of harvesting a deer in these areas in the future is going to continue to be more difficult. The hunter will have to contend with difficult and noisy walking conditions created by downfall, in addition to decreased visibility created by new ponderosa pine and aspen tree growth.

During fall use of agricultural areas decreased from summer. Dusek (1980) also reported a decrease in use of agricultural areas in the fall. Selting (1994) reported that whitetails in his study area selected alfalfa in the fall. The lack of observations in agricultural areas was probably due to the above normal precipitation which produced a fall green-up that provided an abundance of grass.

#### Food Habits

The different results given by the two methods (feeding site exams and fecal analysis) for food habits may have been due to biased sampling. Winter samples for fecal analysis were primarily collected from areas within the study area where animals were

exhibiting a situation similar to yarding. Thus, food habits for two of the three strategies used by whitetails to survive winter in this area were revealed as a result. The difference between the two methods for summer may have been just a result of random sampling or the lack of it. I have more confidence in the feeding site exams because I actually observed what was being consumed. Fecal analysis emphasizes items with indigestible components and underrepresents succulent materials. Yearlong use of browse, forbs and grasses as estimated by feeding site exams were almost identical to that reported by Dusek (1980) who used rumen analysis for the same area, with many of the same species being consumed.

*Winter* - Browse was used most heavily during winter. Fecal analysis results were similar to Dusek's (1980) rumen analysis results. Ponderosa pine and juniper spp. made up almost all of the browse consumed. Kamps (1969) and Martinka (1968) reported that elevated use of conifers by white-tailed deer was the result of deep snow making low-growing shrubs unavailable. Feeding-site examinations suggested that deer feed on agricultural types more than was indicated from fecal analysis. Winter food habits supported the conclusion that white-tailed deer in the Long Pines chose among 3 different strategies to survive the winter.

*Spring* - Forage use during early spring changed from use of agricultural types and conifers to Oregon grape and grasses. Even though browse received its lowest yearly use it still made up the greatest percentage of the whitetails diet according to fecal analysis. Forbs did receive greater use, especially in late spring, than was reported from

fecal analysis. Yellow sweetclover and fireweed were the two most commonly used forbs. Dusek (1980) reported similar results. Snow depths determined the change of forage use.

*Summer* - Whitetails increased their use of both browse and forbs from spring to summer, while decreasing their consumption of grasses. Again Dusek's (1980) results were similar to mine. Chokecherry and snowberry was the most popular browse species used and yellow sweetclover, fireweed, and western salsify was the most popular forb used at this time. Fecal analysis results reported buffaloberry made up the greatest percentage of browse. This was somewhat surprising because of its lack of use observed personally and in the literature. Agricultural types made up a greater percent of the diet as the summer progressed. Again this was probably due to the decrease in amount of succulent vegetation in the uplands as the summer progressed.

*Fall* - Browse use increased throughout the fall, with Oregon grape, snowberry, and chokecherry accounting for most of the use. Agricultural areas continued to be used but represented a much smaller percent of the observations. Dusek (1980) reported that snowberry and Oregon grape received the most use during this time; however he noted that chokecherry and wild plum did not receive much use at this time. He also reported similar use of agricultural areas.

Physical Attributes Of Individual Deer

Dressed weights from the 37 white-tailed deer examined in the Long Pines averaged 6% lower than Sime et al. (1994). I compared the weights of five white-tailed deer sampled in the Long Pines in the late 1970's (Dusek 1980) to the weights of deer I weighed and found that my results averaged 13% higher than Dusek's.

The majority of both the harvested deer and deer that died of natural causes during 1993-1995 were between the age of 0.5 to 4.5. Dusek's data were presented in a manner that was not statistically comparable to mine. Older age animals, during this study, died mainly as a result of harsh winter conditions. The nutritional stress brought on as a result of cold temperatures and deep snow generally affect bucks, the young, and old. My observations of white-tailed deer in eastern Montana support those of Long et al.(1959) and Geist and Bromley (1982, cited in Suttie and Kay 1982) in that bucks in poor condition also generally lose their antlers earlier than if they were in better condition.

Kroll (1992) suggests that once a doe exceeds 4.5 years her contribution to the herd production diminishes. He goes on to say that any positive genetic selection benefits are more quickly expressed in younger doe herds.

Average main beam lengths for whitetails averaged 5, 8, and 12% higher than those in northwestern Montana reported by Sime et al.(1994) for animals 2, 3 and 4+ years. Dusek (1980) only reported mean main beam lengths for yearling males.

