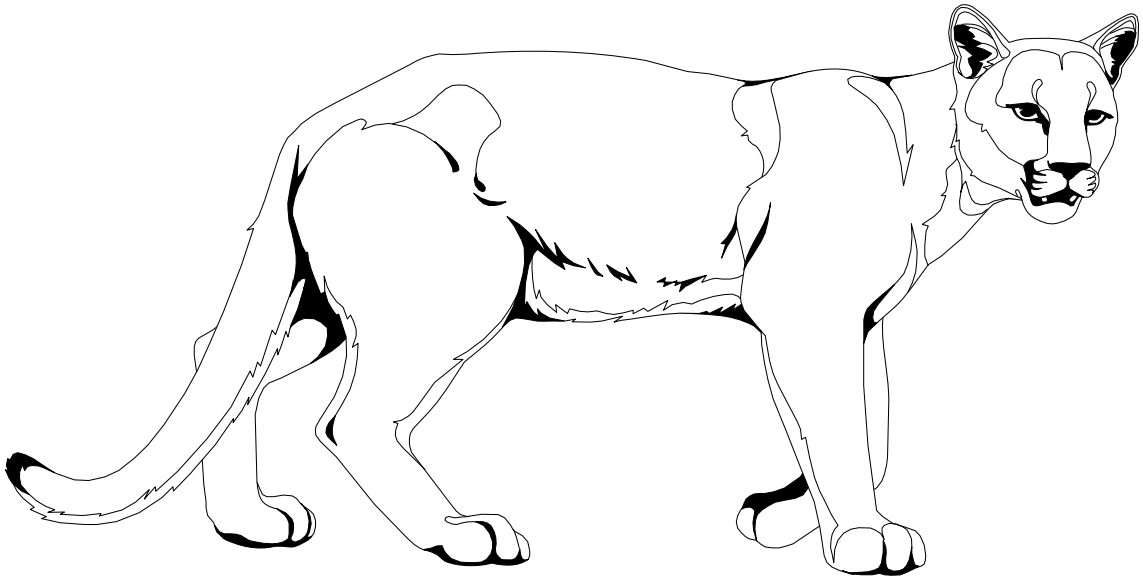
2006 OREGON
COUGAR MANAGEMENT PLAN



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EXECUTIVE SUMMARY

The 2006 Oregon Cougar Management Plan updates the 1993-1998 Oregon Cougar Management Plan. This update will guide Oregon's cougar management, and provides strategies for resolution of human conflicts with cougars.

This plan revision process was initiated in March 2005 with selection of an internal plan revision committee. The committee consisted of ODFW biologists who had experience with cougar management in Oregon and included 5 district biologists, 2 research biologists and 2 headquarters staff biologists. The plan was developed using an open, public process that included an external peer review, two focus group meetings, eight public meetings around the state, and a three-month public comment period.

The plan includes chapters on cougar biology; Oregon cougar data; a historical perspective of cougar management in Oregon; a discussion of livestock, human/pet, and game mammal conflicts associated with cougars; and cougar management goals incorporated into an adaptive management approach for the future.

This plan establishes five objectives that seek to maintain viable, healthy cougar populations in Oregon, reduces conflicts with cougars, and manages cougars in a manner compatible with other game mammal species.

Objective 1 seeks to manage the state's cougar population at a level well above that required for long term sustainability. Achieving and monitoring this objective is complicated. The challenge is to meet the objective without having perpetual research projects in every Cougar Management Zone in the state which is impractical and cost prohibitive. Because the minimum population objective is well above the level of sustainability, and because of the demonstrated resilience of cougar populations (Cougar Management Guidelines, 2005, page 40), exact counts of cougars are not necessary to achieve Objective 1. To accomplish this objective, several strategies recommended in the Cougar Management Guidelines (2005) have been employed. Zone management with mortality quotas will be used to insure harvest does not reduce the population below objective levels. Harvest will occur at three levels of intensity to allow for maintenance of source and sink populations (Cougar Management Guidelines, 2005, page 73-75). Two indicators of cougar abundance will be used. A deterministic, density dependent population model, which utilizes data collected from all cougar mortalities in Oregon, will be used for predicting outcomes on a short-term basis in an adaptive management approach (Cougar Management Guidelines, 2005, page 58). Proportion of adult females in the harvest will also be used to monitor cougar population trajectory (Cougar Management Guidelines, 2005, page 77). In addition, more specific data may be collected in more intensive, smaller scale research studies (Cougar Management Guidelines, 2005, page 77) as well as developing alternative population models that could incorporate stochastic variability for each zone.

Objectives 2 – 4 address solving conflict. The primary strategy to solve conflict since 1995 has been to give advice and, when necessary, remove the problem animal. While solving some problems, this strategy has generally not been effective. Conflict has increased as cougars have expanded into previously unoccupied habitats of human habitation. Human population increases in some parts of the state have exacerbated the problem. Steps necessary to achieve these objectives are straight forward and do not depend on cougar population estimates. In

addition to advice and removal of specific cougars, specific areas with elevated conflict may also be targeted to reduce conflict by reducing cougar numbers. These targeted areas are intended to create a buffer of low cougar density, thereby reducing conflict.

Objective 5 seeks to achieve established management objectives for other game mammal species. Only those Wildlife Management Units (WMU's) where elk or deer populations are below established management objectives, have shown a history of decline and lack of ability to sustain themselves, and where evidence indicates cougar predation is a primary factor may be targeted for cougar population reduction. For bighorn sheep, areas around specific herds will be targeted when evidence indicates cougar predation is a primary factor. At this time, of 66 WMU's in Oregon, 5 WMU's for elk, 14 WMU's for mule deer, and 5 herds of bighorn sheep meet criteria for reduction in cougar numbers.

All management activities will be carried out in an adaptive management approach, as suggested in the Cougar Management Guidelines (2005, pages 74 and 81), which allows for monitoring, evaluation, and changes in management based on results. Those strategies that are not successful at meeting stated objectives would be modified or discontinued. Numerous indicators will be used to monitor success. Total mortality, hunter harvest success rates, and biological data will continue to be collected. These data will contribute to population modeling for each Cougar Management Zone. Cougar-human conflict will continue to be monitored using non-hunting mortalities and complaints concerning human safety, pets, and livestock. herd composition and population status of deer, elk, bighorn sheep, and other game mammals. Research projects will collect information on movements, density, predation rates, and will be able to better detect other factors such as disease.

Legal status, management, and population levels of Oregon cougars have undergone significant changes since the mid-1800's. Cougars may have been extirpated by 1970 had they not been placed under ODFW's management jurisdiction as a game mammal in 1967. Since 1967, management has varied from closed seasons (no public hunting), to controlled hunting with dogs allowed during specific times and areas, to a harvest quota system with unlimited tag availability for areas open nearly year-round with hunting dogs not allowed. Cougar populations have responded to these management changes. Cougars have expanded their range into all available Oregon habitats, and populations have increased from an estimated 214 in 1961 to 3,114 in 1994. The 2003 statewide cougar population was estimated to be 5,101. Correspondingly, conflict has increased from 36 complaints in 1986 to 697 in 2003. In 1995, ODFW established six cougar management zones to administer hunting seasons.

ODFW's mission is to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations. Cougar management is complicated by the dichotomy of sentiment toward cougars among Oregon residents. This plan presents ODFW's strategy to meet its mission and incorporate public attitudes and desires. It is a plan that will be updated and rewritten as agency policies, new biological data, and human and/or cougar populations change.

Estimating cougar numbers and population responses to management actions is not an exact science, especially with limited research that allows for predictable outcomes. In developing this plan, ODFW used >20 years of biological data from Oregon cougars and rarely used population parameter estimates based on literature. Although values presented in the plan appear deterministic, and are presented without variability estimates, annual variation is included

via the 20-plus years of data collection. ODFW does not assert that data and associated analyses are absolute. Rather, information presented in the plan represents a logical, scientific-based evaluation of the present status of cougars in Oregon based in all relevant data available.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PURPOSE OF THE PLAN

The mission of Oregon Department of Fish and Wildlife (ODFW) is to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations. This plan was developed to provide ODFW guidance for managing Oregon's cougar populations and to accomplish the department's mission and statutory requirements.

Oregon Department of Fish and Wildlife first developed a plan for cougar management in 1987 (Oregon Department of Fish and Wildlife 1987) and updated that plan in 1993 (Oregon Department of Fish and Wildlife 1993). However, since adopting the 1993 plan, there have been significant changes in cougar hunting regulations, Oregon's cougar population, and the scientific knowledge available for cougar management. The purpose of this plan is to update the 1993 plan using current knowledge, population estimates, and results of recent Oregon research to guide future cougar management in Oregon.

ODFW has the complex task of balancing public demands for the appropriate management of cougar populations. In particular, sustaining cougar populations and managing cougar impacts to human safety, livestock, and other game mammal populations are paramount considerations for ODFW. ODFW will focus efforts to:

1) Recognize the cougar as an important part of Oregon's wild fauna, valued by Oregonians;
2) Maintain sustainable cougar populations within the state; and
3) Conduct a management program that: (a) meets statutory obligations, (b) minimizes negative interactions between humans and cougars, (c) manages cougars consistent with other game mammals, and (d) incorporates the desires of the public.

CHAPTER I: INTRODUCTION

The largest member of the cat family in Oregon, the cougar is known by many names: panther, puma, catamount, and mountain lion. Historically, the cougar had one of the most extensive distributions of any North American wildlife species (Nowak 1999b).

Although many Oregonians may never see a cougar, they find satisfaction in the knowledge that cougars still remain in Oregon and that their existence is not threatened. The public entrusts Oregon Department of Fish and Wildlife (ODFW) with management responsibility for cougars and depends on ODFW to provide for the animal's continued existence into the future. ODFW recognizes the cougar as a valuable part of Oregon's native fauna. An integral part of a complex biological system, the presence of cougars is an indicator of Oregon's ecological health.

Two important considerations in cougar management are biological carrying capacity and social tolerance levels. Biological carrying capacity is defined as the maximum number of individuals a given unit of habitat can support over time. Cougar carrying capacity is dependent on prey abundance. Some Oregonians would like to have cougar populations managed at biological carrying capacity. Other Oregonians want cougar populations reduced. Social tolerance levels require ODFW to consider biological and social considerations when establishing population objectives for any wildlife species. Because of the social constraints resulting from wildlife impacts to private or public land management, population objectives are not normally set at biological carrying capacity. Wildlife management in Oregon has always considered wildlife-human conflicts. A key objective in Oregon's cougar management strategy involves minimizing conflict between humans and cougars. ODFW is obligated to manage the state's wildlife (Oregon Revised Statute (ORS) 496.012), and respond to situations where wildlife poses a threat to human safety or inflict property damage (ORS 498.012, ORS 498.164).

One challenge facing wildlife managers involves factoring the human dimension into wildlife management strategies. From 1990 - 2003, Oregon's population grew 24.4 percent (U.S. Census Bureau 2005). Statewide cougar populations also have increased during that period to a 2003 estimated population of 5,101 (Oregon Department of Fish and Wildlife unpublished data). Increased human development, combined with increasing cougar populations, have led to a continual increase in conflict in rural, suburban, and urban settings.

A 2002 survey of 360 Oregon residents from six southwest Oregon counties (Jackson, Douglas, Curry, Coos, Josephine, and Klamath) identified a clear dichotomy in public opinions about cougars (Chinitz 2002). Oregonians support a robust cougar population and nearly 64% of respondents said they believe occasional contact with cougars should be accepted as part of living in the Pacific Northwest. However, nearly 75% of the same respondents strongly agreed with the statement, "No matter what the government says, I should have a right to kill a cougar that I think is a threat to people." Most survey respondents (who were almost evenly split between rural and small-city residents) expressed the belief that cougars are a sign of a healthy environment, and would be excited to see a cougar in the wild. However, a high proportion of the same respondents reported that they would feel a threat to their personal safety, and would want the animal killed if it appeared in their neighborhoods.

A similar survey of Washington residents found 84% supported predator reduction to address human safety (Duda et. al. 2002). Roughly 70% of urban Colorado residents in a 1996

study said they believe "…authorities should take steps to control the number of mountain lions coming into residential areas along the Front Range" (Zinn and Manfredo 1996).

In the 1990s, Oregon residents stated their desire to see cougar hunting managed similar to other game mammal species (deer, elk, pronghorn, bighorn sheep, mountain goat, and bear). A 1994 ballot measure (Measure 18) eliminated the public use of dogs for cougar hunting even though hunting with dogs is generally considered the most effective and selective method. However, Measure 18 specifically maintained provisions that allow employees of county, state, and federal agencies to use dogs while acting in their official capacities. Another ballot initiative in 1996 that failed, Measure 34, also would have affected cougar management. One aspect of Measure 34 would have repealed Measure 18 and re-instituted the use of dogs for public cougar hunting.

The cougar management challenge facing Oregon wildlife managers is two-fold: (1) to continue managing and studying cougars in a way that contributes comprehensive data usable in an adaptive resource management model, and (2) to work continually on programs to better educate Oregonians about cougars. Oregonians, through participation in ballot measures and through ongoing interactions with ODFW, have shown a clear desire to be involved in cougar management. ODFW's ability to effectively manage cougars is underpinned by an obligation to develop an informed, educated citizenry to help craft management decisions.

Until 1967, cougars were legally classified as a predator in Oregon and were therefore unprotected. Seen as a threat to the livestock industry, cougars were often killed through bounty programs (Table 1). The estimated statewide cougar population was approximately 200 animals in 1960 (W. Aney, 1973, letter on file at ODFW, Salem). Some speculate cougars might have been extirpated from the state by 1970 without receiving game mammal status and subsequent protection by the then Oregon State Game Commission in 1967 (W.W. Aney, 1973, letter on file at ODFW, Salem).

Cougars are very difficult to observe and count due to their secretive nature and characteristic low population density, which leads many people to believe they are few in number. Thus, some Oregonians recommend increased efforts to protect cougars. Current estimates, based on population modeling and field research, indicate 5,101 cougars inhabited Oregon in 2003. Trends in non-hunting mortalities and complaints also suggest cougar populations have increased and expanded its range.

A number of laws affect cougar management (Appendix D) and provide ODFW direction on which to base current management goals. ORS 496.004 classifies the cougar as a game mammal and gives ODFW management responsibility. ORS 496.012, the Wildlife Policy, directs ODFW to manage wildlife

Table 1. Number of cougars bountied annually in Oregon, 1928-1961.

Year	# Bountied
1928	254
1929	288
1930	337
1931	243
1932	295
1933	177
1934	139
1935	149
1936	167
1937	163
1938	187
1939	194
1940	222
1941	166
1942	101
1943	77
1944	98
1945	123
1946	130
1947	145
1948	187
1949	201
1950	177
1951	143
1952	154
1953	123
1954	148
1955	116
1956	80
1957	103
1958	56
1959	48
1960	36
1961	27

"...to provide the optimum recreational and aesthetic benefits for present and future generations of the citizens of this state...." ORS 498.012, the Wildlife Damage Statute, allows a landowner or lawful occupant of the land to take any cougar that is causing damage, is a public health risk, or is a nuisance without first obtaining a permit from ODFW. Hunting seasons for and removal of specific animals in conflict with humans are ways ODFW meets its statutory obligation to maintain cougar populations, address public safety and livestock damage, and provide recreational opportunities.

Oregon's first cougar management plan was adopted in 1987 to guide cougar management through 1992. An updated cougar management plan was adopted in 1993. This 2006 update discusses the current status, management goals, and objectives for cougar through 2011. This revision also addresses newly identified concerns since the 1993 plan. Where applicable, management strategies have been developed to address the new concerns.

Revision of this plan was initiated in March 2005 with selection of an internal plan revision committee. The committee consisted of ODFW biologists who had experience with cougar management in Oregon and included 5 district biologists, 2 research biologists and 2 headquarters staff biologists. The committee developed an initial draft that was sent in July 2005 to a Scientific Review Panel for review and comment. The committee incorporated comments from the Scientific Review Panel into another plan revision that was presented to a Cougar Plan Focus Group on August 12, 2005. The Focus Group consisted of representatives of environmental, hunting, non-hunting, livestock, tribal, and land management interests who were invited to comment on the draft plan. At the same time, the plan was released for public comment. A total of 1,182 written and/or email communications with 2,266 comments were received from the public through 20 November 2005. Additional comments are expected through the final Commission hearing in early 2006.

During August and September 2005, eight public meetings were held throughout Oregon to gather additional public input (Corvallis, Portland, La Grande, Burns, Bend, Medford, Roseburg, and Klamath Falls). A total of 346 persons attended those meetings and a total of 351 comments were recorded.

The internal committee met again with the Focus Group on September 28, 2005 and took additional input and comments. Some comments and suggestions received from the focus group were incorporated into subsequent revisions of the plan. This Commission Review Draft incorporates or addresses all public comments received, as long as such input was consistent with ODFW's statutory requirements. A second peer review was requested on February 10, 2006 (Appendix K). Comments will be addressed as appropriate.

CHAPTER II: LIFE HISTORY OF COUGARS

Taxonomy

Although archeological records are obscure, the cougar likely evolved as a distinct species 390,000 years ago (Culver et al. 2000). However, recent molecular genetic analyses suggest few discernable subspecies differences among extant North American populations. Culver et al. (2000) suggest cougars likely went extinct in North America during the late Pleistocene Era 10,000–12,000 years ago. They further suggest extant populations in North America are likely the result of natural re-colonization from surviving animals in Central and South America (Culver et al. 2000). Sinclair et al. (2001) and Anderson et al. (2004) support this view with studies suggesting gene flow occurs across extremely wide geographic areas with few barriers to genetic interchange among populations. Cougar dispersal characteristics, especially for males, are sufficient to maintain high gene flow rates, even across interstate highway corridors (Sinclair et al. 2001) and large expanses of inhospitable habitat (Anderson et al. 2004). However, large urban areas may represent a barrier to gene flow among populations (Ernest et al. 2003, Sinclair et al. 2001).

Historically, cougars had the broadest distribution of any mammal in the Western Hemisphere with a range that included most of North America, all of Central America, and most of South America (Nowak 1999b) with as many as 32 recognized subspecies (Culver et al. 2000). Twelve to 15 subspecies have been recognized as occurring in North America (Young and Goldman 1946, Verts and Carroway 1998, Culver et al. 2000, Logan and Sweanor 2000). According to Verts and Carroway (1998), 3 of the 15 subspecies occur in Oregon. Regardless of the potential for different subspecies, due to extensive habitat connectivity ODFW will not manage at the subspecies level.

In Oregon's early history, cougars were characterized as abundant or common throughout most of the forested parts of the state (Bailey 1936). Journals also report that cougars were present in the mountainous portions of southeast Oregon such as Steens Mountain (Bailey 1936), although they likely occurred at much lower densities. Settlement, and burgeoning timber and agricultural industries created conflicts between human interests and cougars. As a result, bounties were placed on cougars as early as 1843 with an annual bounty for 200 or more cougars not uncommon (Table 1). Bounties and unregulated take caused cougar numbers to decline markedly from historic levels by the 1930s, and continued to decrease through the late 1960s. Only 27 cougars were bountied in the final bounty year (1961).

Cougars are currently distributed throughout the state of Oregon (Figure 1). However, their density varies considerably across the landscape, even within geographic areas of relatively similar habitat. Variability in population density likely reflects the local distribution of their primary prey (Pierce et al. 2000a), but also may be affected by a land tenure system dictated by social hierarchies within cougar populations (Seidensticker et al. 1973).

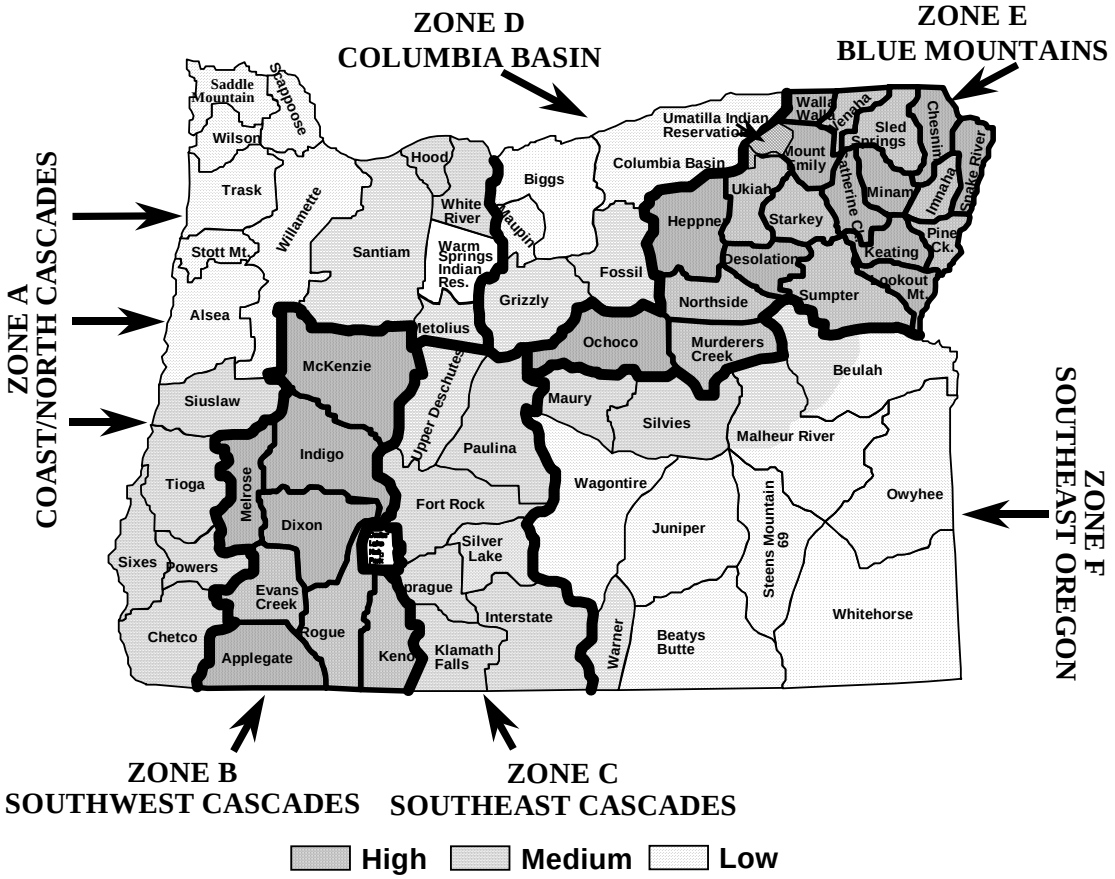

Figure 1. Current distribution and relative density of cougars in Oregon by Wildlife Management Unit and Harvest Quota Zone.

Reproduction and Productivity

Factors affecting cougar productivity (number of kittens born each year) include age at first breeding, birth interval, litter size, sex ratio, and longevity. Seidensticker et al. (1973) believed young females usually breed only after establishing a home range. Females have been documented as breeding for the first time at 22 to 29 months of age (Eaton and Velander 1977,

Rabb 1959, Ashman et al. 1983). Eaton and Velander (1977) stated it was "...probably safe to assume that wild puma in good health are sexually mature by 24 months of age, and if a female were territorially established she would normally give birth by the age of 36 months." Based on 435 female cougars examined by ODFW from 1995 – 2003, 5% of age class 1, 51% of age class 2, 95% of age class 3, 88% of age class 4, 89% of age class 5, 96% of age class 6, and 100% of all females age 7 and older had successfully reproduced (Oregon Department of Fish and Wildlife, unpublished data).

After first breeding, females normally breed soon after loss of kittens or dispersal of their litter (Lindzey 1987) causing birth intervals to vary. Birth intervals have been documented as short as 12 months (Hornocker 1970, Lindzey et al. 1994) and as long as 24 months (Robinette et

al. 1961). Birth intervals measured by other researchers were 17.4 months (Ashman et al. 1983), 18 – 24 months (Lindzey 1987), and 19.9 months (Anderson et al. 1992).

Female cougars may have one to six kittens per litter, but average two to three kittens per litter (Eaton and Velander 1977, Ashman et al. 1983, Logan et al. 1986). Based on 41 pregnant females examined from 1995 – 2003, mean litter size for Oregon was 2.8 kittens per litter (Oregon Department of Fish and Wildlife, unpublished data). This value was consistent with 2.9 kittens/litter based on placental scars (N = 200) and 2.8 kittens/litter based on corpora lutea (N = 79). Sex ratio of kittens at birth is normally equal (Johnson and Couch 1954, Logan et al. 1986, Tanner 1975). A wide range of longevity values has been reported. During 1987 – 1992, a total of 1,111 cougars were aged in Oregon. Of those, 1,089 (98%) were ≤12 years old and 22 (2%) cougars were between 12 - 17 years of age (Trainer et al. 1993). Cougars have a relatively high reproductive potential, and they can quickly replace individuals lost from the population.

Movement, Dispersal, and Home Range

Cougars generally move at night with most movements beginning near dusk (Beier et al. 1995, Logan and Sweanor 2000). Within a population, males make greater daily movements. The longer daily movements of males compared to females result from nightly patrols to defend territories and search for receptive mates (Logan and Sweanor 2000). Males spend as much as 71% of the time traveling (Beier et al. 1995). Conversely, female movement patterns are governed by tasks associated with raising young. Females with nursing kittens typically move in a circuitous path up to about 3 km (1.9 mile) and return daily to care for kittens. As kittens mature and energy requirements increase, the female's movements increase in length as the need to feed growing kittens increases. Within both sexes, the distance moved also is dictated by activity (Beier et al. 1995). Nightly movements show a pronounced peak around dusk for cougars with a kill to feed on compared to cougars without a kill (Beier et al. 1995). In addition, females with kittens tend to arrive at feeding sites earlier than other social groups (Pierce et al. 1998). For cougars without a kill, movement periods were generally longer in duration and distance traveled. There does not appear to be any consistent movement direction relative to topography (Anderson 2003).

Dispersal is an important adaptive mechanism for cougars for several reasons: it helps local populations avoid extreme inbreeding, enhances outbreeding, minimizes potential competition for food and mates, increases the likelihood of recolonizing unoccupied habitats, and minimizes the risk of extinction in isolated populations (Logan and Sweanor 2000). Cougar offspring become independent of the female between 9–21 months of age (Beier 1995, Logan et al. 1996, Logan and Sweanor 2000, Sweanor et al. 2000) with littermates usually independent within 0–1.5 months of each other (Logan et al. 1996).

Male offspring typically disperse at higher rates than females (Logan and Sweanor 2000, Sweanor et al. 2000) and disperse farther than females with reported mean dispersal distances of 2.2–76.6 km (1.36–47.6 mi) for females and 19.0–139.8 km (11.8-86.87 mi) for males (Beier 1995, Logan and Sweanor 2000, Sweanor et al. 2000). Dispersal direction appears random and large expanses of unsuitable habitat can be crossed (Logan and Sweanor 2000). However, favorable habitats are used to link dispersal movements (Logan and Sweanor 2000) and established habitat corridors may be important for isolated populations (Beier 1995). As a result of these dispersal patterns, most males recruited into a population are immigrants, and

immigration may constitute as much as 50% of the recruitment into a population (Logan and Sweanor 2000).

Data from the southern Cascade Mountains of Oregon (Oregon Department of Fish and Wildlife, unpublished data) documented dispersal movements of 29 radio-collared cougars and found the mean movement distance from the natal home range center to the farthest documented location was greater for males (82 km [51 mi]) than females (36 km [22 mi]). Dispersal direction was random. Twenty-six dispersing young survived to establish an independent home range (IHR). Dispersing females required an average of 55 days to establish an IHR compared to 103 days for males. All males that established an IHR were not adjacent to the natal home range while 78% of the female IHRs were adjacent to or overlapped natal home ranges.

Female offspring are more likely than males to establish home ranges near to or slightly overlapping their natal home ranges (Logan et al. 1996, Logan and Sweanor 2000, Sweanor et al. 2000). This may enhance the female's reproductive success due to increased familiarity with the habitats and prey resources available in the area (Logan and Sweanor 2000). Males establishing a home range within their natal home range has only been observed in Florida where available habitat has been severely restricted by human development (Logan and Sweanor 2000). Males generally establish larger home ranges than females and male territories typically overlap those of one or more females. Reported average adult male cougar home ranges vary between 126 – 826 km^2 (48.6-318.9 mi^2) compared to adult female average home ranges of 29 – 685 km^2 (11.2-264.5 mi^2) (Anderson et al. 1992, Logan and Sweanor 2000). Home ranges for cougars in Oregon are within reported ranges. In northeast Oregon, cougar home ranges varied between 39 - 175 km^2 (15 - 68 mi^2, n = 17) for females and 167 - 436 km^2 (64 – 168 mi^2, n = 8) for males (80% kernel home range estimates, Oregon Department of Fish and Wildlife, unpublished data).

Variability in home range size between and within sexes is likely a function of social and reproductive status, habitat quantity and quality, and cougar population density (Logan and Sweanor 2000). Females with nursing young typically have smaller home ranges than females with older young or lone females. Dominant males may have larger home ranges encompassing more females than sub-dominant males. Arrangement of home ranges is governed by the cougar's mating system, energy requirements, and habitat quality (Logan and Sweanor 2000). For females, home range size appears to be based on prey availability for raising young. Male home ranges may be driven primarily by social status and the presence and status of neighboring males. Adult males on established territories generally do not tolerate other males within their home range, which affects dispersal opportunities. Female home ranges appear more stable in size and location than male home ranges. Further, the number and distribution of primary prey can influence the number, size, and distribution of cougar home ranges within an area (Logan and Sweanor 2000, Pierce et al. 2000a). Areas with high prey densities generally have more cougars with smaller home ranges than comparable areas with fewer total prey available. In areas where primary prey are migratory in nature, cougar populations also may exhibit seasonal migrations in association with their prey (Pierce et al. 1999).

Density

Cougar density is influenced by a combination of prey distribution and availability (Pierce et al. 2000a) and tolerance for other cougars (Seidensticker et al. 1973). Generally, prey availability is related to quantity and quality of available habitat for the species. As a result of

cougars' territoriality and dependence on prey availability, cougars typically do not reach density levels observed in many other wildlife species.

A variety of techniques have been used to estimate cougar densities throughout their range. The most rigorous methods rely on intensive radio telemetry and capture-recapture (Logan and Sweanor 2000). Further, how density has been reported has varied considerably, ranging from simple calculations using all ages of cougars for an area to reporting only resident adults contributing to the population. Reported cougar densities are highly variable across their range (Table 2).

In Oregon, preliminary study results indicate densities of 3.9/100 km^2 (10.0/100 mi^2) in the Catherine Creek Unit of the Blue Mountains (Mark G. Henjum, 1995, Oregon Department of Fish and Wildlife, personal communication). Yearling and adult cougar densities were estimated between 3.1 – 6.2/100 km^2 (8 - 16 animals/100 mi^2) in the Wenaha and Sled Springs study sites in NE Oregon (Elk Nutrition Predation Study in NE Oregon, unpublished data, Oregon Department of Fish and Wildlife, La Grande). In the Jackson Creek study area of the south Cascades, cougar density (all ages) changed from 5.4/100 km^2 (13.9/100 mi^2) in 1999 to 2.7/100 km^2 (7/100 mi^2) in 2001 (Oregon Department of Fish and Wildlife, unpublished data). Recent research on a different study area near the Jackson Creek study (SW Oregon Study 2005) initially estimated cougar density at 4.3 adults/100 km^2 (11 adults/100 mi^2, Oregon Department of Fish and Wildlife, unpublished data).

Table 2. Cougar density (#/100 mi^2, #/100 km^2) as reported throughout the species western geographic range.

	Density (#/100 mi^2)		Density (#/100 km^2)		
State or Province	Resident Adults	Total Cougars	Resident Adults	Total Cougars	Citation
Alberta, Canada	3.9 -5.7	7 – 12.2	1.5 – 2.2	2.7 – 4.7	Ross and Jalkotzy 1992
British Columbia, Canada	2.3 -2.8	9 – 9.6	0.9 – 1.1	3.5 – 3.7	Spreadbury 1996
California, USA		23.8		9.2	Sitton 1972
California, USA		13.5		5.2	Neal et al. 1987
California, USA		8.5 – 10		3.3 –3.9	Hopkins 1989
Catherine Creek, OR		10		3.9	Henjum 1995 per. comm.
Colorado, USA		2.8		1.1	Anderson et al. 1992
Idaho, USA	2.6 – 4.4	4.4 – 9.1	1.0 – 1.7	1.7 – 3.5	Seidensticker et al. 1973
Nevada, USA		2.6 – 4.1		1.0 – 1.6	Ashman et al. 1983
New Mexico, USA	2.1 – 5.4	4.4 – 11	0.8 – 2.1	1.7 – 4.3	Logan et al. 1996
Jackson Creek, OR 1999	7	13.9	2.7	5.4	ODFW unpublished data
Jackson Creek, OR 2001	4.4	7	1.7	2.7	ODFW unpublished data
NE OR 2005[a]	8 – 16.1		3.1 – 6.2		ODFW unpublished data
SW OR 2005 [a]	11.1		4.3		ODFW unpublished data
Texas, USA		17.3		6.7	Parsons 1976
Utah, USA	.8 – 1.6	1.6 – 3.6	0.3 – 0.6	0.6 – 1.4	Lindzey et al. 1994
Washington, USA	1 – 1.8	2.3 – 3.9	0.4 – 0.7	0.9 – 1.5	Lambert et al. 2005
Wyoming, USA	3.6 – 3.9	9.1 – 12	1.4 – 1.5	3.5 – 4.6	Logan et al. 1986
Wyoming, USA	6.2 – 8.8		2.4 – 3.4		Anderson and Lindzey 2005

[a] Preliminary data.

Food Habits

Throughout the western United States, deer and elk are the staple food of cougars. Numerous studies have found deer to be the primary food item of cougars even when other ungulate species (e.g. elk, bighorn sheep, or pronghorn) were present (Ackerman et al. 1984, Anderson 1983, Robinette et al. 1959, Ackerman et al. 1984, Cashman et al. 1992, Beier and Barrett 1993, Logan et al. 1996). However, in many of these studies, ungulates other than deer were not available in significant numbers. Although a variety of other species including small mammals and birds may be used, cougars do not persist in areas without ungulate prey.

Cougars in northeastern Oregon consumed (in order of decreasing frequency): mule deer, Rocky Mountain elk, porcupine, snowshoe hare, and deer mice (Maser and Rohweder 1983). Winter foods for cougars in Oregon's Cascade Range were principally black-tailed deer and porcupine (Toweill and Maser 1985). Another Oregon study indicated deer, elk, and porcupine were the most common winter food items (Toweill and Meslow 1977). In some cases there is a difference in prey selection based on sex, age, and reproductive status of cougars (Anderson and Lindzey 2003). In northeastern Oregon, Nowak (1999a) found adult females killed more mule deer (65%) than elk (35%) and tended to select mule deer fawns, older adult mule deer females, and calf elk over other sex and age classes of available prey. Pierce et al. (2000b) also concluded that age and sex of prey was more important in cougar prey selection process than was body condition of the prey. The number of prey consumed by an individual cougar varies with a number of factors which include the cougar's sex, age, size, and reproductive status, as well as weather conditions (kills spoil more rapidly in warm temperatures), competition with other predators (e.g. black bear), and scavenging by other species (birds, coyotes; Iriarte et al. 1990).

In some cases, cougar predation can have a significant impact on specific prey populations. For example, Sweitzer et al. (1997) determined cougar predation caused near-extinction of a porcupine population in northwestern Nevada. In another study, Turner et al. (1992) concluded that cougar predation limited growth of a feral horse population on the California-Nevada border. Wehausen (1996) reported several instances where cougar predation on bighorn sheep populations reduced population growth rates and stopped the opportunity to remove surplus bighorn sheep for relocation to historic habitat. Therefore, a bighorn sheep restoration program was effectively halted. Kamler et al. (2002) suggested cougar predation was responsible for the decline in bighorn sheep populations in most areas of Arizona; these declines were most likely linked to overall declines in mule deer populations which resulted in cougar taking bighorn sheep as alternate prey. Rominger et al. (2004) similarly reported that cougars limited expansion of a transplanted population of bighorn sheep in New Mexico. Hayes et al. (2000) proposed that cougar predation on bighorn sheep may be impeding recovery of a federally listed endangered bighorn sheep population in the Pennisular Ranges of California. In California, cougar predation was found to be the primary cause of a significant decline in mule deer in the Sierra Nevada Mountains, taking both adult and fawn deer (Harrison 1989).

The health of a cougar population is integrally linked to health of its prey base. High cougar predation rates, especially on prey populations with few individuals, can reduce the size and sustainability of prey populations. Likewise, when severe winter conditions or large scale habitat loss severely reduces local prey populations, cougars dependent on those prey may further depress or prevent prey population recovery (Neal et al. 1987). Unfortunately, when this situation manifests itself, cougar populations will also decline (Kamler et al. 2002) or be forced to turn to alternate prey which frequently are other ungulates or domestic livestock.

Interactions with Ungulates

Cougars are obligate carnivores and long-term population persistence is linked directly to ungulate distribution and abundance (Cougar Management Guidelines Working Group 2005). In Oregon, elk and deer are the primary prey for cougars (Toweill and Meslow 1977, Maser and Rohweder 1983, Toweill and Maser 1985, Nowak 1999a). For many years, it was believed cougar population density was based on territoriality where competition among cougars maintained stable populations (Seidensticker et al. 1973). However, in recent years, the land tenure system has been discounted in favor of cougar densities being regulated by prey availability (Pierce et al. 2000a, Logan and Sweanor 2001).

Cougar predation rates on ungulates have been studied by snow tracking (Connolly 1949 [in Anderson and Lindzey 2003], Hornocker 1970), intensive radiotelemetry monitoring (Harrison 1990, Beier et al. 1995, Murphy 1998, Nowak 1999a), and use of GPS collars to locate kill sites and determine ungulate kill frequency (Anderson and Lindzey 2003). From these studies, cougars killed 1 ungulate every 7 to 8 days but predation rates and prey varied by weather conditions, cougar gender, and reproductive status of females. If the kill was scavenged or spoiled due to warm temperatures, cougars killed more often than during cold weather or in the absence of scavengers. Females with young kill more often than an individual cougar. Anderson and Lindzey (2003) estimated cougar kill rates for large mammals of 7.3 days/kill for subadult females, 7.0 days/kill for adult females, 5.4 days/ kill for females with young, 9.5 days/kill for subadult males, and 7.8 days/kill for adult males. Nowak (1999a) found adult females in northeast Oregon killed an average of every 7.7 days with a shorter time-frame in summer-fall (5.6 days/kill) than in winter-spring (9.8 days/kill). Where both elk and mule deer were present, female cougars tended to kill mule deer, whereas male cougars did not select for any age or sex class of deer and tended to kill elk more frequently (Anderson and Lindzey 2003).

The common perception that cougars select only injured or sick animals is incorrect. In California, Pierce et al. (2000b) found female cougars selected for young and older female deer whereas male cougars did not, and mule deer body condition did not affect prey selection. Nowak (1999a) found female cougars selected for calf elk and young or old mule deer. Anderson and Lindzey (2003) found even though female cougars selected for mule deer and males selected elk, both sexes killed elk and mule deer.

Several studies have implicated cougar predation as limiting ungulate populations (Connolly 1978). When prey populations occur at low levels, cougar predation has been shown to limit population growth rates or recovery (Neal et al. 1987). Density dependent factors regulate populations (Holling 1959, Fowler 1981, 1987), whereas density independent factors limit populations. Regulation is any positive density-dependent (effects increase as density increases) process that tends to stabilize population numbers over time. A process that changes population size is termed limitation and normally operates independent of density and thus does not stabilize populations (Skogland 1991). Predation may replace other forms of mortality (compensatory) in prey populations or be an additional form of mortality (additive), depending on nutritional condition of prey and population densities of predator and prey species (Bartmann et al. 1992, Messier 1994, Krebs et al. 1995, Saether 1997). In some cases predation can suppress prey populations by keeping prey at low densities for long periods. Called a predator pit, this theory was first described by Holling (1959). For a predator pit to exist, four criteria need to be met (Cougar Management Guidelines Working Group 2005) including:

1) presence of alternative prey,
2) excellent prey body condition and reproductive performance,
3) high mortality of prey due to predation, and
4) historic evidence of a much larger prey population.

In northeast Washington and northern Idaho, Wakkinen and Johnson (2001) proposed that cougars were negatively effecting population recovery of woodland caribou in part because white-tailed deer were alternative prey for cougars, allowing the cougar population to remain at high numbers. In contrast to a predator pit, a California deer herd declined from about 6,000 to about 1,000 animals over 6 years, most likely because of drought, then increased in the following 5 years to about 2,000 while the adult cougar population decreased 50% during the same period (Pierce et al. 2000a). In this example, drought may have acted as a density independent factor limiting this deer population. In this area in California, there were no sizable alternative prey sources of wild ungulates.

Cougar predation has reduced and limited bighorn sheep population numbers, threatening viability of sheep populations (Wehausen 1996, Hayes et al. 2000). As of 2003, there were 12 separate herds of Rocky Mountain bighorn sheep in Oregon. Recent monitoring of radio-collared bighorns in Hells Canyon found the primary causes of mortality to be disease followed by cougar predation, which accounted for 27% of known mortalities (Cassirer 2004). Thirty-two herds of California bighorn sheep have been reestablished. Several herds have shown significant declines since the 1990s. Evidence suggests cougar predation as the primary cause of decline in several herds and partially responsible for others. Cougar predation has been identified in the Bighorn Sheep Management Plan as a factor limiting bighorn sheep populations and in compromising restoration efforts (Oregon Department of Fish and Wildlife 2003a).

In Oregon, a telemetry study of radio-marked California bighorns (n=33) in the Leslie Gulch herd range found 7 of 13 documented mortalities (54%) were killed by cougars, and three other mortalities were suspected cougar kills (Oregon Department of Fish and Wildlife, 2003, unpublished report). A telemetry study was started in January 2004 to measure adult mortality of California bighorn sheep on Hart Mt. National Antelope Refuge. Results from the first year of monitoring indicated mortality rates of 20% for adult rams and 11% for adult ewes with 50% percent of all mortality attributed to cougar predation.

California bighorn sheep survey data in southeast Oregon indicate the Red Butte population (Owyhee River) has declined from 75 in 1994 to 10 in 2005. The Iron Point population (Owyhee River) has declined from 175 in 1994 to 50 in 2005. The Deary Pasture population (Owyhee River) has declined from 75 in 1994 to 20 in 2005. The Steens Mountain population has declined from 250 in 1994 to 125 in 2005. The Fish Creek Rim population was started in 1993 with 22 bighorns and increased to 78 animals observed by 1999. Since then it has steadily declined with 33 animals observed in 2004. Several transplant attempts in the Owyhee corridor have also failed to establish resident populations: North Fork Owyhee (1995), Middle Fork Owyhee (1994), North Table Mountain on the lower Owyhee (1994), and Sharon Creek on the upper Owyhee (1993). In all cases, declines appear linked to the winter of 1992-93 when mule deer herds were reduced approximately 50% due to severe winter conditions following several years of drought. When mule deer numbers were substantially reduced or eliminated, bighorn sheep may have become the primary prey for some individual cougars

residing in bighorn sheep ranges. Since most of these bighorn sheep populations were small in size (less than 150 animals), cougar predation may have created a predator pit, reversing population trends and in some cases essentially eliminated some populations.

Two recent bighorn sheep transplants may have failed due to cougar predation. Three of 17 Rocky Mountain bighorn sheep released in the Minam River in 2000 were killed by cougars within 7 days of the release. The remaining bighorn sheep left the release area within 30 days and the transplant failed to establish a population. In December 2004, a California bighorn release on Steens Mountain was compromised when 5 of 10 radio-collared ewes were killed by cougars and the remaining animals moved from the release area. This transplant also failed to establish a population.

Cougar predation has been implicated in low calf elk survival and elk population declines. In southeast Washington, cougar predation accounted for more than half the known elk calf mortality (Myers et al. 1998) and end of winter calf:cow ratios averaged 21:100. Cougars were found to impact calf survival in two Idaho study areas with low calf ratios. Cougars were responsible for 38% of known calf mortalities in the Lochsa River study area and 36% in the Clearwater River study area (P. Zager, Idaho Department of Fish and Game, personal communication).

In northeast Oregon, calf:cow ratios declined significantly since the early 1990s in 8 Wildlife Management Units (WMUs). Elk populations declined in those same areas (Oregon Department of Fish and Wildlife 2003b) even as numbers of elk hunters and harvest have been reduced in an effort to maintain elk populations at Management Objective (MO). Since 2000, elk calf:cow ratios have declined in Ukiah, Heppner, Starkey, Desolation, and Fossil WMUs from long-term averages of 35-40 calves per 100 females to less than 20 calves per 100 females. In the Wenaha WMU the elk population declined from more than 4,200 to less than 1,500 elk from 1985 to 2000 (Oregon Department of Fish and Wildlife 2003b). In this area, cougars were responsible for 69% of the radio-collared elk calf mortalities, while pregnancy rates of prime-aged cows were high (Rearden 2005). In most years, elk body condition and pregnancy rates in northeast Oregon have been consistently high, and generally better than any other area in the state (Oregon Department of Fish and Wildlife 2003b).