### Causes of Mortality

The majority of mortality reported during this study was the result of EHD. EHD is a virus that affects both livestock and wildlife. Cattle (*Bos taurus*), mule deer, pronghorn (*Antilocapra americana*), and elk (*Cervus elaphus*), are usually considered long term carriers or reservoirs. Thus, the disease is perpetuated by them (Feldner and Smith 1981). The virus is transmitted by biting midges in the genus *Culicoides*. The midge obtains the virus by biting carriers and then transmits the disease by biting other animals, such as whitetails which are very susceptible to the disease. EHD characteristically occurs from August through October. The first severe frost of the fall kills most of the midges and abruptly ends the spread of the disease for the year.

Clinical signs in live white-tailed deer depend partly on virulence of the virus and duration of the infection. The symptoms change as the disease progresses in an infected animal. EHD is typically categorized into three forms; peracute, acute, and chronic. Peracute (rapid form) shows only severe fluid swelling (edema) of the head, neck, eyelids, tongue, and lungs. An animal living somewhat longer will show the "classic" signs of the acute form. In addition to edema in the previously mentioned locations, an animal will also have hemorrhages or congestion in the heart, rumen, abomasum, or intestines. Fever develops causing the animal to seek water to cool itself off. This is why infected animals, at least in eastern Montana, (especially white-tailed deer) are often found dead near sources of water. There may be ulcerations on the dental pad, tongue, palate, rumen, omasum, and abomasum. The chronic form is typified by growth interruptions on the

hooves and sometimes peeling of hoof walls. Other chronic signs are ulceration, scarring, and loss of papillae in the rumen. Not all of the above mentioned signs may be found in an individual animal. Other diseases also produce similar clinical and subclinical signs, but not in this area (SCWDS 1990). Whitetails in eastern Montana experienced a major epidemic during the late summer-early fall of 1995. The 123 whitetails from this study area closely represented the mean age composition reported for hunter harvested deer for 1994. The disease did not appear to be sex or age specific. The largest disparity occurred between the 5+ age groups. This can possibly be explained by the nature of these animals. Older bucks, in this area, at this time are more solitary and are more likely to be found in the uplands where they might not get as great exposure to *Culicoides*. However, it should be noted that not many of the known older age animals showed up dead. It was difficult to assess what percentage of the population was lost to EHD.

#### Hunter Use Of The Long Pines

The response rate of returned questionnaires was identical to that reported by Dusek (1980). The average number of hunters per party has increased to 4.8 from the 3.1 reported by Dusek. The majority of people responding to my questionnaires were nonresidents. As Dusek reported less than 1% of responding residents were from Carter County. While it is true that the majority of the hunters were from outside Carter County, residents failed to return their questionnaires. Almost 60% of responding nonresidents were from the upper midwest. Dusek (1980) reported similar results.

Data from questionnaires indicated that the greatest proportion of all hunters hunted the first two weeks of the season, which is exactly what Dusek (1980) reported. The overall success rate for both residents and nonresidents was 10% higher than that reported by Dusek (1980). As Dusek (1980) reported, the comparatively high levels of use by deer hunters and harvest of deer in the Long Pines, in addition to comparatively high rate of hunter success, demonstrated the high potential offered by the area for deer hunting.

### Conclusions

Since Dusek (1980) conducted his study in the Long Pines in the late seventies the composition of the whitetail's habitat has changed. The 1988 forest fire created a mosaic of unburned-burned pine forests (logged-unlogged), hardwood draws, and grasslands. Events such as wild fires, which are considered catastrophic, may be beneficial to whitetails. White-tailed deer appear to favor the early stages of forest growth, because these stages provide an abundance of nutritious browse. As the food habit data suggest the whitetails diet is primarily comprised of browse.

Even though the fire has changed the vegetational composition of the Long Pines there were many similarities between my results and Dusek's (1980). The major differences in range use was: I observed more use of open density ponderosa pine, burn, and agricultural areas verses the medium to dense density ponderosa pine that Dusek reported. Food habits were very similar. The only noticeable difference was the timing

of the use of agricultural areas. I reported whitetails using agricultural areas during winter and then dispersing to the forest once the snow began to dissipate. Dusek reported that deer dispersed to agricultural areas from the forest. Body weights and antler characteristics have also increased since Dusek's study. But hunter use and success has stayed virtually the same.