The relationship between calf elk survival and cougar population abundance was analyzed using long-term data sets collected by ODFW. Annual elk pregnancy rates have been determined for many WMUs from more than 10,000 hunter-collected reproductive samples (Kohlmann 1999). Biologists determined end-of-winter calf:cow ratios from field inventories for most WMUs (Oregon Department of Fish and Wildlife 2003b). Data were combined to provide a calf survival index (%) by dividing the end-of-year calf:cow ratio by pregnancy rates determined for the previous year. A cougar abundance index was calculated from the sum of all known cougar mortalities for the year elk were classified and the following year, and expressed as the number killed per 100 mi^2 (Figure 2). The cougar abundance index reflects relative cougar population within a WMU. Pregnancy rate data were determined from hunter-collected samples obtained between 1986 and 2002 and restricted to WMUs with a minimum of 10 reproductive tracts from adult cow elk ages 3 to 13. WMUs included Ochoco (11 years), Grizzly (2 years), Heppner (13 years), Ukiah (9 years), Desolation (11 years), Starkey (16 years), Mt. Emily (1 year), Wenaha (7 years), Sled Springs (13 years), and Chesnimnus (12 years). As cougar numbers increased, calf elk survival decreased (Figure 2). While several factors may

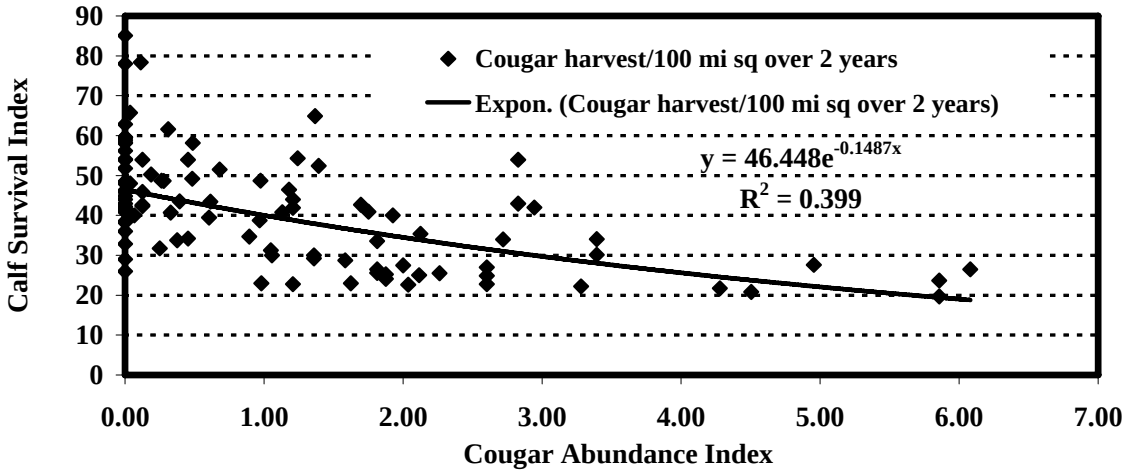

Figure 2. Relationship between cougar abundance (cougars killed/100 mi^2) and Rocky Mountain calf elk survival (%) in Oregon, 1986-2002. The analysis assumes that as cougar abundance increases there is a corresponding increase in cougar harvest/100 mi^2. As cougar abundance increases calf elk survival decreases.The cougar index reflects relative cougar population within a WMU.

contribute to low calf:cow ratios, evidence is accumulating that suggests cougar predation can be a major factor contributing to low recruitment in Rocky Mountain elk.

Cougar predation also impacts mule deer populations. In California, cougar predation was found as the primary cause of a significant decline in mule deer in the Sierra Nevada Mountains (Harrison 1989). A 3-year Oregon study found cougar predation of adult mule deer as the leading mortality cause, accounting for 33% of all known mortality (Mathews and Coggins 1997). A study of a wintering mule deer herd in Hells Canyon, Idaho showed a 25% annual mortality rate for adult does from 1999-2001 (Edelmann 2003). The primary cause of adult doe mortality was cougar predation. A review of published studies addressing deer-predator relationships by Ballard et al. (2001) indicated impacts of predation were confounded by numerous factors and predation may be significant in some areas under certain conditions.

Habitat

Cougar habitat in Oregon is abundant with 55% of the land in public ownership (Levine, 1995) and managed primarily by the U.S. Forest Service and Bureau of Land Management. Additionally, much of the private ownerships are timber lands or range lands which provide cougar habitat. Cougars are widely distributed throughout Oregon in every habitat type that offers either topographic or vegetative cover. Even flat agricultural areas like the Willamette, Rogue, and Umpqua Valleys are used by cougars, which find cover in riparian corridors and wooded areas. It is likely cougars use these valleys in conjunction with forested areas in the surrounding foothills. In much of Oregon, cougar habitat selection coincides with the habitat used by their primary prey, deer and elk. Forested areas, canyons or rugged mountainous terrain, and areas with high prey populations are preferred. This is consistent with Seidensticker et al. (1973) who described optimum cougar habitat suitability in Idaho as a combination of abundant prey and suitable cover (vegetation and/or terrain) for successful stalking.

The best habitat and highest densities of cougars are found in northeast and southwest Oregon (Figure 1) where deer and/or elk are abundant. This is reflected by locations of cougars killed in Oregon from 1987-2004 (Figure 3). Much of northwest Oregon appears too densely forested to provide optimum habitat and much of southeast Oregon has open habitats with low wild ungulate densities that do not maintain high cougar densities. While most of the habitat in northwest and southeast Oregon may not be optimal, there are areas with the right combination of habitat and prey populations to sustain high numbers of cougars.

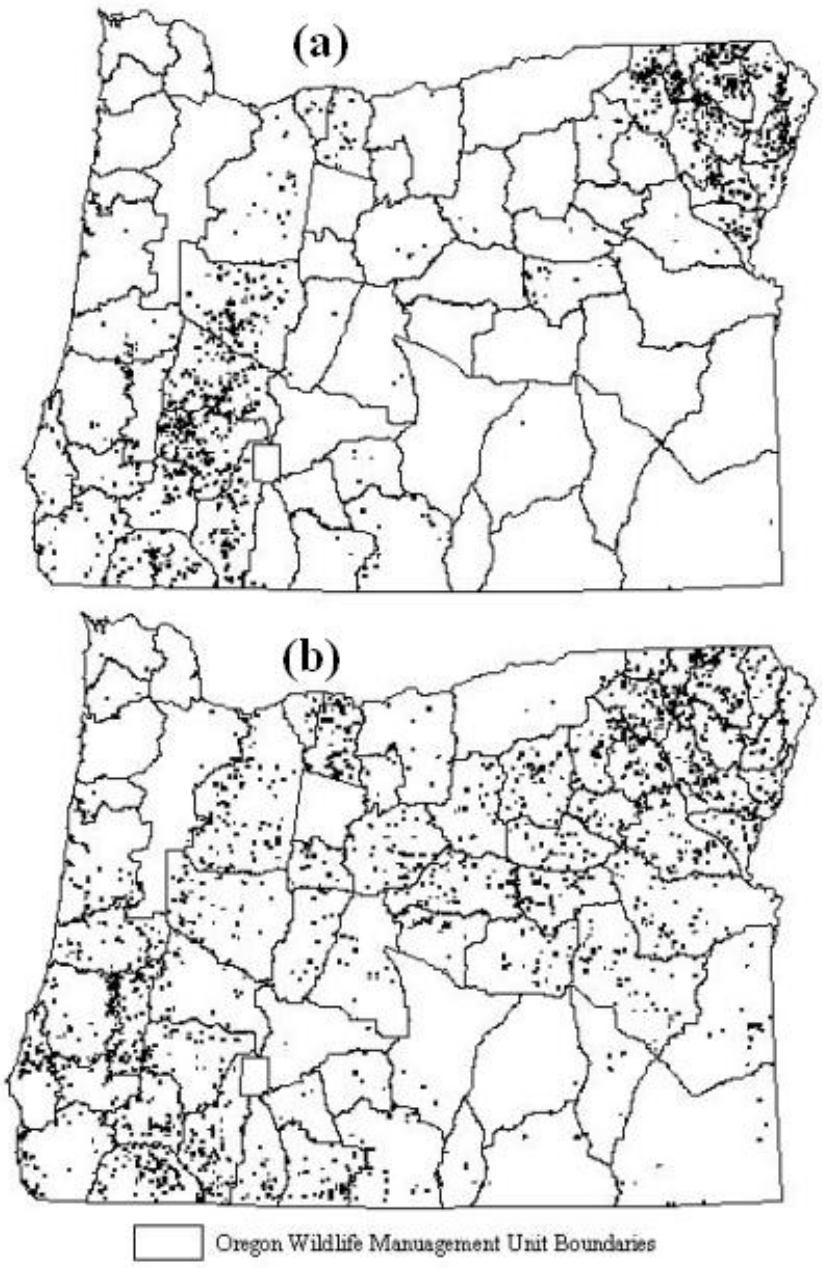

Figure 3. Location of known cougar mortalities (hunting and non-hunting) in Oregon between 1987-1994 (a) and 1995-2004 (b). Data are plotted in the center of the section where the kill occurred.

ODFW's Catherine Creek Study in northeast Oregon examined cougar's use of specific habitat components. Results suggested over 90 percent of locations used by cougars during the day were characterized by rock outcroppings and/or downed logs beneath a forested canopy. Field observations also suggested cover is important for bedding sites and stalking prey. Several female den sites were also associated with these habitat components. During winter, cougars tended to avoid areas of deep snow, as did their prey species. Instead, cougars were found where prey was abundant in forested areas with multi-storied canopy cover where snow depths were less. Land managers should consider retaining these habitat components.

Some Oregonians are concerned that forest management activities may negatively impact cougar populations. Habitat management activities that negatively affect deer and elk populations likely pose the most significant limitation to cougar populations. By retaining important habitat components within intensively managed habitats, it is possible to maintain healthy populations of both cougars and their prey. Road management programs designed to limit disturbance to deer and elk are appropriate in areas of high road densities. Forest management practices that increase forage for deer and elk will likely also benefit cougars.

Human development and land use affects cougar habitat primarily by affecting prey densities, increasing the potential for conflicts, and increasing vulnerability to human caused mortality factors. Cougars have proven to be highly adaptable to human disturbance. The increasing number of complaints ODFW receives about cougars in populated and developed areas is a testament to this adaptability. Populated areas can harbor high prey densities especially where people may be feeding deer, turkeys or other prey species on their property. Populated areas can also have an abundance of pets and livestock. These concentrations of prey species can attract cougars. Additionally, residential development and high road densities in some areas such as deer and elk winter range can also reduce prey species. Intensive farming is generally unfavorable to cougars, because cover and natural prey species are often reduced.

Assessing Populations

Age and Sex Structure

Many wildlife species can be aged using characteristics of one or more of their teeth. Elk, mule deer, and other ungulates normally are aged by tooth replacement and wear patterns or analysis of growth rings in the tooth that result from differential cementum deposition rates associated with annual periods of good (summer) and poor (winter) nutrition. Rings created in the tooth root during periods of poor nutrition can be microscopically identified and number of rings in the cross section of the root usually corresponds to the animal's age. Cougars are more difficult to age than other game mammal species using this method because they generally do not have annual poor nutrition periods that effect cementum deposition rate in the tooth.

Ashman et al. (1983) presented criteria for a general classification of cougar age groups based on physical characteristics of the tooth such as tooth dimensions, degree of tooth wear, and coloration, which allowed managers to place cougars into one of three general age categories: 0–16 months old, sub-adults (17–24 months old), and adults (>24 months old). This method, however, failed to provide managers with an age distribution of the adult segment of the population.

ODFW has developed a reliable cementum analysis technique for aging cougars (Trainer and Matson 1989). Since 1987, ODFW has used cementum deposition layers in the second premolar tooth (PM2). Validated on known age cougars, the technique is usually correct within ± one year of actual age (Trainer and Golly 1992). The technique provides a method to sample cougar population age structure, facilitate population modeling efforts, and monitor and analyze overall population status. Previous investigators suggested few cougars live past the age of 10-12 years in the wild (Young and Goldman 1946, Hansen 1992). However ODFW's aging technique has found a few wild cougars living as long as 18 years (Trainer and Golly 1992).

ODFW evaluates sex and age structure of cougar mortalities to monitor overall cougar population health. All cougars killed for any reason must be checked in at an ODFW office. From 1987 to 1994, 52–65% of hunter harvested cougars were males (Table 3). This occurred for four primary reasons: (1) adult males have larger home ranges than adult females and young males tend to disperse farther than young females increasing the probability of hunters encountering them; (2) cougar hunters preferred males to females because males tend to be larger; (3) cougar hunters recognized females are the reproductive base of a population; and (4) hunters are not allowed to take spotted kittens and females with spotted kittens during hunting seasons. Since 1994, the proportion of total cougars killed by hunters has declined and take of cougars due to all other causes (primarily damage and human safety) has increased (Table 4). Therefore a higher percentage of females are taken during the hunting season than before 1994.

Table 3. Sex ratio of hunter-killed cougars in Oregon, 1970-2003. (1970-1983 data from hunter harvest surveys; no survey in 1982 & 1983; 1987-2003 data from mandatory check-in; 1987–2003 data reported by calendar year.)

Year	Male	Female	Unk.	Total	% Male
1970	4	6		10	40
1971	8	10		18	44
1972	10	12		22	45
1973	7	9		16	44
1974	11	5		16	69
1975	4	11		15	27
1976	10	6		16	63
1977	16	11		27	59
1978	16	18		34	47
1979	9	14		23	39
1980	10	14	8	32	31
1981	17	13	3	33	52
1982			57	57	
1983				54	
1984	39	38	2	79	49
1985	29	32	1	62	47
1986	52	65		117	44
1987	73	55	1	129	57
1988	89	47		136	65
1989	73	43		116	63
1990	125	76		201	62
1991	75	49		124	60
1992	111	73		184	60
1993	96	66		162	59
1994	104	94	1	199	52
1995	13	9		22	59
1996	27	16		43	63
1997	32	29		61	52
1998	55	55		110	50
1999	71	97	1	169	42
2000	103	85		188	55
2001	115	104	1	220	52
2002	104	128		232	45
2003	127	122		249	51

Age distribution of known cougar mortalities is an indicator of population status and the impact of mortality on a population. The presence of young cougars in the harvest indicates reproduction is occurring and that mortality rates are conservative enough to allow females to reach reproductive age. High percentages of young in the harvest with few older age class animals may indicate low exploitation rates.

Conversely it may indicate higher levels of exploitation if this occurs after harvest rates have removed older aged animals. Likewise, the presence of older cats in the harvest suggests harvest rates are conservative enough to allow a sector of the population to reach older age classes. If excessive removal was occurring from a small or declining population, fewer cats would be found in the older age classes over time. This trend is not evident in Oregon (Table 5). Anderson and Lindzey (2005) found that cougar populations did not begin to decline until adult (3+) females comprised at least 25% of the harvest. In Oregon from 2001 through 2003, the average proportion of adult females in the harvest where age could be determined was 19.6%, suggesting the population is continuing to increase.

Prior to 1994, age data from Oregon's cougar mortalities indicated that both young and old were represented in the population (Table 5). Greatest representation was found in the younger age classes indicating a growing population. The 1- and 2-year-old age classes also are most susceptible to hunting because they are the dispersing animals, are therefore more vulnerable to hunting, and are more likely to be taken on damage complaints. Cougars less than one year of age are for the most part protected from hunting and are not represented in large proportions. The consistent presence of older animals in the harvest indicates excessive exploitation is not occurring. In general, cougars taken on damage are younger than those taken during hunting seasons (Trainer and Golly 1992).

Table 4. Total cougar mortality and proportion of mortality by hunting and non-hunting causes (damage, human safety/pet, and other combined), in Oregon 1987-2003.

Year[a]	N	Hunting	Non-hunting
1987	142	0.91	0.09
1988	162	0.84	0.16
1989	145	0.80	0.20
1990	251	0.80	0.20
1991	162	0.77	0.23
1992	226	0.81	0.19
1993	210	0.77	0.23
1994	259	0.77	0.23
1995	97	0.23	0.77
1996	166	0.26	0.74
1997	181	0.34	0.66
1998	240	0.46	0.54
1999	324	0.52	0.48
2000	352	0.53	0.47
2001	365	0.60	0.40
2002	403	0.58	0.42
2003	412	0.60	0.40
	87-94 avg	0.20	0.80
	95-03 avg	0.49	0.51

[a] Data for 1987-2003 are by calendar year.

Hunting and Hunter Harvest

Hunter success varies from year to year depending on snowfall during the hunting season and available hunting methods. Snow helps hunters positively identify cougar tracks and reduces the possibility of hunting females with young or non-target wildlife species. Hunting with the aid of trailing dogs has been shown to be the most efficient method for hunting cougars.

Harvest steadily increased in Oregon until 1994 when a ballot initiative (Measure 18) passed, banning the use of dogs as a legal cougar hunting method. Harvest dropped significantly from 1995 to 1997 but has steadily increased since 1998 (Table 6). Hunting methods now used were seldom used 10 – 15 years ago, and while harvest continues to increase, it has been directly related to increased numbers of cougars and cougar hunters. Cougar tags can now be purchased by anyone for a statewide General Season, and the number of cougar tags increased from 588 in 1994 to 34,135 in 2003. Cougar hunter success rates have declined from 40% in 1994 to 1 - 2%

Table 5. Age distribution of known cougar mortality (hunting, damage, other losses) in Oregon, 1987-2003. Data are reported for the calendar year.

		Number Killed By Age Class												Proportion Killed By Age Class										
Source	Year	0	1	2	3	4	5	6	7	8	9	10+	Unk	0	1	2	3	4	5	6	7	8	9	10+
Hunt	1987	3	14	34	19	14	11	8	4	2	3	3	14	0.03	0.12	0.30	0.17	0.12	0.10	0.07	0.03	0.02	0.03	0.03
	1988	6	23	38	25	18	4	6	2	1	1	2	10	0.05	0.18	0.30	0.20	0.14	0.03	0.05	0.02	0.01	0.01	0.02
	1989	2	17	41	16	6	10	7	4	4	3	4	2	0.02	0.15	0.36	0.14	0.05	0.09	0.06	0.04	0.04	0.03	0.04
	1990	9	16	40	42	27	21	12	4	7	1	11	11	0.05	0.08	0.21	0.22	0.14	0.11	0.06	0.02	0.04	0.01	0.06
	1991	1	10	23	16	17	19	14	7	6	5	4	2	0.01	0.08	0.19	0.13	0.14	0.16	0.11	0.06	0.05	0.04	0.03
	1992	6	5	29	25	27	27	21	13	10	5	14	2	0.03	0.03	0.16	0.14	0.15	0.15	0.12	0.07	0.05	0.03	0.08
	1993	6	8	32	21	17	14	20	10	10	8	8	8	0.04	0.05	0.21	0.14	0.11	0.09	0.13	0.06	0.06	0.05	0.05
	1994	4	23	32	27	22	18	22	10	8	7	18	8	0.02	0.12	0.17	0.14	0.12	0.09	0.12	0.05	0.04	0.04	0.09
	1995	1	3	3	5	3	4		1		1		1	0.05	0.14	0.14	0.24	0.14	0.19	0.00	0.05	0.00	0.05	0.00
	1996	2	10	6	5	4	3	2	3	2	1	3	2	0.05	0.24	0.15	0.12	0.10	0.07	0.05	0.07	0.05	0.02	0.07
	1997	2	9	13	4	10	2	4	6	2	1	4	4	0.04	0.16	0.23	0.07	0.18	0.04	0.07	0.11	0.04	0.02	0.07
	1998	10	21	26	13	13	11	5	1	3	2	3	2	0.09	0.19	0.24	0.12	0.12	0.10	0.05	0.01	0.03	0.02	0.03
	1999	13	31	44	21	18	15	9	4	3	2	4	5	0.08	0.19	0.27	0.13	0.11	0.09	0.05	0.02	0.02	0.01	0.02
	2000	6	33	42	33	16	15	9	10	6	4	8	6	0.03	0.18	0.23	0.18	0.09	0.08	0.05	0.05	0.03	0.02	0.04
	2001	10	40	49	26	24	27	15	9	4	2	6	8	0.05	0.19	0.23	0.12	0.11	0.13	0.07	0.04	0.02	0.01	0.03
	2002	12	49	45	34	27	16	15	10	6	3	4	11	0.05	0.22	0.20	0.15	0.12	0.07	0.07	0.05	0.03	0.01	0.02
	2003	11	49	63	31	24	12	12	8	12	3	4	20	0.05	0.21	0.28	0.14	0.10	0.05	0.05	0.03	0.05	0.01	0.02
Non-	1987		3	4	3	2	1							0.00	0.23	0.31	0.23	0.15	0.08	0.00	0.00	0.00	0.00	0.00
Hunt	1988	2	13	5		1			1	2			2	0.08	0.54	0.21	0.00	0.04	0.00	0.00	0.04	0.08	0.00	0.00
	1989	4	4	8	8	1		2				1	1	0.14	0.14	0.29	0.29	0.04	0.00	0.07	0.00	0.00	0.00	0.04
	1990	7	10	8	6	3	2	2	2	1	1	2	6	0.16	0.23	0.18	0.14	0.07	0.05	0.05	0.05	0.02	0.02	0.05
	1991	6	4	8	4	6	1	2	1	2	1	1	2	0.17	0.11	0.22	0.11	0.17	0.03	0.06	0.03	0.06	0.03	0.03
	1992	7	4	5	6	4	6	1	1		1	4	3	0.18	0.10	0.13	0.15	0.10	0.15	0.03	0.03	0.00	0.03	0.10
	1993	3	2	10	4	7	4	1	3	1	2	3	8	0.08	0.05	0.25	0.10	0.18	0.10	0.03	0.08	0.03	0.05	0.08
	1994	4	9	6	13	6	2	5	1	2	2	1	9	0.08	0.18	0.12	0.25	0.12	0.04	0.10	0.02	0.04	0.04	0.02
	1995	8	19	15	12	4	3	2		1	2	4	5	0.11	0.27	0.21	0.17	0.06	0.04	0.03	0.00	0.01	0.03	0.06
	1996	11	27	27	14	9	7	6	2	2	2	1	15	0.10	0.25	0.25	0.13	0.08	0.06	0.06	0.02	0.02	0.02	0.01
	1997	10	28	26	10	8	11	5	4	3	3	2	10	0.09	0.25	0.24	0.09	0.07	0.10	0.05	0.04	0.03	0.03	0.02
	1998	15	32	16	16	10	6	3	2	3		6	21	0.14	0.29	0.15	0.15	0.09	0.06	0.03	0.02	0.03	0.00	0.06
	1999	22	45	24	21	13	5	3	3	5		5	9	0.15	0.31	0.16	0.14	0.09	0.03	0.02	0.02	0.03	0.00	0.03
	2000	30	31	31	19	11	7	9	4	2		6	14	0.20	0.21	0.21	0.13	0.07	0.05	0.06	0.03	0.01	0.00	0.04
	2001	12	33	32	16	10	11	6	4	3	3	5	10	0.09	0.24	0.24	0.12	0.07	0.08	0.04	0.03	0.02	0.02	0.04
	2002	15	51	39	18	8	6	6	7		2	5	14	0.10	0.32	0.25	0.11	0.05	0.04	0.04	0.04	0.00	0.01	0.03
	2003	17	38	34	23	14	9	4	1	1	1	2	20	0.12	0.26	0.24	0.16	0.10	0.06	0.03	0.01	0.01	0.01	0.01

in 2003 (Table 6). Currently many cougars are harvested by hunters that randomly encounter a cougar while hunting for other species, but also have a cougar tag.

Table 6. Cougar hunting effort and harvest in Oregon by season, 1970-2003.

	Eastern Oregon				Western Oregon				Statewide			
Year	# of Tags	# of Hunters	Harvest	% Success	# of Tags	# of Hunters	Harvest	% Success	# of Tags	# of Hunters	Harvest	% Success
1970	25	16	10	63					25	16	10	63
1971			15				3				18	
1972	75	46	22	48					75	46	22	48
1973	83	55	16	29					83	55	16	29
1974	75	34	16	47					75	34	16	47
1975	95	52	15	29					95	52	15	29
1976	115	52	14	27	10	8	2	25	125	60	16	27
1977	115	54	25	46	25	19	2	11	140	73	27	37
1978	105	64	24	38	25	16	10	63	130	80	34	43
1979	115	54	19	35	25	17	4	24	140	71	23	32
1980	120	56	17	30	40	33	15	45	160	89	32	36
1981	98	52	25	48	43	31	8	26	141	83	33	40
1982	117	69	43	62	46	29	14	48	163	98	57	58
1983	132	51	41	80	56	34	13	38	188	85	54	64
1984[a]	167	(a)	42		96	(a)	37		263	(a)	79	
1985[a]	207	(a)	36		155	(a)	26		362	(a)	62	
1986	232	161	61	38	230	146	56	38	462	307	117	38
1987	227	157	76	48	230	180	90	50	457	337	166	49
1988	237	163	63	39	205	162	69	43	442	325	132	41
1989	226	153	65	42	225	203	79	39	451	356	144	40
1990	241	178	78	44	230	185	77	42	471	363	155	43
1991	252	173	86	50	230	192	69	36	482	365	155	42
1992	267	189	93	49	250	202	94	47	517	391	187	48
1993	285	201	82	41	275	212	78	37	560	413	160	39
1994	308	178	84	47	280	180	60	33	588	358	144	40
1995[b]		229	22	10		87	12	14	385	316	34	11
1996		424	26	6		237	19	8	779	661	45	7
1997		530	31	6		333	30	9	935	863	61	7
1998		5,612	96	2		3,766	57	2	11,761	9,378	153	2
1999		7,357	108	1		6,071	49	1	14,564	13,428	157	1
2000[c]		10,421	86	1		8,676	50	1	22,386	19,097	136	1
2001[d]		14,471	159	1		11,912	61	1	28,447	26,383	220	1
2002		9,006	171	2		4,929	59	1	32,126	13,935	230	2
2003		16,564	182	1		11,751	59	1	34,135	28,315	241	1

[a] No harvest survey conducted to estimate hunting effort.
[b] Begin general season framework and tag sales.
[c] Short season to facilitate change to calendar year season framework.
[d] Begin calendar year season framework.

Hunting techniques used to specifically target cougars include calling and tracking. When deer migrate to lower elevation, open country during winter, cougars follow the herds. Where hunters have access to those same areas calling and tracking are more successful. Where winter ranges are near private property, cougars can become concentrated in and around homes and livestock and are often taken during winter on livestock damage and/or human safety/pet concerns.

Cougar populations are resilient to hunting pressure because of their high reproductive potential. In addition, cougar populations have demonstrated the ability for rapid growth and recovery from reduction. Robinette et al. (1977) reported a total annual mortality of 32 percent of the population in Utah, while Ashman et al. (1983) noted a sustained total annual mortality of at least 30 percent in Nevada. Ashman et al. (1983) believed under "moderate to heavy exploitation (30%-50% removal)" cougar populations on their Nevada study areas had the "recruitment capability of rapidly replacing annual losses." Anderson and Lindzey (2005) concluded cougar populations would be stable or increasing as long as adult female harvest was ≤ 25% of the harvest, and with an annual harvest of more than 25% of the total cougar population. Anderson and Lindzey (2005) found after a 66% population reduction by hunting in Wyoming, the cougar population recovered in numbers within 3 years with about 18% of the cougar population harvested annually. Ross and Jalkotzy (1992) documented a population increase of approximately 40% in an Alberta cougar population from 1984 – 1989, following a decline in hunter harvest. Logan and Sweanor (2001) found a peak annual growth rate of 28% for adult cougars following removal of 58% of the independent cougars (adults and subadults) and the population recovered in 31 months. In Oregon, the cougar population recovered from near extinction in 1961 to an estimate of nearly 3,000 by 1992 (Keister and Van Dyke 2002).

Illegal Kill

The 1987 Cougar Management Plan directed ODFW and the Oregon State Police (OSP) to determine the extent of the illegal harvest. Current regulations require any person taking a cougar to bring the hide and head of all cougars, and reproductive organs from females to an ODFW office. ODFW collects biological samples and information, and attaches an ownership seal to the hide. This seal must remain with the hide until the hide is processed. This requirement distinguishes a legally harvested cougar (marked with a seal) from one that is not (unmarked) for easier identification by enforcement officers. ODFW also collects information pertaining to the hunt or damage situation when hunters check in their cougar. This information provides OSP data related to the season should they receive reports of illegal hunting activity.

The current extent of illegal cougar kills remains unknown. In recent years ODFW and OSP have received far more inquiries from the public regarding potential human-safety concerns than issues with poaching. Poaching is difficult to quantify. However, ODFW has not yet found poaching to have a widespread negative biological impact on Oregon's cougar population. Due to ODFW's regulations, it is unlikely illegally killed cougars are being processed by taxidermists. Illegally killed animals left where they were killed are more difficult to document and can best be determined from radio-telemetry studies. Data from 6 ongoing or completed radio-telemetry studies of Oregon cougars (Catherine Creek, Jackson Creek, NE Elk Nutrition Predation Study, and SW Elk Nutrition Predation Study [see Chapter II], Gagliuso 1991, Nowak 1999a) indicate few illegal kills. During 4 years in the Catherine Creek Study, 1 cougar was illegally killed (n = 41 radios monitored). In the 11-year Jackson Creek study, 7 illegal kills of radio-collared cougars were recorded and accounted for 10.8% of all documented deaths (n = 113 radios monitored, 65 mortalities). No illegal kills were recorded during a 3-year southwest Oregon study (n = 26 radios monitored). In a study conducted between 1985 and 1987, Gagliuso (1991) found 3 of 8 radio-collared cougars were killed illegally in the Umpqua drainage of the same general area where the SW Elk Nutrition Predation Study is ongoing. Nowak (1999a) did

not report any illegal kills of 7 cougars monitored over 2 years in the Catherine Creek study area in northeast Oregon.

Damage, Human Safety/Pet Mortality

The number of cougars killed in Oregon due to damage and/or human safety/pets has increased. From 1987 - 1994, ODFW recorded 186 mortalities taken on conflict (23.3 cougars/year), accounting for 7 – 16% of the total known annual mortality (Table 4). From 1995 through 2003, 1,046 were taken on conflicts (116.2 cougars/year), accounting for 30 – 65% of the total known annual mortality (Table 4). Cougars killed as a result of causing damage to livestock is the leading cause of non-hunting mortality with cougars killed in response to human safety/pet concerns the second highest cause (Table 7).

Table 7. Trend in non-hunting (damage, human safety/pet, roadkill, other) cougar mortality in Oregon, 1987-2003.

	Number of Mortalities					Proportion by Source			
Year	Livestock Damage	Human Safety/Pet	Roadkill	Other	Total	Livestock Damage	Human Safety/Pet	Roadkill	Other
1987	8	2	1	2	13	0.62	0.15	0.08	0.15
1988	13	3	5	5	26	0.50	0.12	0.19	0.19
1989	15	1	7	6	29	0.52	0.03	0.24	0.21
1990	29	3	10	8	50	0.58	0.06	0.20	0.16
1991	22	4	4	8	38	0.58	0.11	0.11	0.21
1992	17	3	6	16	42	0.40	0.07	0.14	0.38
1993	20	7	15	6	48	0.42	0.15	0.31	0.13
1994	28	11	9	12	60	0.47	0.18	0.15	0.20
1995	41	22	7	5	75	0.55	0.29	0.09	0.07
1996	64	34	13	12	123	0.52	0.28	0.11	0.10
1997	82	20	9	9	120	0.68	0.17	0.08	0.08
1998	93	20	8	9	130	0.72	0.15	0.06	0.07
1999	91	39	13	12	155	0.59	0.25	0.08	0.08
2000	120	25	10	9	164	0.73	0.15	0.06	0.05
2001	97	25	12	11	145	0.67	0.17	0.08	0.08
2002	111	23	20	17	171	0.65	0.13	0.12	0.10
2003	111	28	16	9	164	0.68	0.17	0.10	0.05

Other Human-related Mortaltiy

Vehicle collisions are the most common human-related mortality not associated with hunting, damage, or human safety/pet issues. The number of cougars killed by vehicle collisions also has increased. From 1987 through 1994, 57 cougars were killed by vehicle collision (7.1 cougars/year). From 1995 through 2003, 108 cougars were killed by vehicles on roads ("roadkill", 12.0 cougars/year, Table 7).

Natural-caused Mortality

Several causes of natural mortality have been documented in cougars including injuries obtained while capturing prey, intra-specific predation and cannibalism, starvation, and disease. During the Jackson Creek study, all natural mortality factors mentioned above were documented but affected young cougars (<3 years of age) more than adults. Specific causes of natural mortality vary by gender and age and between populations. Natural causes of mortality are likely higher in non-hunted populations since research has shown human-caused mortality to be most significant in hunted populations (Hornocker 1970). Kittens, dispersing sub-adults, and very old cougars experience higher mortality than prime-aged adults (Tanner 1975, Russell 1978, Anderson 1983).

Parasites and Diseases

Limited data are available on diseases and parasites of free-ranging cougars. Most documented information was collected from captive held cougars or those euthanized because of

safety issues or aberrant behavior. Most studies have been unable to examine a large sample of cougars and in many cases documentation of disease or parasites is from examination of a single cougar. The impact of disease and/or parasites to cougar populations remains undocumented and is an issue for future investigation. Many pathogens found in domestic cats are also found in wild cougars. Based on serological analysis, exposure to disease may be indicated even though there is little evidence of clinical disease. Feline calicivirus occurs worldwide in domestic and wild felids and causes acute upper respiratory tract disease. Though exposure to this virus has been documented in cougars, clinical disease has not been observed. Feline panleukopenia is a highly contagious disease primarily found in domestic cats but only rarely reported in free-ranging cougars. However, there have been suspected cases in Colorado (Anderson et al. 1992) and Oregon (Oregon Department of Fish and Wildlife, unpublished data). A young male cougar in California, euthanized due to human safety concerns, was found to be antibody positive for feline leukemia virus (FeLV), but this appears unusual since the authors indicated this was the first documented case of FeLV in a free-ranging wild felid in North America (Jessup et al. 1993). Cougars have been found infected with a cougar-specific form of FIV (feline immunodeficiency virus), particularly in the Rocky Mountains (Biek and Poss 2002) but apparently the virus does not cause disease. Puma lentivirus, was documented in Washington cougars (Evermann et al. 1997). Feline parvovirus, a viral disease causing intestinal malabsorption and diarrhea has been documented to cause disease and death in Colorado (C.R. Parrish unpublished data) and Wyoming (E.S. Williams unpublished data) cougars. However, effects of this disease on cougar populations are unknown. Cougars have occasionally been diagnosed with the rabies virus.

Bacterial diseases occur in cougars but are generally acquired directly or indirectly from their prey. Cougars have been documented to serve as susceptible hosts to the plague bacterium (*Yersinia pestis*) (Tabor and Thomas 1986, Paul et al. 1994). The principle mode of transmission is via a flea bite and causes high morbidity and mortality from systemic infection in affected animals. The disease is more prevalent in cougars when deer populations are low and they consume more rodent prey (Smith 1994).

More documentation exists on cougar parasites than diseases because of persistence of parasite and the ability to detect it in cougars after death. Several parasites have been found in cougars and many appear related to the prey they consume. Currently, ODFW is conducting research on the presence, speciation, and pathological effects of nodular stomach worms (*Cylicospirura* spp.) in Oregon cougars. The nematodes appear in a significant number of cougars and have been found to cause granulomatous lesions in the proximal intestine and pyloric region of the stomach. This parasite has been implicated in deaths of several radio-collared cougars in Oregon. However, the impact of this parasite on cougar populations is not currently known. The first report of the nematode *Ollulanus tricuspis* was from cougars in Washington (Rickard and Foreyt 1992) and has since been shown to cause gastritis and vomiting in cougars (Collett et al. 2000). Additional gastrointestinal parasites found in Washington included 2 other species of nematodes and 2 species of cestodes. Rausch et al. (1983) documented 9 species of helminthes from cougars in northeastern Oregon, including 2 cestode species found in Washington cougars documented by Rickard and Foreyt (1992). *Toxoplasma gondii* oocysts were found in 1 of 12, and antibodies to *T. gondii* were found in 11 of 12 (Aramini et al. 1998) cougars necropsied in British Columbia during an outbreak of human toxoplasmosis. The authors concluded the presence of cougars presented a risk to the water supply of Victoria, BC. A hemoparasite, *Cytauxzoon felis*, is known to occur in the Florida panther but its' impact to the population has not been assessed. *Trichinella spiralis* was first

documented in a domestic cougar (Kluge 1967) and first documented in free-ranging cougars from Montana (Winters 1969). Two trematodes, *Alaria marclanae* (Fischthal and Martin 1977) and *Nanophyetus salmincola* (Kistner et al. 1979), have been found in single free-ranging cougars. Salmon poisoning disease (SPD) is a highly fatal helminth-transmitted rickettsial disease (*Neorickettsia helminthoeca*) occurring on the western slopes of the Cascade mountain range from northern California to central Washington. The life cycle of the trematode requires snails, fish and mammals or birds. There has been one documented case of a free-ranging cougar kitten succumbing to SPD (Kistner et al. 1979) but effects on Oregon cougar populations is thought to be relatively low due to cougar dietary preferences for deer and not fish.

A helicobacter-like organism was found to cause the death of a captive cougar (Hill et al. 1997). Giardia spp. occurs in many species of wildlife and has been documented at high prevalence in Canadian cougars (M.E. Olson, unpublished data). This water-bourne parasite is transmitted via fecal-oral routes. It can cause clinical malabsorption and diarrhea in affected animals. However clinical pathology has not been documented in cougars. Cestodes or tapeworms (*Taenia ovis krabbei, T. rileyi, Echinococcus oligarthrus)* have been documented in cougars (Sousa and Thatcher 1969; Rausch et al. 1983; Rickard and Foreyt 1992) although the significance to cougar populations is unknown.

Intra-specific and Inter-specific Mortality

Cannibalism, infanticide, and territorial fighting have been documented in cougars (Robinette et al. 1961, Cougar Management Guidelines Working Group 2005). The highest cause of natural mortality for young males in the Jackson Creek study (southwest Oregon) was intra-specific killing, apparently by larger adult males. In the Catherine Creek study (northeast Oregon), one cougar was found dead from wounds consistent with being killed by another cougar. In the northeast Nutrition-Predation study, 1 unmarked yearling male was found killed by a radio-collared adult male. Cougars interact with bears and wolves with at least two references in the scientific literature of wolves killing cougars (Cougar Management Guidelines Working Group 2005).

Injury

Injuries are difficult to document in cougar populations, in part because they occur infrequently. In the Catherine Creek study (see Chapter III), one radio-marked cougar was found dead with a broken sternum, presumably from being kicked by an elk. In the Jackson Creek study, 7 of 113 radio-marked cougars monitored during December 1992 – September 2003 died because of injuries (Oregon Department of Fish and Wildlife, unpublished data).

Starvation

Starvation often occurs to injured animals. No radio-marked cougars in Oregon are known to have starved without previous injuries. Frequently, cougars in poor body condition are killed on livestock or pet complaints. Had they not been killed, these individuals may have died of starvation.

Population Viability

Population viability analysis (PVA) is defined as the process of determining the probability of a population surviving for a reasonably long period of time, e.g. a population has

95% probability of surviving for 100 years. One aspect of PVA is determining the minimum viable population (MVP) which describes the smallest possible size at which a biological population can exist without facing extinction due to demographic, environmental, and/or genetic variability (stochasticity).

Numerous studies have shown that as population size increases, random demographic differences become averaged over a larger number of individuals, and the impact of demographic stochasticity (such as major changes in survival or reproduction) decreases substantially when population size is greater than 100. Environmental stochasticity usually refers to unpredictable events that potentially affect all members of a population. For example, changes in carrying capacity may occur due to severe weather events or from fire impacts to habitat. If the environmental impact is extreme, population size may not be sufficient to buffer against extinction of a local population. Genetic degradation may occur due to reduced genetic variability such as caused by inbreeding. Generally, genetic concerns only affect population viability when very small remnant populations exist (e.g. less than 50 individuals).

Some wildlife populations can persist at very low numbers. Following are a few examples of population viability information:

1) A remnant population of Florida panther was surviving in south Florida with an estimated 12-13 panthers but was considered in danger of extinction (Alvarez 1986). A plan for the Florida panther suggested that an initial 130 breeding individuals (year 2000) and an increase to 500 breeding age panthers (year 2010) would be required to prevent extinction and provide for the panthers' recovery (Captive Breeding Specialist Group 1989).
2) In a study of Eurasian lynx being reintroduced into a patchy environment, it was demonstrated that release of at least 10 females and 5 males was required to establish a viable population with an extinction probability of less than 5% in 50 years (Kramer-Schadt et al. 2005).
3) A PVA for Island Fox recommended maintaining 150 foxes in each of 2 subpopulations to reduce the risk of extinction due to demographic stochasticity (Kohlmann et al. 2005).
4) The estimated minimum area to establish [and maintain] a new transplant of cougars (in Florida) was 518 Km^2 (200 mi^2) assuming a deer density of 9 deer per 87-121 ha (19-27 deer per mi^2). This area did not account for additional area needed for population expansion by offspring (Belden et al. 1986).

Historically cougar populations were at much lower numbers than are currently estimated in Oregon. Preliminary application of existing Population viability analysis (PVA) models (STOCHMVP, INMAT2A, see Dennis et al. 1991 and Mills and Smouse 1994) to Oregon cougar data suggests that the current modeled population estimate of 5,100, and the proposed minimum population threshold of 3,000 are much greater than the minimum number of individuals required for genetic and/or demographic viability. Both these values also are much greater than minimum population sizes required for persistence in most other populations and taxa where population viability has been estimated. The current habitat and prey populations in Oregon are sufficient to support a cougar population many times greater than the minimums reported above and are keys to long-term persistence of the cougar population.

The process of making species management decisions when uncertainty exists can be problematical. However, the 2006 Oregon Cougar Management Plan (CMP) proposes using an adaptive management process to constantly evaluate decision about cougars in Oregon. In an evaluation of 4 techniques (minimum standard, precautionary principle, minimax regret criterion, and adaptive management) used to account for uncertainty in decisions that protect species from extinction, the adaptive management process (the technique proposed in the 2006 CMP) was superior to the 3 other methods, although it was more costly and time consuming (Prato 2005).

CHAPTER III: INFORMATION ON COUGARS IN OREGON

ODFW has collected data on cougars for over 35 years. Four sources of information are used to manage cougars: (1) Biological data, (2) Non-hunting mortality, (3) Cougar complaints, and (4) Research. Each information source provides a different type of data, and no single source would be sufficient to adequately manage cougars on a statewide basis. ODFW believes the 4 combined sources provide confidence for population modeling to assess population trends.

Biological Data Collection

ODFW currently requires mandatory examination of all known mortalities. Regulations require any person taking a cougar to bring the head and hide from all cougars, and reproductive organs from females to ODFW. ODFW collects both upper premolar teeth (if present) and records pertinent data including date, method of kill, and location where the kill occurred. Additionally, ODFW attaches a seal to the hide. This seal must remain with the hide until the hide is processed. These data and the biological samples are transferred to the ODFW Wildlife Population Laboratory in Corvallis. Analysis of reproductive organs allows ODFW biologists to determine average litter size at birth, proportion of reproductively active females, and age at first parturition. Analysis of teeth allows ODFW to determine age structure of cougar populations. Biological data provide the foundation for population assessment.

Non-Hunting Mortality

Non-hunting mortality includes all known cougar deaths not caused by hunting and includes cougars killed as a result of human safety, pet or livestock damage, and road kills. Cougars that die from disease or other natural causes are rarely reported to ODFW but are included in non-hunting mortality. Non-hunting mortality has substantially increased from 13 in 1987, to 60 in 1994, to 164 in 2003 (Table 7). The majority of this increase is due to cougars taken in response to livestock and human safety/pet complaints. Non-hunting mortality is less subjective than complaints and thus is the best measure of cougar-human conflict.