Even though the composition of the vegetation in the Long Pines has changed, whitetail use of the area has not changed that much. Use of areas with dense canopy coverage may have been emphasized by the harsh winter conditions during Dusek's (1980) study. Agricultural areas were important both in winter and late summer and may be of more importance to whitetails in this area than the unburned canopy coverage offered by the ponderosa pine.

Although the weather, composition of the habitat and even deer numbers has been quite variable since Dusek's (1980) study, the hunting opportunity has stayed the same. There are few large parcels of public land that allow the sportsmen the opportunity to hunt for both white-tailed deer and/or mule deer and have such a high success rate without having to worry about obtaining landowner permission. In addition, sportsmen looking to harvest trophy animals have a good chance of doing so. One of the key reasons why this population does so well is the harvest of the does. Aside from additional hunting opportunity, buck to doe ratios are close to one to one, the habitat is better protected from over-population, and there is less pressure exerted on the buck segment of the population.

### Recommendations

Because the Long Pines is a popular and important area to sportsmen, I have listed some recommendations that will continue to help both the white-tailed deer and the people who enjoy hunting them.

1) Since the population of white-tailed deer in the Long Pines has experienced a decline in numbers as a result of EHD, the public has suggested abolishing the harvesting of does. Even though this population has gone through various environmental changes from the time Dusek (1980) conducted his study till now there have been no apparent adverse effects of hunting. In 1987 the population in the Long Pines experienced a major epidemic of EHD that resulted in a reduction of whitetails. The following year a forest fire burned a good portion of their habitat suppressing the already low population. The one thing that remained constant for all of these years was the hunting opportunity. The harvesting of does has been beneficial for reasons previously mentioned. It is important that the harvest of whitetail does continues. Verme (1969) reported that if the habitat is capable of supporting a greater deer density that high productivity and more female births would result. Adult males often suffer disproportionately higher natural mortality than females of similar ages (Woolf and Harder 1979, Gavin et al. 1984). Thus, the harvesting of does will continue to provide hunting opportunity and will also help keep the sex ratio close to one to one.

2) Because of the importance of the agricultural areas that surround the national forest it would be in the best interest of the Montana Fish, Wildlife & Parks to develop partnerships with landowners through habitat enhancement programs to insure that such areas will continue to exist. CRP lands are also important areas for whitetails. Crested wheatgrass (*Agropyron desertorum*) is a common type of wheatgrass used in CRP lands. Urness et al. (1983) reported that crested wheatgrass has superior protein levels, compared to native browse, and tends to produce greater amounts of fall regrowth and earlier spring growth than native grasses. Incorporation of this wheatgrass into future plantings of CRP lands would be beneficial to deer.

3) Several landowners that border the National Forest have been very cooperative with the public allowing access to both the National Forest and their own deeded land. It is important that both the U.S.D.A. Forest Service and the Department of Fish, Wildlife and Parks develop or maintain a working relationship with these individuals. This relationship should include addressing their needs, such as supplementary help with fencing material for deer damage to haystacks, by periodic field visits and phone calls instead of them having to call when a problem arises. This should develop a stronger relationship between the landowner, sportsman, and Government agencies.

4) The results of Dusek's (1980) and this study suggested that whitetails in this area have fared well under the two different habitat conditions. This suggests that composition of the forest can vary substantially and that white-tailed deer can adapt. Because the fire burned large tracts of land it was important that the trees that burned were left to provide security and thermal cover. The fire has definitely improved the browse component of the Long Pines, and browse is an important part of the whitetails diet. Future fire management should include some type of burning. The time frame and type of fire management used depends on the goals of the different people and agencies involved.

5) My results demonstrated that this area continues to be an important area to sportsmen because the whitetail population offers; quality, quantity, hunting opportunity and access to a large piece of public land. Because of these unique qualities and the importance of them, the white-tailed deer should be incorporated into management decisions.

6) Road management for the future should include the consideration of closing some of the secondary roads at least during the fall hunting season. A considerable amount of hunting in the Long Pines is done from some type of vehicle. The downfall after the fire has closed many areas to vehicular use. This does not take away the opportunity for those wanting to hunt from a vehicle, but it

does provide an opportunity for someone wishing to walk and not worry about vehicles disturbing the animals or their experience.

7) All-terrain vehicles (ATVs) when used in the proper way<sup>2</sup> are useful tools.

Many hunters complained about ATV misuse. I observed ATV tracks in many areas not even remotely close to roads. ATV use may be limited to main roads except for a few hours early in the afternoon, during which time game retrieval would be allowed. Currently too many individuals are abusing ATV use.

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