Cougar Complaints

Damage complaints consist of the contacts received by ODFW and USDA Wildlife Services (WS) regarding conflict with cougar. Contacts made to OSP or to other enforcement agencies are referred to ODFW or to Wildlife Services and ultimately are included in annual tallies of complaints. For cougars, complaints are primarily categorized as involving human, pet, or livestock safety. Human safety complaints include concerns for humans where people have encountered a cougar or where a cougar or cougar sign is observed in populated areas. Pet complaints are recorded when pets are killed or injured by a cougar or when a cougar or cougar sign has been observed in close proximity to pets. Livestock complaints include physical injuries and predation of livestock, and concerns for livestock safety in areas where a cougar or cougar sign has been observed. Complaints not readily identifiable in one of these categories are counted as other. Sightings reported to the department with no discernable concern expressed by the reporting person are not counted as a complaint.

From 1992–2003, cougar damage complaints have been tracked in Oregon using a standardized form filled out by District staff. Cougar damage data were summarized annually by type of complaint for reporting in ODFW's annual big game harvest reporting process (Table 8). Beginning in 2001, the Department began entering all damage complaints into a computer

database to simplify annual summaries. Since 2004, ODFW has used a process whereby data forms are completed by District staff and sent to Wildlife Division for review of consistency and completeness. District staff corrects any errors found on the form and data are entered into the database. Following data entry, an independent accuracy check is completed and original data forms are filed. This process of managing and entering the data includes two independent checks for accuracy and allows for relatively current queries of existing conflict levels by Zone, unit or county. A new form has been developed that facilitates recording more detail regarding conflicts involving cougars that will improve consistency and use of complaints, and allow comparison of future complaint levels to past complaint levels.

Table 8. Cougar complaints by category and sightings reported in Oregon, 1986-2003.

	Category					
Year	Livestock	Pets	Safety	Other	Total	Sightings
1986					36	
1987					59	
1988					54	
1989					63	
1990					86	
1991					157	
1992	67	3	5	109	184	
1993	95	9	10	162	276	
1994	223	37	294		554	
1995	285	50	396	11	742	
1996	309	49	482		840	
1997	316	53	429		798	
1998	372	52	530		954	
1999	421	95	556		1,072	
2000	369	51	466	56	942	135
2001	330	72	399	28	829	151
2002	336	40	369	20	765	195
2003	320	47	322	8	697	162

Not all complaints can be verified as actual cougar conflicts due to the large number of complaints ODFW receives, staffing limitations, because cougar do not always leave detectable sign, and because complaints are not always reported in a timely fashion. Even when cougar sign is evident, it often disappears within a day or two because of weather, or activities by other animals, people, or equipment. The draft plan acknowledges that using all complaints reported to the Department by the public will include some that do not actually involve cougars. However, using only complaints that can be verified as having a cougar present with hard evidence such as tracks or scats etc. will under-represent actual levels of cougar conflict due to the difficulties of confirmation. Thus, ODFW believes using all reported complaints does measure the public concern that exists over cougar occurrence in populated areas. Additionally, using all complaints is consistent with how complaints were historically recorded.

The majority of cougar damage complaints resulting in cougar control actions are verified. These generally involve livestock complaints where the carcass or kill site is used as a focal point for trapping or starting a pursuit with hounds. Using kill sites or carcasses as a focal point to begin control actions improves the likelihood of the control action resolving the conflict. Cougar complaints involving livestock are generally addressed by WS in counties participate in the program, or by landowners or their agents in non-participating counties. The majority of cougar-human safety concerns are not verified and do not result in control efforts. Those few situations where cougars have been killed because of human safety concerns generally involve verified complaints where threats to human safety are considered high. The majority of cougar complaints reported to ODFW are addressed primarily by providing advice on precautionary measures that reduce risk, and providing information on legal provisions that allow for taking the cougars causing the concern. Occasionally ODFW will assist in the take of a cougar that is causing damage or a safety threat.

Oregon Cougar Research

ODFW has been involved in 3 long-term research projects on cougars, one with two separate study sites. Research has provided information for many biological parameters needed to model cougar populations. In addition, research results have provided the basis for establishing population density in different management zones.

Catherine Creek Study

ODFW initiated a study in the Catherine Creek WMU (Union County, northeast Oregon) in 1988 to determine cougar population density. Additional objectives included documenting cougar productivity, survival, dispersal, and effects of hunting on the population. Hunting regulations at that time included controlled hunting and use of dogs.

Between January 1989 and April 1995, 72 cougars were captured and 56 individuals were radio-collared during 7 capture seasons. Thirty-eight bi-monthly telemetry flights were conducted between December 1991 and July 1993 to estimate the cougar population. Population estimates showed seasonal differences that likely reflected the migratory nature of the cougar prey base, primarily mule deer and elk. The average population estimate for the WMU during the summer-fall period was 23.6 cougars (range 20-27). The winter-spring average population estimate was 16.8 (range 8-23). The average annual population estimate was 19.3 (range 8-27).

Twelve adult females produced 19 litters with 42 kittens (14M, 24F and 4 unclassified). Litter size averaged 2.21 with births documented during all months except May and November. Peak birth months were March and September. Age at first breeding for 3 known age adult females was 21, 22, and 23 months.

Twenty-seven mortalities of radio-collared cougars were documented. Five different mortality causes were determined, with hunting accounting for 67% of all cougar deaths. Documented deaths did not all occur within the study area, but included radio-collared cougars that dispersed or were otherwise outside the study area boundary. Hunting accounted for 18 cougar deaths within the study boundary and included 11 radio-collared and 7 unmarked cougars.

Jackson Creek Study

In December 1993, ODFW initiated the Jackson Creek study (Douglas County) to determine cougar population parameters in the south Cascades. A total of 113 cougars (58 male, 55 female) were captured and radio-marked during 11 capture periods between December 1992 and May 2003. When the study ended in 2004, 33 cougars were being monitored, 65 had died (37 males, 28 females) and 15 were unaccounted for (transmitter failure was suspected in some cases). Regulated hunting during the study varied greatly. During the first 2 years, hunting was regulated via controlled hunt drawing with limited tags and the use of dogs was legal. After passage of Measure 18 in 1994, use of dogs was prohibited and cougar hunting opportunity has gradually shifted to longer, general cougar seasons and increasing numbers of cougar tags. Cougar density estimates on the Jackson Creek study ranged from 13.9 total cougars/100 mi^2 in 1999 to 7 total cougars/100 mi^2 in 2001.

Percentage of mortalities due to a single cause varied annually. Prior to Measure 18 in 1994, legal harvest was the highest mortality cause. Since 1997, natural mortality (particularly disease/parasites) had the most impact on adult and sub-adult cougars. Between May 2000 and

June 2002, 14 natural-caused mortalities were documented. During the early study years (1993-1997) the percentage of radio-marked cougars that died annually was variable, and reached nearly 70% during 1996 when 8 of 12 cougars died. During 1998-2002, more than 30 cougars were marked, and fluctuations in annual mortality were less erratic. Additional data analyses on capture, home range size and overlap, reproduction, sub-adult dispersal, population density estimates, age-specific survival rates, and causes of mortality are currently being conducted.

Nutrition – Predation Study (ongoing at time of writing)

In response to concerns over cougar predation's potential impact on declining elk populations, ODFW initiated research in two study areas with two study sites each in 2002. The study addresses 5 objectives:

1. Measure nutritional condition, reproductive status, and survival of cow elk;
2. Quantify causes of mortality and survival rates of calf elk from birth to age 1;
3. Estimate densities of elk, mule deer, cougars, and black bears within study sites;
4. Test regional models of elk recruitment; and
5. If cougar predation is identified as a significant source of calf elk mortality, test whether cougar predation is additive or compensatory mortality.

During 2002-2004, ODFW researchers captured, marked and monitored 147 cow elk, 221 elk calves, and 43 cougars in the northeast study area. Preliminary analysis revealed densities of sub-adult and adult cougars from 8-16 per 100 mi^2. Annual calf survival ranged from 26-52% and cougar predation caused 68% of documented calf mortalities. Preliminary analysis did not indicate a direct relationship between cow nutritional condition and calf survival. Information on calf survival from 2002-2004 has been summarized in a MS thesis (Rearden 2005). The ODFW research is scheduled to continue through June 2008.

During 2002-2004, ODFW researchers captured, marked and monitored 110 cow elk, 132 elk calves, and 26 cougars in the southwest study area. Preliminary analysis revealed adult cougar densities from 9-11 per 100 mi^2. Annual calf survival ranged from 7-53% and cougar predation caused 66% of the documented calf mortalities. Research on the southwest study area will conclude in June 2006.

Published Literature/Reports on Cougars in Oregon

A number of studies or reports on Oregon cougars have been completed since 1971 and are listed below:

Akenson J. A., M. C. Nowak, M. G. Henjum, and G. W. Witmer. 2003. Characteristics of mountain lion bed, cache and kill sites in northeastern Oregon. pages 111-118 in S. A. Becker, D. D. Bjornlie, F. G. Lindzey, and D. S. Moody editors, Proceedings of the Seventh Mountain Lion Workshop. Lander, Wyoming. The authors describe habitat characteristics of cougar diurnal bed sites and cache sites near lion-killed prey. The habitat characteristics at these sites were compared with random habitat plots in the same study areas. Rock structure and downed logs were important habitat components at diurnal sites as was rock structure at cache sites. Canopy cover at cache sites was significantly higher than at random sites. Cougars used sites in close proximity to habitat edges more frequently than expected based on random plots. The authors demonstrated the importance of small-scale

physiographic features within the larger scale habitat complex that cougars live in. They suggest that their data supports the concept of cougars being an adaptable, yet vulnerable, species and that wildlife managers should realize the variability of cougars' habitat need.

Gagliuso, R.A. 1991. Habitat Alteration and human disturbance: their impact on cougar habitat utilization in southwest Oregon. M.S. Thesis. Oregon State Univ., Corvallis. 112 pp. The author radio-collared and monitored 8 cougars in Douglas County during 1985-1987. Home range averaged 59 mi^2 (153.1 km^2) for females and 210 mi^2 (543.5 km^2) for males. Cougars avoided using clearcuts and preferred mature forest stands. Cougars did not avoid active timber harvest sites or roads compared to random locations. Cougars did not avoid campsites, but did avoid permanent residences. The study suggested the most important impact of humans was not necessarily habitat alteration, but instead increased mortality to the cougar population due to harvest (legal and illegal) and road kills.

Harcombe, D. W. 1976. Oregon Cougar Study. Oregon Dept. of Fish and Wildl., Portland. 62pp. The objectives of this study were to identify preferred and critical habitat of the cougar, develop population sampling techniques readily usable by management personnel, estimate the cougar population by WMU, and determine cougar numbers in selected areas. Historical bounty records and a summary of cougar management history in Oregon were included. The author reported on 41 days of tracking surveys in which 15 cougar tracks were observed and a method for estimating cougar numbers by means of summer tracks was provided.

Keister, G. P. Jr. and W. A. Van Dyke. 2002. A predictive population model for cougars in Oregon. Northwest Science 76(1):15-25. The authors analyzed cougar harvest, damage complaints, and biological data of harvested cougars to evaluate the status of cougars in Oregon. Using data from Oregon cougars and published literature, the authors developed a density-dependent model of the Oregon cougar population. Based on the 1993 population estimate, the model indicated that a sport harvest of 5.4% of the population allowed a 5% annual growth. Model simulations indicated a sport harvest of 10% and a total (annual) mortality of 35% of the population was needed to stabilize population growth. The authors estimated the cougar carrying capacity of Oregon habitat would be reached by 2009.

Kohlmann, S.G. and R. L. Green. 1999. Body size dynamics of cougars (*Felis concolor*) in Oregon. Great Basin Naturalist 59(2): 193-194. The authors investigated body size dynamics of 1,076 cougars harvested in Oregon between 1987-1997. Body mass of sub-adults increased rapidly to age 4 and thereafter gained less than 1% annually. Cougar body mass was significantly correlated to body length for both sexes. Male cougar body mass averaged 50.8 % greater than females. Body mass of sub-adults varied among season of harvest. The authors speculated that "significant weight changes in sub-adults are a result of food deprivation during dispersal."

Maser, C. and R.S. Rohweder. 1983. Winter food habits of cougars from northeastern Oregon. Great Basin Naturalist 43(3):425-428. The authors examined 64 cougar stomachs and 41 intestinal tracts between 1976-1979. The most frequent occurring prey item was mule deer, followed by elk, porcupine, snowshoe hare, and deer mice.

Nowak, M.C. 1999. Predation rates and foraging ecology of adult female mountain lions in northeastern Oregon. M.S. Thesis, Washington State Univ. Pullman, WA. 75pp. The author monitored radio-collared adult female mountain lions for 25-day predation sequences

between 1996-1998 in an effort to document all ungulate kills. The number of days between kills averaged 7.7 days annually, with kills being more frequent in the summer-fall (5.6 days) and less frequent in the winter-spring (9.8 days). Seventy-five ungulate kills were documented (65% mule deer and 35% elk). Adult female cougars selected fawns and older adult female deer and elk calves, while prime age deer and elk were killed less than expected. Twenty-one non-ungulate prey species were documented.

Rausch, R.L., C. Maser, and E.P. Hoberg. 1983. Gastrointestinal helminths of the cougar, *Felis concolor* L., in northeastern Oregon. Journal Wildlife Diseases 19(1):14-19. The authors examined 39 cougars killed by hunters during December of 1976-1978. Helminths of nine species were identified. *Toxascaris leonina* was the most common nematode occurring in 69% of the cougars, although natural infections in cougars had never been previously reported. The authors suggest that six species of helminths might be expected to occur regularly in cougars because the intermediate hosts of helminths are the mammals on which cougars prey. There was no discussion of the potential impact of helminth infections on individual cougars or on the population.

Rearden, S. N. 2005. Juvenile survival and birth-site selection of Rocky Mountain elk in northeastern Oregon. M.S. Thesis. Oregon State University, Corvallis. 105pp. This thesis provides an analysis of survival and causes of death of calf elk for the first 15 weeks of life from 2002 – 2004 in the Elk Nutrition Predation Study in NE Oregon. It also provides an analysis of annual survival of calf elk for 1 year. Primary causes of mortality for the first 15 weeks of life were cougar predation followed by black bear predation. Calves with earlier birth dates and larger birth mass had a higher probability of survival for the first 15 weeks. Annual survival of calves in 2003-04 was 26% in Wenaha and 52% in Sled Springs. Preliminary analysis revealed similar pregnancy rates for lactating and nonlactating cows.

Toweill, D.E. and C.E. Meslow. 1977. Food habits of cougars in Oregon. Journal Wildlife Management 41(3):576-578. The authors examined 25 stomachs from cougars killed by hunters in December 1971 and 1972. Mule deer (or black-tailed deer) were the most common documented prey item (13 stomachs). Elk and porcupine also were documented. Unlike other studies, no hares or smaller mammals were found in the stomachs. No domestic animal remains were documented.

Toweill, D. E. and C. Maser. 1985. Food of cougars in the Cascade Range of Oregon. Great Basin Naturalist 45(1):77-80. The authors examined the contents of 61 cougar digestive tracts collected from the west slope of the Cascade Mountains between 1978-1984. Forty-two cougars were obtained in December and January and the other 19 during the rest of the year. Black-tailed deer and porcupines were the most common documented natural prey items. Data suggested that cougars foraged in closed-canopy vegetation during the winter, and that more open habitats were used during other times of the year.

Toweill, D. E., C. Maser, L.D. Bryant, and M.L. Johnson. 1988. Reproductive characteristics of eastern Oregon cougars. Northwest Science 62(4):147-150. The authors examined reproductive tracts of 46 male and 51 female cougars obtained from hunters during December of 1976-1982. Fifty-two percent of the males showed spermatogenesis and 45% of the females were classified as reproductively active. Four females were pregnant. Placental scar counts were used to estimate the mean litter size of 2.4. The authors cautioned against using body weight for assessing sexual maturity, indicating placental scar counts as the best estimator of cougar fecundity.

Additional Literature About Oregon Cougars

Carter, C.N. 1998. Fiscal effects of voter initiatives to ban certain methods of bear and cougar hunting: Oregon's experience. Human Dimensions of Wildlife 3(2):29-41.

Chinitz, A.E. 2002. Laying the groundwork for public participation in cougar management: a case study of southwestern Oregon (*Puma concolor*). M.S. Thesis, University of Oregon, Eugene, OR. 158 pp.

Ebert, P.W. 1971. The status and management of the felids of Oregon. Pgs. 68-71 *in*: Jorgensen, S.E. and L.D. Mech. Proc. of a Symposium on the native cats of North America, their status and management. U.S. Dept. Int., Fish and Wildlife Service, Twin Cities. MN.

Ingram, R. 1984.Oregon-cougar status report. Pgs. 53-55 *in*: J. Roberson and F. Lindzey (eds.) Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Research Unit. Zion National Park. 271 pp.

Maser, C. and D.E. Toweill. 1984. Bacula of mountain lion (*Felis concolor*), and bobcat (*Felis rufus*). Journal of Mammalogy 65(3):496-497.

Nowak, M.C., T.E. Taylor, and G.W. Witmer. 2000. Prolonged scavenging by a female mountain lion in northeastern Oregon. Northwest Naturalist 81(2):63-65.

Oregon Department of Fish and Wildlife. 1987. Oregon Cougar Plan. Oregon Department of Fish and Wildlife, Portland, Oregon, USA. 23 pp.

Oregon Department of Fish and Wildlife. 1993. Oregon's Cougar Management Plan 1993-1998. Oregon Dept. Fish and Wildl., Portland, OR. 33 pp.

Toweill, D.E. 1986. Notes on the development of a cougar kitten. The Murrelet 67:20-23.

Toweill, D.E., C. Maser, M.L. Johnson, and L.D. Bryant. 1984. Size and reproductive characteristics of western Oregon cougars. Pgs. 176-184 *in*: J. Roberson and F. Lindzey (eds.) *In*: Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildlife Research Unit. Zion National Park. 271 pp.

Trainer, C.E. and G. Matson. 1989. Age determination in cougar from cementum annuli counts of tooth sections. Pg. 71 *in*: R.H. Smith (ed.) Proc. of the Third Mountain Lion workshop. Arizona Chapter, The Wildlife Society and Arizona Game and Fish Department, Prescott, Arizona. 88pp.

Van Dyke, W.A. and M. Henjum. 1983. The cougar in northeastern Oregon. Oregon Wildlife 38(3):8-10.

Additionally, there are several Federal Aid in Wildlife Restoration annual reports prepared by ODFW staff related to cougar research in Oregon.

Population Modeling

Use of population models for wildlife management has become common in the last 20 years. Models have routinely, and successfully, been used for elk, deer, and pronghorn in Oregon and other western states. Properly used, models are tools to help make management decisions. Input necessary for deer and elk models include productivity and mortality data. Productivity data comes from herd composition, collected annually from field surveys.

Mortality data comes from harvest, from telephone surveys, and survival estimates. Model reliability depends on quality of input data, which often depends on sample size.

Cougar population estimates used in the 2006 Oregon Cougar Management Plan (CMP) come from a deterministic, density-dependent population model (Figure 4). The model is used for evaluating short-term harvest scenarios, as recommended in the Cougar Management Guidelines (2005, page 58). The model incorporates measured productivity and observed mortality to calculate changes in the cougar population.

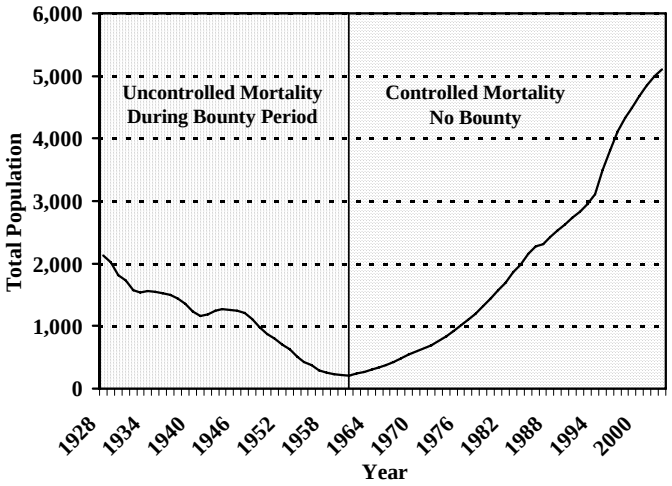

Figure 4. Modeled cougar population trend in Oregon, 1928–2003 (after Keister and Van Dyke 2002).

The cougar model utilizes extensive, long-term data collected from cougars in Oregon, which provides confidence in the estimates. These data include measures of both productivity and mortality. All cougars killed in Oregon since 1970 were required to be checked at an ODFW office. Based on cougars checked and examined at the Wildlife Lab in Corvallis, ODFW determined productivity of females and sex and age of all known mortalities. Productivity is based on three indicators: kittens/litter,placental scar counts, and corpora lutea counts. From 1995-2003, 41 pregnant female cougars were examined and had an average of 2.8 kittens/litter. Reproductive tracts were examined for placental scars (N=200, average = 2.9 kittens/litter) and corpora lutea (N = 79, average = 2.8 kittens/litter). Proportion of females sexually active, by age, is also important in determining overall productivity of cougars in Oregon, and was determined from 452 female cougars. The model uses age and sex of 2,538 known cougar mortalities documented from 1995-2003.

To describe the modeling process used for Oregon cougars, a manuscript (Keister and Van Dyke. 2002) was written, peer reviewed, and published. We analyzed harvest, damage complaints, and biological data obtained from harvested cougars, prior to 1993, to evaluate cougar status in Oregon. A density-dependent model was developed, which helped explain cougar population trends. The model was aligned with an ODFW cougar population estimate in 1961 and used to predict population performance under several hypothetical situations. A model sensitivity analysis was completed to determine factors most important in affecting population change and to give an indication of model precision. During the sensitivity analysis, model performance was consistent with changes in the biological parameters used in the model.

Since 1995, the model has been used to estimate the cougar population in Oregon and help determine harvest quotas by zone. Because total mortality (including harvest) has generally been less than quotas, the modeled cougar population in Oregon has continued to increase. During development of the 2006 CMP, the statewide model was updated utilizing sex, age, and reproductive data collected from 1993 – 2003. In addition, models were created for each of 6 zones. The statewide cougar population estimate is the sum of the 6 zone estimates.

Despite the strength of the data used to build the model and the scientific review of the model, the accuracy of population estimate has been questioned. ODFW used two approaches to address the subject. First, model performance was again evaluated on the updated, zone models. ODFW used variables (i.e. litter size, natural mortality rates) that were documented earlier to most affect model outcomes (see published paper). Two scenarios were evaluated to determine the effect of input variable changes on population estimates during the life of the 2006 CMP (5 years).

In the first scenario, ODFW assumed mortality quotas were met for the next 5 years and varied litter size and natural mortality rates. When litter size was lowered by 10% (to 2.52 kittens/litter), the statewide population estimate was reduced by 11% in 5 years. When natural mortality rates were lowered for each age class by 10%, the statewide population estimate increased by 9%. When natural mortality rates were increased by 10%, the statewide population estimate was reduced by 14%.

ODFW next tested a similar situation but without changing current harvest levels. When litter size was lowered by 10%, the statewide population estimate was reduced by 6% in 5 years. When natural mortality rates were lowered by 10%, the statewide population estimate increased by 6%. When natural mortality rates were increased by 10%, the statewide population estimate was reduced by 6%.

Confidence intervals allow an interpretation of the accuracy of the estimate and the impact of variability from demographic and environmental components. Because there is no random variability in a deterministic model, it is not possible to calculate intervals for the population estimate. Other species which are more visible and lend themselves to direct estimation methods on an annual basis are usually modeled with stochastic models that incorporate demographic and environmental variability. With cougars however, annual surveys are not feasible, making partitioning stochasticity into demographic and environmental components difficult. Further, stochastic models are generally much more complicated than deterministic models and as complexity increases, reliability tends to decline. ODFW believe, therefore, a more biologically relevant way to measure our cougar model accuracy is to evaluate maximum and minimum possibilities.

Formulas provided in Science (Carbone C., and J. L. Gittleman, 2002. *A common rule for the scaling of carnivore density*. Science 295: 2273-2276) were used to calculate the maximum number of cougars that could be supported by the primary prey, deer and elk, in Oregon. Assuming the average weight of all cougars is 110 lbs, the maximum number of cougars that could be supported by the ~121,000 elk and ~560,000 deer in Oregon is 7,644 (95% confidence interval for this estimate was 3,496 – 17,045)(the presence of secondary prey species would make this estimate higher). This compares favorably to a statewide population estimate of 5,101 in 2003 and a maximum population estimate of 7,628, as stated in the 2006 CMP.

A minimum population estimate can be calculated from population reconstruction based on verified mortalities. Population reconstruction determines the minimum number of animals alive for each age class at any year in the past. To get a complete enumeration of all cougars checked in, enough time must have passed to include all ages of cougars. For example, to include all cougars up to 10 years of age, the analysis must look back 10 years from present. Thus, for 1999, only cougars 6 years old or younger can be accounted for. The estimate derived from population reconstruction is therefore an absolute minimum because older aged animals are not accounted for in recent years, nor are undetected mortalities from natural causes, and animals that are still alive. Based on cougars killed due to hunting, damage, safety, and road kills and

checked in to ODFW from 1999 – 2004, a minimum population of at least 1,284 cougars existed in Oregon during 1999. This compares to a population estimate from the model of 4,488 in 1999.

Another important consideration is the context within which the population estimate would be used under the proposed 2006 CMP. The population estimate is only important in 1 of 5 objectives outlined in the CMP. Objective 1 seeks to manage the state's cougar population at a level well above that required for long-term sustainability. Because the minimum population objective is well above the level of sustainability, and because of the demonstrated resilience of cougar populations (see Chapter II, 2006 CMP and Cougar Management Guidelines, 2005, page 40), exact estimates of cougars are not necessary to achieve Objective 1. In fact, as referenced by the Cougar Management Guidelines (2005, p 45), Caughley (1977) stated "the majority of ecological problems can be tackled with help of indices of abundance, absolute estimates of densities being unnecessary luxuries." To accomplish Objective 1, several strategies recommended in the Cougar Management Guidelines (2005) have been employed within the 2006 CMP. Zone management with mortality quotas (Cougar Management Guidelines, 2005, page 75) will be used to insure mortality does not exceed objective levels. Harvest will occur at three levels of intensity to allow for maintenance of source populations (Cougar Management Guidelines, 2005, page 73-75) to insure the continued existence of abundant and widespread cougar populations. Two indicators of cougar abundance will be used as indicators of population abundance: (1) A deterministic, density-dependent population model will be used for predicting outcomes on a short-term basis in an adaptive management approach (Cougar Management Guidelines, 2005, page 58). (2) Proportion of adult females in the harvest, described in Chapter 6 of the 2006 CMP, will also be used to monitor cougar population trajectory (Cougar Management Guidelines, 2005, page 77). In addition, more specific data may be collected in more intensive, smaller scale research studies (Cougar Management Guidelines, 2005, page 77).

In summary, a population model for cougars in Oregon has been used in a similar manner as models used routinely for deer and elk to help make management decisions. The statewide model used for cougars was built on extensive, long-term data from Oregon. Models (statewide and zone specific) are deterministic and model parameters do not include annual variation as a result of random effects (e.g. the effect of weather on survival or productivity). However, human-caused mortality can be measured annually and used for management decisions. The data analysis and modeling process was written into a manuscript which was peer reviewed and published. Population estimates using the model were compared with 2 other modeling approaches. ODFW concludes that modeled population trends are reasonable. Because cougar population estimates appear to be reasonable and represent only one part of a comprehensive strategy, we believe they are more than adequate for predicting population response to different management scenarios.

CHAPTER IV: COUGAR MANAGEMENT IN OREGON

Management Stages

The status and management of cougars in Oregon has a long and varied history. This history, and the corresponding population response, is best partitioned into 3 segments.

Unprotected Predator – Cougar Population Decline, 1800's - 1967

No data are available to estimate cougar numbers in Oregon prior to European settlement. Cougars were characterized as widespread and common throughout most of the forested parts of the state in the 1800's and early 1900s (Bailey 1936). Settlement of the state brought burgeoning timber and agricultural industries, which lead to conflict between human and cougar populations. Bounties were placed on cougars and other "predators" as early as 1843. During this time there were no restrictions on how cougars could be killed, consequently a suite of methods including using hounds for hunting, traps, poisons, and unregulated shooting were utilized. Although records are not consistent, paying a bounty for 200 or more cougars per year was not uncommon between 1900 and 1930. Number of cougars bountied peaked around 300 in the early 1930s and declined to 27 in 1961 (Table 1). The Oregon Legislature repealed the bounty system in 1961. Actual bounties ranged from $10 per cougar in 1911 to a high of $50 per cougar from 1939-1961. Based on bounty records and population modeling (Keister and Van Dyke 2002), cougar numbers by the 1960s had declined markedly from historic levels.

From 1961-1967 cougars were still defined as "predators" and were not protected by any laws or regulations. The 1961 statewide cougar population was estimated at approximately 200. In 1967, the cougar was classified as a game animal, which gave the Oregon State Game Commission (now ODFW) management responsibility. The Game Commission responded by closing cougar hunting seasons during 1968 and 1969. Cougar were protected from hunting during these 2 years, however, 26 cougars were killed on livestock damage complaints.

Game Animal Classification – Cougar Population Recovery, 1967 - 1994

Game animal status allowed ODFW to implement population management by controlling harvest rates. However, provisions in ORS 498.012 allowed cougars to be taken without a permit when depredating domestic livestock. Primarily in response to livestock damage complaints in northeast Oregon, ODFW authorized the first controlled cougar season in 1970 (Table 6). ODFW offered 25 cougar tags for $5 each valid in a one-month season (December 1-31) for the Snake River, Imnaha, and a portion of the Minam WMUs in Wallowa County. Ten animals were harvested with 80 percent classified as immature. ODFW continued to offer controlled cougar hunting opportunities through 1994. The number of hunt areas and tags available gradually increased. The number of cougar hunting opportunities, available tag numbers, and the extent of hunting areas were based on a combination of previous cougar mortality patterns in the area, age and sex composition of the known mortalities, and trend in the number and type of complaints received. As the cougar population, number of hunts, and number of tags increased, so did the popularity of hunting the species. Success rates were generally high during this period (Table 6), provided the hunter had access to trained dogs. Chances of drawing a cougar tag dropped to as low as 10% in 1982 (Table 9).

Numerous administrative changes also occurred that affected hunting during the early years of cougar management. The bag limit was changed in 1974 from "One Cougar" to "One

Cougar Except Spotted Kittens and Females With Spotted Kittens Are Protected". Cougar tag fees were raised from $5 to $10 in 1975, and raised again in 1987 to $50.

Table 9. Cougar hunting demand during controlled seasons in Oregon, 1980-1994.

Year	Authorized	Applicants	% Chance to Draw	Applicants Per Tag
1980	160	1,063	15	6.6
1981	161	1,487	11	9.2
1982	168	1,674	10	10
1983	188	1,732	11	9.2
1984	263	1,788	15	6.8
1985	362	1,759	21	4.9
1986	462	1,685	27	3.6
1987	457	835	55	1.8
1988	442	706	63	1.6
1989	451	612	74	1.4
1990	471	664	71	1.4
1991	482	797	60	1.6
1992	517	921	56	1.8
1993	560	1219	46	2.2
1994	588	1575	37	2.7

During this period, ODFW also developed a series of documents to guide cougar management. A draft Strategic Plan was developed in 1974. The first *Oregon Cougar Management Plan* was adopted by the Fish and Wildlife Commission in 1987 (Oregon Department of Fish and Wildlife 1987). Concurrent with the 1987 plan, ODFW began collecting age and reproductive information from all known cougar mortalities to assist in making management decisions (Trainer and Matson 1989). The 1987 plan was revised and adopted by the Fish and Wildlife Commission in 1993 (Oregon Department of Fish and Wildlife 1993).

Since ODFW was given management authority for the species, harvest has played a critical role in management, with hunter harvest generally accounting for 77–91% of the known cougars killed in the state from 1987–1994 (Table 4). Hunters, predominantly using trained dogs, were generally quite successful with an average success rate of 42% from 1970–1994 (Table 6). Prior to 1987, annual cougar harvest was dominated by males in 11 of 15 years (Table 3). From 1987–1994, males were still being selected for harvest by hunters (52–65%). Hunters also tended to take mature animals with 47–78% of the harvest from 1987-1994 composed of animals 3 years old or older (Table 5).

Since 1967 the statewide cougar population has made a remarkable recovery. In 1961, remnant populations occurred in southwestern and northeastern Oregon. By 1974, an ODFW Strategic Planning document estimated the statewide cougar population at 2,000 animals and estimated approximately 25% of the state was cougar habitat. At that time, the Willamette Valley and Columbia Basin were not considered cougar habitat. A 1980 statewide wildlife planning update delineated approximately 50% of the state as cougar habitat and estimated the population at 1,800 animals. Neither of these population estimates were based on survey or modeling data but, instead were estimates of the ability of habitats to support cougars based on density estimates derived from studies done in other states.

By 1993 ODFW estimated the statewide population at about 3,000 animals occupying approximately 80% of the state. Controlled hunting, mainly in response to livestock damage complaints, was authorized in approximately 50% of the state in 1994.

Under the hunting season framework employed from 1970 - 1994, all cougar seasons were controlled (limited areas, tags, and season lengths) and authorized annually by the Oregon Fish and Wildlife Commission. Since 1971 hunters successfully taking a cougar were required to have the

cougar or parts thereof checked by ODFW so biological samples and information could be recorded. In addition, ODFW used this information, trend in number of complaints received, number of cougar taken to control damage, estimated natural mortality, and the number of sighting reports received over time to set tag numbers, hunt areas, and season lengths.

The controlled hunt system was considered appropriate for addressing cougar damage complaints while meeting goals to maintain healthy cougar populations and provide recreational hunting opportunity. Approximately 50% of the state was open to cougar hunting in 1994 and there were no or limited seasons authorized in areas reporting little or no cougar damage. With high success rates when using dogs, controlled hunting seasons enabled ODFW to regulate the number and location of hunters, which reduced hunter crowding and improved quality of the hunting experience while addressing management concerns. The system allowed ODFW to change harvest rates from year to year in response to changing conditions, as well as concentrate hunting efforts in areas with excessive damage problems.

Current Management Program – Post 1994

Cougar management changed dramatically in 1994 when Measure 18, a citizen Ballot Initiative, passed during the November general election making it unlawful for cougar hunters to use dogs (ORS 498.164). With expectations of a marked decline in hunter success rates, ODFW changed cougar hunting from controlled hunts with a limited number of highly successful hunters with access to trained dogs to an unlimited general statewide season beginning in 1995. Season dates were also expanded from 2 ½–4 months in 1994 to 7 months in 1995. With the objective of ensuring appropriate harvest levels distributed throughout the state, ODFW instituted a quota-based system of harvest management. Quota numbers were set at approximate level required to stabilize the cougar population if the quota was met. Low hunter success rates without using dogs precluded reaching these quotas during the 1990s. Since 1995, individual zone harvest quotas were reached 3 times (Table 10). Year-round cougar hunting seasons were established in four western Oregon areas in 1998 to help address high cougar–human conflict levels. By 2001, the general cougar season had been expanded to 10-months occurring within the calendar year with a second tag available in the Blue Mountain Quota Zone. Beginning in 2005, the area open for taking a second cougar was expanded to all of eastern Oregon.

Table 10. Cougar hunting season quota and harvest by cougar management zone in Oregon, 1995–2003.

		Hunting Season								
	Zone	95-96	96-97	97-98	98-99	99-00	2000[a]	2001	2002	2003
Quota	A Coast/N Cascade.	65	65	81	83	87	91	91	93	116
	B SW Cascade.	73	73	91	94	99	104	104	106	133
	C SE Cascade.	26	26	32	32	34	36	36	37	46
	D Col. Basin	9	9	11	11	12	13	13	13	16
	E Blue Mtns.	67	67	84	86	91	96	96	98	123
	F SE Oregon	41	41	53	54	57	60	60	61	76
	Statewide Total	281	281	352	360	380	400	400	408	510
Harvest	A Coast/N Cascade.	2	12	18	35	25	24	24	28	35
	B SW Cascade	10	7	12	22	24	26	37	31	24
	C SE Cascade.	2	4	5	14	10	3	21	12	16
	D Col. Basin	0	4	1	5	3	7	9	14	10
	E Blue Mtns.	18	13	22	62	79	53	98	102	114
	F SE Oregon	2	5	3	15	16	23	31	43	43
	Statewide Total	34	45	61	153	157	136	220	230	242

[a] Begin calendar year season framework.

Several other changes impacted cougar management during this period. In 1997 the Oregon Legislature reduced the general cougar tag price from $50.00 to $10.00. Additionally, the Sport Pac license was created for Oregon residents that included a general cougar tag with purchase of the license package. Cougar tag sales increased dramatically from 937 in 1997 to over 34,000 in 2003 (Table 6). Two other statutory changes also increased ODFW's cougar management flexibility. In 1999, the Oregon Legislature adopted legislation allowing persons to legally take cougars posing a threat to human safety without a permit (ORS 498.166). In 2003, ORS 498.012 was modified to expand allowable take of wildlife causing damage, including cougars, to also allow take of animals posing a public health risk, or causing a public nuisance.

These statutory and regulatory changes resulted in changes to harvest. Initially, harvest declined sharply after the use of dogs was prohibited from 144 in 1994 to 34 in 1995. Hunter harvest remained low until 1998 (Table 6). Concurrent with the decline in harvest, the proportion of total cougar mortality attributed to hunting fell below 50% of the total known mortality for several years (Table 4). With subsequent increases in total general season cougar tag sales and the increase in the cougar population, cougar harvest has slowly increased to levels observed prior to 1994.

Although the absolute numbers of cougars harvested are similar, impacts of harvest on cougar populations before and after 1994 are not directly comparable. The proportion of the total statewide cougar population being harvested is now much less because the estimated cougar population has increased since 1994, and harvest prior to 1994 was from a limited portion of the state (approximately half) while current regulations allow harvest from the entire state. Therefore, a similar harvest has much less impact on the population. For these reasons current harvest levels have not been successful in preventing additional population growth or stabilizing cougar populations at 1994 levels.

Information from annual telephone hunter surveys indicates many cougars are harvested incidental to hunting other species, primarily deer and elk. Age composition of the harvest also changed with the new cougar-hunting framework. With dog available for hunting, hunters tended to take older, male cougars (Table 11). Without the use of dogs, the median age of cougars taken by hunters dropped in nearly all zones with age data available before and after 1994 (Table 11). Only minor changes were observed in the distribution of harvest between males and females with the proportion of males dropping to near 50% for most zones (Table 12).

Table 11. Measures of central tendency for ages of known cougar mortalities in Oregon, 1987-2003[1].

		Female												Male									
		1987-1990[2]			1991-1994[2]			1995-1998			1999-2003			1987-1990[2]			1991-1994[2]			1995-1998			1999-2003		
	Zone	N	$\overline{X}$	***M***	N	$\overline{X}$	***M***	N	$\overline{X}$	***M***	N	$\overline{X}$	***M***	N	$\overline{X}$	***M***	N	$\overline{X}$	***M***	N	$\overline{X}$	***M***	N	$\overline{X}$	***M***
Hunt	A	10	2.5	3.0	28	4.6	4.0	19	2.7	2.0	71	2.0	2.0	30	3.5	3.0	31	5.2	4.0	32	2.6	2.0	73	3.0	3.0
	B	92	3.0	3.0	106	4.2	3.5	22	3.1	2.0	29	3.0	2.0	158	3.2	3.0	161	4.3	4.0	22	3.5	3.0	77	3.1	2.0
	C				9	4.9	3.0	8	3.1	3.5	32	3.7	2.0				18	5.2	5.0	8	3.1	2.5	37	4.0	4.0
	D							3	1.7	1.0	20	3.1	4.0				3	5.3	5.0	5	3.0	2.0	26	3.2	3.0
	E	108	4.0	3.0	126	4.7	4.0	44	3.8	2.0	241	3.3	3.0	145	3.7	3.0	163	5.1	5.0	45	4.3	4.0	206	3.6	3.0
	F				1			6	2.3	1.5	75	3.3	3.0				3	7.3	8.0	13	5.4	4.0	80	3.5	3.0
Non-Hunt	A	16	2.1	1.0	15	4.0	3.0	50	3.0	2.0	99	2.6	2.0	12	2.8	2.0	29	4.3	3.0	78	2.5	2.0	113	2.3	2.0
	B	21	2.0	1.0	25	2.8	2.0	50	2.0	1.0	81	1.8	1.0	26	2.5	2.0	36	3.0	3.0	74	2.1	2.0	115	2.0	2.0
	C				1			1			12	3.0	2.0	1			6	3.5	3.5	9	2.8	2.0	27	3.9	3.0
	D							1			9	1.6	1.0	2	7.0	7.0				3	5.3	5.0	15	2.7	2.0
	E	7	2.4	2.0	26	3.5	2.5	52	4.7	3.5	86	3.3	2.0	19	3.2	3.0	22	5.4	5.0	66	3.1	2.0	94	3.3	2.0
	F	2	2.5	2.5				4	2.5	1.5	21	3.2	3.0	3	4.3	4.0	1			7	2.9	3.0	50	3.5	3.0
Combined	A	26	2.3	1.0	43	4.4	4.0	69	2.9	2.0	170	2.3	3.3	42	3.3	3.0	60	4.7	4.0	110	2.5	2.0	186	2.6	2.8
	B	113	2.8	2.0	131	3.9	3.0	72	2.3	2.0	150	2.3	2.0	184	3.1	3.0	197	4.0	4.0	96	2.4	2.0	192	2.5	2.0
	C				10	5.2	4.5	9	3.8	4.0	44	3.5	2.0	1			24	4.8	5.0	17	2.9	2.0	64	3.9	3.5
	D							4	3.3	2.5	29	2.5	3.0	2	7.0	7.0	3	5.3	5.0	8	3.9	5.0	41	3.0	3.0
	E	115	3.9	3.0	152	4.5	4.0	96	4.3	3.0	327	3.3	2.0	164	3.7	3.0	185	5.1	5.0	111	3.6	3.0	300	3.5	3.0
	F	3	2.0	1.0	1			10	2.4	1.5	96	3.3	3.0	3	4.3	4.0	4	7.5	8.0	20	4.5	4.0	130	3.5	3.0

[1] Zone = 6 management areas established in 1995 for harvest quotas, N = sample size, $\overline{X}$ = average age of cougars in the sample, ***M*** = median age of cougars in the sample.

[2] Values are from cougar mortalities collected by WMU during 1987-1994 that were partitioned into the zones established in 1995.

Table 12. Proportion male, proportion adult female, and average age of adult female cougars killed in Oregon, 1987-2003.

		% Male[a]				% Adult Female[b]				Adult Female Average Age[b]			
	Management Zone	1987-1990	1991-1994	1995-1998	1999-2003	1987-1990	1991-1994	1995-1998	1999-2003	1987-1990	1991-1994	1995-1998	1999-2003
Hunting	A Coast–N Cascades	0.76	0.53	0.60	0.50	0.15	0.31	0.16	0.13	3.5	6.3	4.6	3.9
	B SW Cascades	0.64	0.60	0.50	0.54	0.19	0.25	0.20	0.21	4.4	5.6	5.3	4.9
	C SE Cascades		0.68	0.50	0.54		0.22	0.26	0.22		6.7	4.0	6.1
	D Columbia Basin		1.00	0.63	0.57		0.00	0.13	0.28			4.0	4.9
	E Blue Mountains	0.58	0.55	0.49	0.46	0.25	0.30	0.24	0.28	5.7	5.9	6.8	5.3
	F SE Oregon	0.50	0.75	0.65	0.51	0.00	0.00	0.11	0.25			4.5	5.0
	Average	0.62	0.69	0.56	0.52	0.15	0.18	0.18	0.23	4.5	6.1	4.9	5.0
Non-Hunting	A Coast–N Cascades	0.43	0.67	0.59	0.54	0.11	0.20	0.13	0.16	7.0	6.1	6.5	5.7
	B SW Cascades	0.55	0.58	0.59	0.59	0.06	0.20	0.10	0.09	7.0	4.7	4.7	4.3
	C SE Cascades	1.00	0.86	0.90	0.68	0.00	0.14	0.10	0.10		8.0	9.0	6.8
	D Columbia Basin	1.00		0.75	0.64	0.00	0.00	0.25	0.08			8.0	4.5
	E Blue Mountains	0.73	0.46	0.54	0.53	0.12	0.27	0.28	0.22	5.7	5.9	6.7	6.1
	F SE Oregon	0.60	1.00	0.67	0.68	0.20	0.00	0.09	0.10	4.0		6.0	4.5
	Average	0.72	0.71	0.67	0.61	0.08	0.14	0.16	0.13				
Combined	A Coast–N Cascades	0.64	0.59	0.59	0.53	0.13	0.26	0.12	0.22	4.7	6.3	5.9	5.1
	B SW Cascades	0.62	0.59	0.57	0.56	0.15	0.24	0.12	0.13	4.5	5.5	5.0	4.7
	C SE Cascades	1.00	0.71	0.65	0.59	0.00	0.20	0.19	0.17		6.9	4.8	6.2
	D Columbia Basin	1.00	1.00	0.67	0.59	0.00	0.00	0.15	0.20			6.0	4.9
	E Blue Mountains	0.59	0.54	0.52	0.48	0.22	0.31	0.25	0.27	5.7	5.9	6.8	5.5
	F SE Oregon	0.57	0.80	0.66	0.56	0.25	0.00	0.10	0.21	4.0		5.0	4.9
	Average	0.74	0.71	0.61	0.55	0.13	0.17	0.16	0.29	4.7	6.2	5.6	5.2

[a] Includes all males where sex and age could be determined.

[b] Includes only females know to be 3 years old or older.

CHAPTER V: COUGAR MANAGEMENT OBJECTIVES

In accordance with the Wildlife Policy (ORS 496.012), the purpose of this plan is to maintain cougar populations while managing cougar conflicts with humans, livestock, and other game mammals. In addition to meeting ODFW's statutory obligation, the following objectives address the broad range of public opinions regarding cougars in Oregon. Objective 1 establishes as ODFW policy the maintenance of a statewide population of cougars that is self-sustaining and assurtes the widespread existence of the species in Oregon. Objectives 2–5 address major types of cougar conflict. The five objectives are intended to be independent of each other. If objectives 2–5 can be achieved, the cougar population can be any number higher than the minimum objective of 3,000.

Objective 1: ODFW will manage for a cougar population that is at or above the 1994 level of approximately 3,000 cougars statewide.

Assumptions and Rationale

Cougars naturally occur at much lower densities than many other wildlife species, and are very secretive in nature. Because cougar observations are rare relative to other wildlife species such as deer and elk, many people feel cougar populations are in jeopardy. ODFW data (harvest records, modeling, etc.) indicate Oregon's cougar populations have increased statewide.

Historically, cougar populations were at much lower numbers than are currently estimated in Oregon. Application of existing Population Viability Analysis (PVA) models (STOCHMVP, INMAT2A, see Dennis et al. 1991 and Mills and Smouse 1994) to Oregon cougar data suggests the current modeled population estimate of 5,100, and the proposed minimum population threshold of 3,000 are much greater than the minimum number of individuals required for genetic and/or demographic viability. Both these values also are much greater than minimum population sizes required for persistence in most other populations and taxa where population viability has been estimated. The current habitat and prey populations in Oregon are sufficient to support a cougar population many times greater than the minimums reported above and are keys to long-term persistence of the cougar population.

Cougars are carnivores and rely on elk and deer in Oregon as primary prey. Thus, maintaining healthy elk and deer populations insures an adequate prey base for sustainable cougar populations. About 50% of Oregon's land base is in public ownership. Much of this area is contiguous elk and deer habitat that also is suitable cougar habitat. Further, scattered throughout Oregon are designated wilderness areas, wild and scenic rivers, and other areas where human access is limited and little cougar harvest occurs.

Cougar management in Oregon is complicated by a diverse array of competing viewpoints regarding cougars, making cougar management very contentious. Some people desire high deer and elk populations, few cougar-human or cougar-livestock conflicts, and would accept cougar population reduction. Others oppose reducing cougar numbers for any reason, particularly if it is simply to avoid conflicts with other human uses of the land or wildlife resource. Acceptable cougar population levels are dependent on individual perspectives.

The Fish and Wildlife Commission's direction in June 1995 was to stabilize the statewide cougar population at the estimated 1994 level of approximately 3,000. The intent of this plan is to address cougar conflict while maintaining a healthy population of at least 3,000 cougars

statewide. With adequate control of conflict, the cougar population may be any number higher than the minimum objective of 3,000.

Actions

1.1. Continue to authorize cougar hunting seasons in a manner that meets ODFW's statutory mandates to maintain the species and provide consumptive and non-consumptive recreational opportunities.

1.2. Continue the mandatory check of all harvested cougars.

1.3. Continue using sex and age data collected from all known mortalities to monitor cougar population status

1.4. Utilize GIS analyses (Figure 3) to evaluate habitat connectivity, and identify areas with limited or no cougar harvest (population source areas) as a result of limited public access.

1.5. Investigate new methods and options to monitor and evaluate cougar populations.

1.6. Utilize an adaptive management strategy (included in this plan) for managing cougars.

1.7. Continue to study cougar population characteristics as well as the impact of hunting on cougar populations. Research findings and new information will be used to evaluate, update and/or amend management programs.

1.8. Using information gained from actions 1.2 – 1.7, continue to update and evaluate zone population models.

1.9. Continue using population modeling to monitor cougar population status.

1.10. Maintain protection for spotted kittens and females with spotted kittens as a hunting regulation.

1.11. ODFW will manage for a population of cougars in Zone A that does not decline below an estimated population of 400.

1.12. ODFW will manage for a population of cougars in Zone B that does not decline below an estimated population of 1,200.

1.13. ODFW will manage for a population of cougars in Zone C that does not decline below an estimated population of 120.

1.14. ODFW will manage for a population of cougars in Zone D that does not decline below an estimated population of 80.

1.15. ODFW will manage for a population of cougars in Zone E that does not decline below an estimated population of 900.

1.16. ODFW will manage for a population of cougars in Zone F that does not decline below an estimated population of 300.

Objective 2: So long as objective 1 is met (statewide cougar population at or above 3,000 animals) ODFW will proactively manage cougar-human conflicts as measured by non-hunting mortalities (cougars taken as a result of livestock, human safety/pet complaints). ODFW may take management actions to reduce the cougar population.

Assumptions and Rationale

Non-hunting mortality has been consistently reported since 1970. It represents verified conflict and therefore is not as subjective as complaint or sighting reports. Non-hunting mortality is the best measure of cougar-human conflict and includes all known cougar deaths not caused by hunting (Table 7). Therefore, non-hunting mortality will be used as an index to measure conflict for Objective 2. Only cougars taken reactively as a result of livestock and human safety/pet complaints will be used. Cougars that die from road kill, illegal kill, disease, or other natural causes are not included in monitoring progress toward this objective.

Evaluation of mortality and age data suggest that non-hunting mortality levels observed for Zones A, B, and E in 1994 were generally acceptable to the public. For Zones C, D, and F, mortality and age data suggests that non-hunting mortality associated with cougar population recovery and expansion intensified about year 2000.

Actions

2.1. Continue to monitor non-hunting mortality resulting from livestock and human safety/pet complaints:

2.2. Manage for lower cougar densities in areas with recurring cougar-human conflict:

a) by informing citizens of their rights to address conflict involving cougars as allowed by Oregon law;

b) by considering additional hunting or control methods in those areas where cougar-human conflicts occur;

c) by targeting areas for more intensive cougar removal by ODFW employees or agents where cougar-human conflicts are the highest.

2.3. Encourage establishment and/or support of active U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) Agents in those 14 counties without established WS personnel:

a) by working with County Commissioners to encourage participation in the WS program;

b) by working with other groups to support WS funding.

2.4. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by non-hunting mortality, does not to exceed the 1994 level of 15 cougars in Zone A.

2.5. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by non-hunting mortality, does not to exceed the 1994 level of 11 cougars in Zone B.

2.6. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by non-hunting mortality, does not to exceed the 200 level of 5 cougars in Zone C.

2.7. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by non-hunting mortality, does not to exceed the 2000 level of 5 cougars in Zone D.

2.8. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by non-hunting mortality, does not to exceed the 1994 level of 13 cougars in Zone E.

2.9. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by non-hunting mortality, does not to exceed the 2000 level of 11 cougars in Zone F.

Objective 3: So long as objective 1 is met (statewide cougar population at or above 3,000 animals) ODFW will proactively manage cougar-human safety/pet conflicts as measured by human safety/pet complaints. ODFW may take management action to reduce the cougar population.

Assumptions and Rationale

Some Oregon residents have expressed a concern about being attacked by a cougar. Cougar attacks on humans are rare (Beier 1991). Fitzhugh et. al. (2003) documented 16 fatal attacks in North America. There has not been a documented, fatal human attack by a cougar in Oregon; however, from 1995 through 2003 there was an average of 26 (range 20 –39) cougars killed annually for threats to human safety/pets (Table 7).

Human safety complaints include situations where cougars appear accustomed to human activity and development, and are often seen during daylight hours in close proximity to houses and people. Pet losses due to cougars in populated areas are considered a human safety concern because of the close association of pets and humans. ODFW considers conflict levels observed in 1994 as generally acceptable to the public in Zones A, B, and E. Because of the apparent relatively recent increase in cougar population in Zones C, D, and F, ODFW believes objectives of minimizing conflict can be met by using trigger values for these three Zones that are reflective of levels observed in 2000.

ODFW contracts with Wildlife Services (WS) to conduct cougar control work in 22 Oregon counties. Control efforts are closely associated with individual safety complaints, and are designed to take only the animal creating the safety situation. To standardize damage control statewide, ODFW developed guidelines for responding to cougar sighting and damage complaints (Appendix B).

ODFW has statutory responsibility to address cougar-human conflict. As cougar numbers increased and the human population expanded into rural and suburban areas, cougar-human conflicts and complaints have increased since the early 1990's (Table 8). Continued human population expansion and habitat loss will ultimately result in increased conflict, and a decrease in numerous wildlife species, including cougars. Through implementation of this plan, conflicts will decline while maintaining a population of ≥ 3,000 cougars (Objective 1), which insures continued existence of a healthy cougar population in Oregon.

Actions

3.1. Encourage minimizing cougar-human conflicts through non-lethal methods where appropriate:

a) by providing the public with advice and educational material for reducing human safety risks associated with residences and property;

b) by providing the public with advice and educational material for reducing human safety risks while recreating in cougar habitat;

c) by providing advice and educational material on cougar behavior that can serve to minimize safety risks.

3.2. Manage for lower cougar population densities in and around areas of human occupancy:

a) by informing citizens of their rights to address human safety situations involving cougars as allowed by Oregon law;

b) by considering additional hunting or control methods in those areas where cougar-human conflicts occur;

c) by targeting areas for more intensive cougar removal by ODFW employees or agents (Administrative Removal) where cougar-human safety conflicts are the highest. Hunting will be used wherever possible. Administrative removal of cougars will only be used in areas where hunting alone has not proved effective at reducing conflict.

3.3. Encourage establishment and/or support of active WS Agents in those 14 counties without a WS program:

a) by working with County Commissioners to encourage participation in the WS program;

b) by working with other groups to support WS funding.

3.4. Evaluate new information and techniques used to minimize cougar-human interactions:

a) by monitoring research from other states and federal agencies to identify new ways to minimize human safety conflicts;

b) by supporting research to reduce cougar-human conflicts;

c) by adjusting cougar management based on results of the Adaptive Management process described in Chapter VI of this plan.

3.5. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by human safety/pet complaints, do not to exceed the 1994 level of 191 in Zone A.

3.6. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by human safety/pet complaints, do not to exceed the 1994 level of 84 in Zone B.

3.7. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by human safety/pet complaints, do not to exceed the 2000 level of 28 in Zone C.

3.8. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by human safety/pet complaints, do not to exceed the 2000 level of 20 in Zone D.

3.9. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by human safety/pet complaints, do not to exceed the 1994 level of 22 in Zone E.

3.10. ODFW may manage cougar-human conflicts so that the cougar population and distribution, as indicated by human safety/pet complaints, do not to exceed the 2000 level of 54 in Zone F.

Objective 4: So long as objective 1 is met (statewide cougar population at or above 3,000 animals), ODFW will proactively manage cougar-livestock conflicts as measured by non-hunting mortalities (cougars taken as a result of livestock) and livestock damage complaints. ODFW may take management actions to reduce the cougar population.

Assumptions and Rationale

Ranching and farming are important components of Oregon's economy. Addressing cougars–livestock conflict is an essential part of this management plan. Cougar–livestock conflicts reported to ODFW have increased to a high of 421 in 1999 and continue to be a concern (Table 8). As the cougar population has increased and the human population expanded into rural and suburban areas, the potential for cougar-livestock conflicts has increased. Dispersing sub-adult cougars compete with mature and established adults and are frequently forced into areas occupied by people with livestock. ODFW will give special attention around areas where cougar-livestock conflicts occur, with the overall objective to minimize such conflicts.

Cougars rarely cause damage to land or crops; most damage occurs when cougars take or attempt to take livestock. The Damage Statute (ORS 498.012) allows landowners (or lawful occupants) to take any cougar that is causing damage, is a public nuisance, or poses a public health risk on property they own or lawfully occupy, without first obtaining a permit from ODFW. The statute requires a person taking a cougar to immediately notify a person authorized to enforce the wildlife laws. Landowners may kill the individual cougar(s) causing the damage using dogs and/or with the aid of bait (ORS 498.164(3)).

Wildlife Services (WS) is contracted and paid by ODFW to conduct cougar control work in 22 Oregon counties. Control efforts are closely associated with individual damage complaints, and are designed to take only the animal creating the damage situation. In Oregon counties where WS is not available, landowners or their agents conduct damage control efforts. ODFW receives numerous phone calls from concerned citizens regarding cougar-livestock conflicts. Many complaints are handled by ODFW and do not result in a cougar being taken. Technical information, educational material on cougar behavior, and explanation of current laws regarding livestock protection from cougar depredation is often provided.

Actions

4.1. Encourage minimizing cougar-livestock conflicts through non-lethal methods:

a) by providing education on cougar behavior to minimize vulnerability of livestock.
b) by discussing alternatives in livestock management to reduce the potential for cougar conflicts.

4.2. Manage for lower cougar population densities in areas with cougar-livestock interactions:

a) by informing livestock owners of their rights to address damage as allowed by Oregon law;

b) by considering additional hunting or control options in those areas where cougar-livestock conflicts are high.

c) by targeting areas for more intensive cougar removal by ODFW employees or agents (Administrative Removal) where cougar-livestock conflicts are the highest. Hunting will be used wherever possible. Administrative removal will be used only in those areas where hunting alone has not proved effective at reducing conflict.

4.3. Encourage establishment and/or support of active WS Agents in counties with cougar-livestock conflicts:

a) by working with County Commissioners to encourage participation in the WS program;

b) by working with WS and other groups to support WS funding.

4.4. Evaluate new information and techniques used to control cougar-livestock interactions:

a) by monitoring research in other states or federal agencies to identify new cougar damage control options;

b) by supporting research on reducing cougar-livestock conflicts;

c) by adjusting cougar management based on the results of the Adaptive Management process described in Chapter VI of this plan.

4.5 ODFW may manage cougar-livestock conflicts so that the cougar population and distribution, as indicated by livestock complaints, do not to exceed the 1994 level of 102 livestock damage complaints in Zone A.

4.6 ODFW may manage cougar-livestock conflicts so that the cougar population and distribution, as indicated by livestock complaints, do not to exceed the 1994 level of 69 livestock damage complaints in Zone B.

4.7 ODFW may manage cougar-livestock conflicts so that the cougar population and distribution, as indicated by livestock complaints, do not to exceed the 2000 level of 24 livestock damage complaints in Zone C.

4.8 ODFW may manage cougar-livestock conflicts so that the cougar population and distribution, as indicated by livestock complaints, do not to exceed the 2000 level of 12 livestock damage complaints in Zone D.

4.9 ODFW may manage cougar-livestock conflicts so that the cougar population and distribution, as indicated by livestock complaints, do not to exceed the 1994 level of 25 livestock damage complaints in Zone E.

4.10 ODFW may manage cougar-livestock conflicts so that the cougar population and distribution, as indicated by livestock complaints, do not to exceed the 2000 level of 27 livestock damage complaints in Zone F.

Objective 5: So long as objective 1 is met (statewide cougar population at or above 3,000 animals), ODFW will proactively manage cougar populations in a manner compatible and consistent with management objectives for other game mammals outlined in ODFW management plans.

Assumptions and Rationale

As described under "Interactions with Ungulates" there is increasing evidence that cougar predation can limit some ungulate populations. ORS 496.012 directs the Fish and Wildlife Commission to maintain all species of wildlife at optimum levels, to provide optimum recreational benefits, and to regulate wildlife populations in a manner compatible with the primary uses of the land. In accordance with this direction, management plans have been established by Oregon Administrative Rule for bighorn sheep and mountain goat (OAR 635-120), elk (OAR 635-170), and mule deer (OAR 635-190). Most recent versions of the plans define desired levels or management objectives for each species. For elk and mule deer, management objectives include specific winter population levels and male:female ratios for each WMU. For bighorn sheep, ODFW seeks to restore viable populations in all historically occupied habitats that are currently suitable.

Actions

5.1. Manage for healthy populations of all game mammals;

5.2. Identify game mammal populations that are below adopted objectives and where cougar predation may be a limiting factor;

5.3. Increase cougar harvest to address target populations identified in action #5.2 while maintaining minimum cougar populations for each zone:

a) by providing hunters educational material describing successful cougar hunting strategies and continuing a strong public outreach program regarding cougar impacts to other game mammal populations;

b) by managing hunts and hunters to increase cougar harvest in target areas;

c) by utilizing ODFW employees and/or its agents to increase cougar take in target areas. Hunting will be used wherever possible. Administrative removal will be used only in those areas where hunting alone has not proved effective at reducing conflict.

5.4. Continue collecting data and conducting surveys for use in identifying and clarifying game mammal population problems identified in action #5.2.

5.5. Adjust cougar management for each zone based on the Adaptive Management process described in this plan.

CHAPTER VI: ADAPTIVE MANAGEMENT PROCESS

Adaptive resource management acknowledges uncertainty in management practices and the need to learn from management activities (Lancia et al. 1996). While traditional wildlife research seeks specific answers through controlled experiments and monitoring, projects tend to be relatively small scale due to monetary and logistic constraints. Adaptive management provides a mechanism to understand problems at a larger scale that is more applicable to specific management situations. Similar to research, the process of adaptive management relies on the scientific method that includes synthesis of existing knowledge, proposing testable hypotheses, implementing treatments, monitoring outcomes of treatments and controls, and adjusting management based on information gained from the experiment. However, adaptive management differs from a research experiment in that the study occurs at the management scale, and uses changes in management as the actual treatment. This difference represents the greatest strength of adaptive management.

Anderson and Lindzey (2005) manipulated a cougar population in Wyoming and found cougar harvest composition can be used to adaptively manage cougar populations where sex and age data are collected from harvested cougars. Composition of adult females in the harvest was used to measure progress toward population objectives in two Wyoming study areas. This approach worked because different sex and age segments of the population have different vulnerabilities to harvest, with adult females being least vulnerable. In one study area, harvest was increased to over 40% of the population for 2 years. The adult female proportion of the harvest increased from 14% to 41% as the resident adult population declined by approximately 60%. Harvest rates were then reduced to 18% of the population for 3 years and the population recovered to near pretreatment levels as did proportion of adult females in the harvest. In a second study area, harvest quotas were increased by 240% for seven years. Quotas were never met, but data indicated management objectives to reduce and stabilize the cougar population were met. Following the first treatment year of intensive harvest, the mean age of adult females dropped from 6–8 years old to 3–4 years old in both areas. ODFW data show that from 2001 – 2003, adult females (3 or more years old) made up 19.6% of the harvest in Oregon with a mean age of 4.8 years (Table 12). This suggests cougar populations in Oregon are not declining.

ODFW's Adaptive Management Plan for Cougar

Statewide

Oregon is a diverse state varying in elevation from sea level to over 10,000 feet in elevation. Habitat varies from temperate rain forests and broad valleys west of the Cascade Mountains to sagebrush steppe deserts in the southeast quarter of the state and mixed conifer forests in the Blue Mountains and eastern slope of the Cascades. In Oregon, 55% of the land is publicly owned (Levine 1995) and managed primarily by the U.S. Forest Service and Bureau of Land Management. Additionally, much of the private property is timber lands or range lands which provide cougar habitat. Most (87%) of the human population resides in the interior valleys west of the Cascade Mountains (Levine 1995). Wildlife populations are as diverse as the habitats of the state. While there are areas of non-suitable cougar habitat, and highly urbanized areas where cougar presence is not desirable, most of the state provides suitable habitat with multiple prey species. Habitat continuity within Oregon provides unrestricted opportunity for movement and dispersal, which has been demonstrated by expansion of cougar distribution to include almost the entire state. Cougar populations have increased in Oregon over the last 35

years (Keister and Van Dyke 2002). With such great diversity in habitat, wildlife, and human habitation patterns, interactions of cougars with people and other wildlife species vary across the state.

For management purposes, Oregon is divided into 6 cougar management zones each with similar habitats, human demographics, land use patterns, prey base, and cougar density. Each zone is comprised of several WMUs and areas of emphasis and/or conflict. Adaptive management will be employed to manage cougar populations by zone, WMU, or target areas for 5 years to meet management goals and objectives. Available data on trends in cougar-human/livestock conflicts or elk, deer, and bighorn sheep populations will be evaluated to identify zone specific areas where cougar population treatments are needed. Cougar harvest quotas for all known human caused mortalities (hunting, conflict, targeted removal) will be established based on the estimated cougar population in the zone as determined by zone specific population models. Adaptive management requires an assessment of treatment effects before and after the treatment is implemented. Results will be evaluated and management will be adjusted as necessary to meet objectives.

All management activities will be carried out using an adaptive management approach, as suggested in the Cougar Management Guidelines (2005), which allows for monitoring, evaluation, and changes in management based on results. However, because each cougar management zone in Oregon is unique with its own issues and challenges, each zone may be managed differently to achieve goals and management objectives specific to that zone. As suggested by the Cougar Management Guidelines (2005), harvest will occur at three levels of intensity within each zone. Most zones contain wilderness and roadless areas, or other areas that will receive little harvest. Other areas within each zone will be identified and managed more intensively to achieve objectives for cougar-human conflicts, cougar-livestock conflicts, and/or elk, deer, bighorn sheep, and mountain goat populations. Cougar population reduction will be a priority around high human habitation where conflict exists. Areas around some recent native species transplants, big game winter ranges, and other areas of high game mortality may be targeted for intensive cougar harvest if cougar predation is identified as a limiting factor (Oregon Department of Fish and Wildlife 2003a). Intensive cougar management in targeted areas should meet objectives for reducing cougar conflicts. Yet moderate cougar harvest in other areas, and little or no harvest in areas with limited hunter access should maintain cougar populations at or above the minimum identified in Objective 1.

Hypotheses to be Tested and Measurement Criteria

1) Increased cougar mortality near human habitation will reduce cougar-human conflicts to desired levels. Criteria to measure conflict will primarily be non-hunting mortality and secondarily number of complaints received.

2) Increased cougar mortality in areas with low ungulate population levels will increase ungulate recruitment or survival and allow population objectives to be met. Criteria to measure elk recruitment will be based on spring calf:cow ratios. Based on elk population modeling and case histories, ODFW believes 23 calves:100 cows is necessary to maintain an elk herd in the absence of antlerless elk hunting. Trend counts or population modeling will determine attainment of ungulate population objectives.

3) Areas with low – medium cougar harvest will act as source populations serving to maintain cougar populations at or above minimum levels. Criteria to measure cougar

population status will be based on known cougar mortality (including total mortality, age and sex ratios, average age of adult females), research results, and population modeling.

4) Increased cougar mortality near areas of livestock concentrations will reduce cougar-livestock conflicts to desired levels. Criteria to measure conflict will primarily be non-hunting mortality and secondarily number of complaints received.

Objectives for Cougar Management

Management objectives and actions will be implemented and monitored at three levels: statewide, by zone, and by target area (Table 13). The Statewide objective is to decrease cougar conflicts to an acceptable level while maintaining a total population of at least 3,000 cougars.

ODFW will continue population modeling by zone and will monitor the proportion of adult females in the total known mortality to insure cougar populations do not drop below zone minimums. Proportion of adult females in the total known mortality indicates whether cougar numbers are increasing, decreasing, or stable. When the proportion of adult females exceeds 25%, research indicates the cougar population begins to decline (Anderson and Lindzey 2005).

Areas with recurring cougar-related conflict will be identified as Target Areas. To decrease conflict in target areas, the objective will be to decrease cougar numbers within the area. Target areas may vary in size from large (e.g. an entire WMU where conflict is generally associated with game mammals) to small areas encompassing specific areas of livestock damage or human safety/pet conflict. When target areas are the size of a WMU, cougar removal should be intensive enough

Table 13. Summary of management objectives and actions at different scales in Oregon.

Scale	Objective	Action
Statewide	Cougar population estimate > 3,000.	Adjust harvest to maintain cougar population > 3,000.
	Non-hunting mortality related to human safety/pet and livestock complaints < 60/year.	Treat targeted areas to achieve objectives (see zone descriptions and Tables 16-21.
	Human safety and pet complaints < 350/year.	Treat targeted areas to achieve objectives (see zone descriptions and Tables 16-21.
	Livestock complaints < 2/year.	Treat targeted areas to achieve objectives (see zone descriptions and Tables 16-21.
	Meet management objectives for other game mammals.	Treat targeted areas to achieve objectives (see zone descriptions and Tables 16-21.
Zone	Meet specific objectives for each zone (see zone descriptions).	See zone descriptions and Tables 16-21 for objectives and criteria.
	Maintain a three-year average proportion of adult (3+ year old) female cougars in the total mortality at no more than 25-35%.	Adjust cougar harvest to achieve objective.
	Do not exceed total mortality quotas for each zone.	If zone quotas are met, hunting and target area harvest will cease; livestock damage and human safety response will continue.
Target Areas	Resolve conflicts by decreasing cougar numbers. Increase the three-year average proportion of adult (3+ year old) females in the total mortality to 40-45% with a subsequent decline in average age of adult females to 3 - 4 years old.	Apply intensive harvest to target areas to meet objectives (see Tables 16-21). Target area harvest will cease when: 1) objectives are met or 2) zone quotas have been met or 3) it is determined that intensive cougar removal cannot meet objectives.

to result in an initial increase in adult females in the total mortality up to 40-45%, followed by a decline in subsequent years as resident adult females are removed. As adult female cougar numbers decrease in the target area, the mean age of adult females should decline to 3-4 years (Anderson and Lindzey 2005). If conflict is occurring in areas that are small (generally associated with human safety/pet and livestock conflicts) the specific proportion of adult females in the total mortality has limited application. Therefore, in these areas, cougars will be removed until the conflict subsides in the target area. With a decreased cougar population in the target area a decrease in cougar conflict is expected. As young cougars migrate into the target area, control will have to continue at some lower level, or resume at more intensive levels in the future date to insure cougar conflict is held at acceptable levels.

Proposed Techniques to Reach Adaptive Management Objectives

Techniques ODFW managers have used for cougar management include:

1) Manipulate cougar hunting season structure, i.e. controlled hunting, general seasons;
2) Establish the annual number of cougar tags available;
3) Manipulate hunting bag limits;
4) Manipulate hunting season length;
5) Establish legal methods for cougar hunting; and
6) Distribute cougar harvest by zone using a quota system.

These techniques revolve around using hunting to address cougar management goals. Subsequent to passage of Measure 18 in 1994, harvest quotas have not been met in most zones. This has resulted in ODFW not being able to control cougar population growth or adequately resolve cougar-human conflicts.

Many techniques utilized to control damage problems and/or human concerns with other wildlife species appear ineffective with cougars (Conover 2002). Exclusion (fencing), chemical repellants, fumigants, toxicants, chemical sterilants, scare devices, capture and re-location, harassment (pursuit seasons), and modifying human behavior or animal husbandry methods have been inappropriate or inadequate for control of cougar-human conflict. Reduction of cougar numbers, in areas of identified conflict, may be the best approach to achieve desired objectives.

The Cougar Management Guidelines (Cougar Management Working Group 2005) made 11 recommendations for management of cougar hunting. ODFW's previous cougar management has implemented all recommendations other than developing an adaptive management framework (as proposed in this plan). ODFW can meet proposed management objectives through a combination of public hunting and administrative cougar removal (by agency personnel or agents) in targeted areas with recurring conflict and within the adaptive management process described in this plan. Quotas established under adaptive management will include all known mortality, not just hunting mortality (Table 14). Quotas under adaptive management will be evaluated annually and will be set to meet objectives. In order to compare non-hunting mortality prior to implementation of this plan with future non-hunting mortality, cougars taken proactively by administrative removal in target areas will be recorded separately. Cougars taken reactively in response to specific complaints will continue to be recorded as non-hunting mortality.

Zone A – Coast/North Cascades

Table 14. Comparison of 2006 cougar hunting quotas, total mortality quotas under adaptive management, and 2003 cougar population estimates in Oregon.

Quota Zone	2006 Hunting Quota	Adaptive Management Total Mortality Quota	2003 Estimated Population
A Coast/N Cascade	152	120	615
B SW Cascade	173	165	1,534
C SE Cascade	61	65	331
D Col. Basin	22	62	318
E Blue Mtns.	160	245	1,581
F SE Oregon	100	120	722
Statewide Total	668	777	5,101

The Coast/North Cascades Cougar Management Zone (Figure 1) is comprised of approximately 21,790 mi^2 (37% public land) of which approximately 19,600 mi^2 is occupied by cougars. The remainder is open agricultural land, developed areas, and water bodies. This zone includes the Coast Range Mountains as well as a portion of the Klamath Mountains, the Willamette Valley, and approximately the northern third of the Cascade Mountains. Sixteen WMUs and the Warm Springs Indian Reservation make up this zone. The zone includes 15 Wilderness Areas (884 mi^2), and numerous U.S. Forest Service "Inventoried Roadless Areas" that total an additional 775 mi^2. The White River and Jewell Meadows Wildlife Areas, major big game winter ranges, are in this zone. Elevations range from sea level to the 11,240-foot peak of Mount Hood. Habitats are diverse, ranging from flat agricultural lands in the Willamette Valley to alpine habitats at the highest elevations above extensive mixed conifer forests (Figure 5). This zone has the highest human population of any cougar management zone with major human populations around the Portland, Salem, and Eugene metropolitan areas. There are numerous other smaller communities located primarily in the Willamette Valley and coastal bays. Primary industries outside the metro areas include ranching, farming, timber, and recreation.

Based on population modeling, the Zone A population density increased from 2.2 cougars/100 mi^2 of habitat in 1994 to 3.1 cougars/100 mi^2 of habitat in 2003 (Oregon Department of Fish and Wildlife, unpublished data). From 2001 through 2003, 13.3% of the cougar mortality in the zone was adult (3 yr+) females with an average age of 5.4 years (Oregon Department of Fish and Wildlife, unpublished data). Cougar-human conflict in Zone A increased substantially since the early 1990's due to increasing cougar numbers and increasing human population. Non-hunting mortality in response to livestock and human safety/pet complaints increased from 15 in 1994 to 40 in 2003 (Appendix G). In Zone A, non-hunting mortality has been higher than hunter harvest since 1995 (Table 15).

Cougar complaints increased from 153 in 1993 to 293 (102 livestock, 191 human safety/pets) in 1994, climbed to a high of 425 in 1996, and declined to 236 in 2003. A major reason for the decline since 1999 was cougar sightings were recorded separately from complaints. For example in 2003, 84 sightings were recorded separately and not included in the complaint total (Appendix H). Complaints include concerns for human safety and pets, as cougars are seen on private property, near residences, and in city limits, and concerns for livestock safety and loss.

Elk population trends have been increasing for several decades in most WMUs in this Zone. In recent years, elk populations in several WMUs have been stabilized through antlerless elk hunts to control populations at Management Objective (MO) levels. The forage base

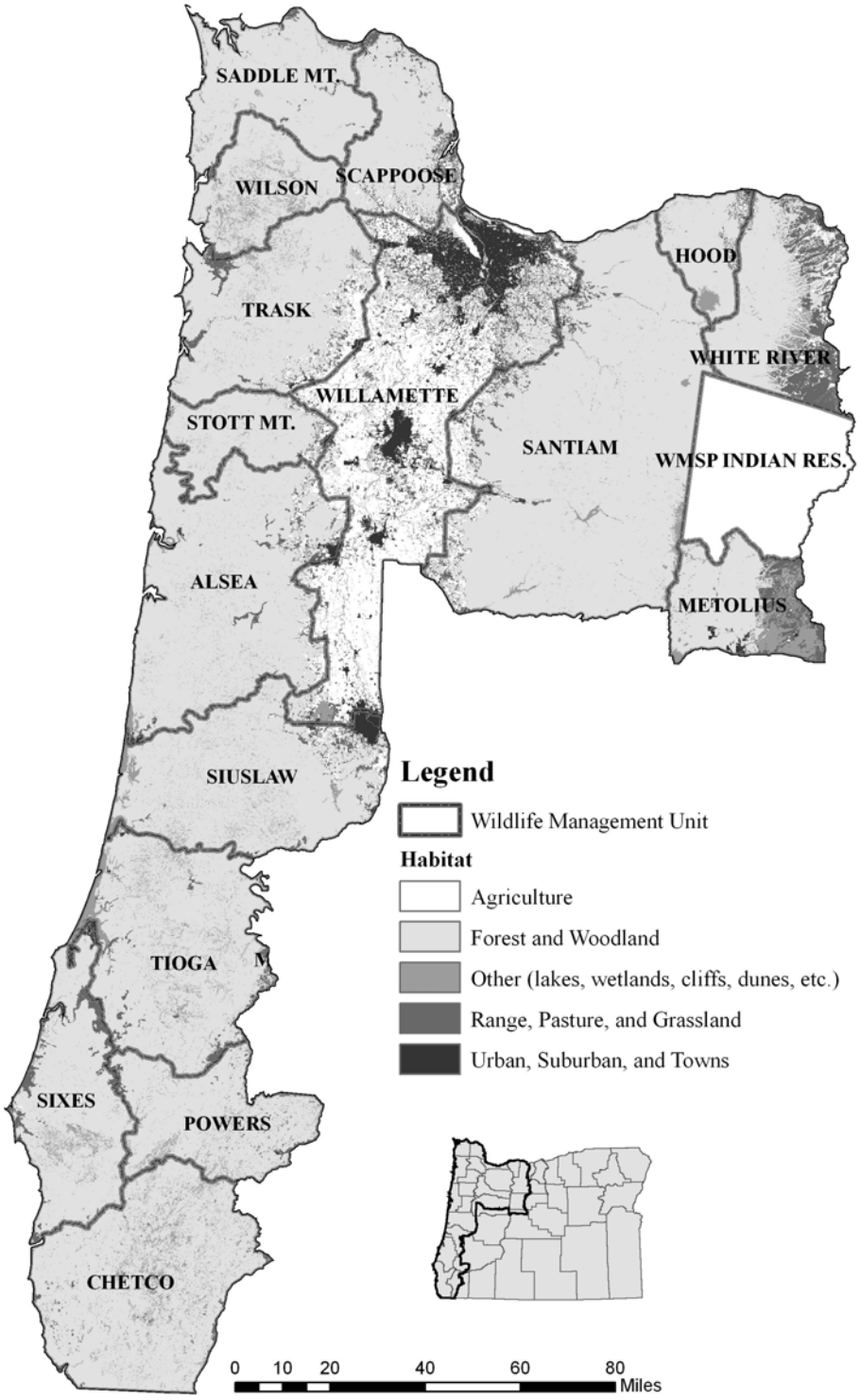

Figure 5. Habitat characteristics of cougar management zone A.

Table 15. Number of male and female cougars killed in Oregon by cougar quota management zone. Only animals of known sex are included.

		A			B			C			D			E			F		
Class	Year	♂	♀	Total	♂	♀	Total	♂	♀	Total	♂	♀	Total	♂	♀	Total	♂	♀	Total
Hunting	1987	5	5	10	30	15	45			0			0	38	35	73			0
	1988	13	3	16	39	19	58						0	36	25	61	1		1
	1989	4	2	6	29	21	50						0	40	20	60			0
	1990	13	1	14	71	41	112						0	41	33	74		1	1
	1991	3	1	4	35	14	49	2	2	4			0	35	32	67			0
	1992	7	7	14	48	33	81	4		4			0	52	33	85			0
	1993	11	5	16	36	29	65	6	4	10			0	43	28	71			0
	1994	12	16	28	44	34	78	7	3	10	3		3	35	40	75	3	1	4
	1995		1	1	6	1	7						0	6	7	13	1		1
	1996	4	4	8	7	4	11	3		3	2	2	4	9	6	15	2		2
	1997	11	7	18	4	7	11	3	1	4			0	9	12	21	5	2	7
	1998	18	10	28	5	10	15	2	7	9	3	1	4	22	22	44	5	5	10
	1999	13	17	30	13	14	27	8	7	15	3		3	25	48	73	9	11	20
	2000	21	11	32	14	15	29	3	4	7	6	3	9	41	43	84	18	9	27
	2001	11	13	24	23	14	37	10	11	21	7	2	9	51	46	97	13	18	31
	2002	13	15	28	15	17	32	6	6	12	6	9	15	41	61	102	23	20	43
	2003	17	19	36	17	11	28	11	4	15	4	6	10	58	59	117	20	23	43
Non-Hunting	1987	3	4	7	1	2	3						0		2	2		1	1
	1988	3	3	6	10	4	14				1		1	2	1	3	1	1	2
	1989	1	1	2	9	6	15				1		1	8	3	11			0
	1990	5	8	13	8	11	19	2		2	1		1	9	1	10	2		2
	1991	4	1	5	10	8	18	1		1			0	5	9	14			0
	1992	7	4	11	6	7	13	3		3			0	7	4	11			0
	1993	11	4	15	12	8	20						0	5	5	10	1		1
	1994	10	7	17	12	6	18	2	1	3			0	7	10	17			0
	1995	18	9	27	17	7	24	2		2			0	9	12	21	1		1
	1996	22	15	37	23	21	44	3	1	4	2	1	3	17	13	30			0
	1997	23	19	42	17	13	30	2		2			0	25	17	42	1	1	2
	1998	20	14	34	20	13	33	2		2	1		1	25	22	47	6	3	9
	1999	16	10	26	19	17	36	4	4	8	1	1	2	29	35	64	13	3	16
	2000	25	23	48	21	13	34	5	3	8	5	1	6	26	24	50	6	4	10
	2001	26	29	55	19	17	36	7	2	9	3	1	4	15	12	27	5	6	11
	2002	37	19	56	26	18	44	6	2	8	2	3	5	22	16	38	10	6	16
	2003	20	24	44	32	18	50	5	2	7	5	3	8	20	13	33	16	5	21

necessary to support elk populations at current levels appears to be declining in much of the zone as a result of changes in forest management on public and private lands (Oregon State University 2005). On public lands there has been a reduction of timber harvest as well as a shift from clear-cut logging to selective cutting. On private timberlands, timber management has become much more intensive. The result is less forage available on both public and private forestlands. Spring calf ratios have not shown a declining trend (Oregon Department of Fish and Wildlife 2003b)

and have been well above the ratio of approximately 23 calves:100 cows necessary to maintain elk herds in the absence of antlerless elk hunting. Elk populations in this zone do not appear limited by cougar predation at this time. Elk populations could decline over the next several decades in some WMUs within the zone if the forage base continues to decline because of forest management. In some WMUs forage already regulates elk reproduction because lactating Roosevelt cow elk seldom breed in the year following successful reproduction (Trainer 1971). Trainer (1971) suggested elk forage quality in the Coast Range was poor, resulting in lactating cow elk not ovulating. If elk numbers decline enough, cougar predation could create a predator pit and limit population recovery.

Deer throughout Zone A have shown a declining trend for many years as measured by declining harvest levels and hunter success rates. As with elk, the forage base necessary to support deer appears to be declining in much of the zone as a result of changes in forest management on public and private lands (Oregon State University 2005). Beginning about 1998, Deer Hair Loss Syndrome (DHLS) became evident in northwest Oregon, and has since spread throughout the lower elevations of this Zone. Adenovirus hemorrhagic disease (AHD) has also been detected in Zone A. With DHLS and AHD mortality currently apparent in much of the zone, ODFW does not believe cougar predation is the primary factor affecting deer populations at this time. If the DHLS and AHD problems subside, as is typical of most disease concerns, cougar predation could potentially limit deer population recovery if deer numbers decline and a predator pit develops.

As human and cougar populations have increased in Zone A over the last two decades, cougar–human conflicts have increased. Cougar hunting seasons were liberalized after Measure 18 was passed in an attempt to control cougar population growth. A harvest quota was established for Zone A intended to stabilize the population at the 1994 level. Liberalization of cougar hunting has proven inadequate to control cougar population growth and resulting cougar-human conflicts. Hunter harvest has ranged from 25% to 30% of the zone quota over the last 5 years. A major obstacle to reaching harvest quotas has been that much of the conflict occurs on private property and hunter access is limited. Much of the hunter harvest in this zone occurs in forested areas well away from human conflict areas. Landowner options for damage control have proven inadequate. Although dogs and trapping can still be used to address damage, landowners are limited to their own property for any control efforts, while cougars often leave their property after causing damage. WS programs, which provide some options for control on adjacent properties, are not funded or are only partially funded in many counties in this zone. This limits options available to landowners to deal with cougar conflicts. Management challenges in Zone A are to increase effectiveness of non-lethal methods to reduce conflict and to increase lethal cougar control to reduce cougar numbers in target areas.

Adaptive management may be used to reduce conflict to 1994 levels, as measured by non-hunting mortality and complaints. Mortality quotas will include all known mortalities due to human causes. The minimum cougar population for Zone A is 400. Modeling indicates a total human-caused mortality of 120 cougars/year (Table 14) for 5 years could occur without reducing cougar numbers below the minimum population of 400. If total human caused mortality reaches 120/yr for 5 years, subsequent mortality would need reduced to approximately 60 cougars/year to prevent the population from declining below the minimum. Conflict will be monitored with established measurement criteria and management will be adjusted based on results.

Approximately 20% of Zone A is in wilderness areas, roadless areas, state parks, municipal watersheds, or large blocks of private industrial forest lands with limited public access where cougar harvest is expected to be low. Identified target areas will be managed more intensively to achieve objectives for cougar-human conflicts. Particular attention will be given to areas around human habitation where cougar-human conflicts have been documented. Intensive cougar management in targeted areas should meet objectives for reducing cougar-human conflict. Moderate cougar harvest in much of the zone and limited harvest in areas of restricted hunter access will maintain cougar populations at or above minimum levels.

Cougar Management in Zone A

If criteria defined in Table 16 are met, total cougar mortality may be increased in targeted areas throughout Zone A. Areas of human habitation with elevated or recurring cougar-human

Table 16. Adaptive management parameters for Cougar Management Zone A: Coast/North Cascades.

Management Concern	Indicator	Objectives	Criteria Triggering Targeted Area Management
Sustain Populations	Cougar population	Cougar population estimate >400 cougars for the zone	Cougar population estimate <400 cougars will result in harvest reductions in the zone.
	Cougar Mortality	Do not exceed total mortality quota	If zone quotas are met, hunting and target area harvest will end. Response to livestock damage and human safety/pet complaints will continue.
Human Interactions	Non-hunting mortality related to livestock and human safety/pet	< 15 cougars killed per year for the zone	>15 cougars killed/yr could trigger control in areas around human habitation or livestock operations.
	Human safety and pet complaints	< 191 complaints per year for the zone	> 191 complaints/yr could trigger control in areas around human habitation.
	Livestock complaints	< 102 complaints per year for the zone	> 102 complaints/yr could trigger control in areas around livestock operations.
Ungulate Populations	Elk	Maintain 3 year mean calf ratios comparable to 1994 levels which averaged approximately 30 - 40 calves/100 cows	Units with < 23 calves/100 cows for 3 years and below population Management Objective for 3 years.
	Deer	Maintain healthy populations with little evidence of disease that support optimum deer populations	Target only when evidence indicates cougar predation threatens viability of the deer population.
	Ungulate transplants	Insure viable transplants	Target only when evidence indicates cougar predation threatens success or viability of transplant.
	Wildlife Areas (WA)	Meet Management Objectives of the Area	Target WA if cougars prevent achieving WA objectives.

conflict may be identified for more intensive cougar management. Currently this applies primarily to the Willamette Valley and adjacent foothill fringe where the highest human population occurs. Desired outcomes include a decrease in cougar-human conflicts measured by non-hunting mortality and cougar complaints. Results will be monitored and hunting or cougar removal programs modified to meet desired outcomes for the zone (Table 16).

Of 16 WMUs in the zone, none currently have elk or deer populations at levels that would trigger intensive cougar control. If data indicate cougar predation is affecting ODFW's ability to meet deer or elk population objectives, some areas may be targeted for intensive cougar control (Table 16).

In the future ODFW may consider transplanting certain wildlife species within Zone A. Columbia white-tailed deer populations within the zone are federally classified as an endangered species. Recovery efforts could involve establishing new sub-populations in the zone. ODFW is restoring mountain goats to historic habitats throughout the state, and several release sites are identified in the zone. If evidence indicates cougar predation threatens transplant success or viability, release areas may be targeted for intensive cougar control.

Zone B – Southwest Cascades

The Southwest Cascades Cougar Management Zone (Figure 1) includes approximately 12,355 mi^2, 56% of which is public land. Zone B includes the southern two-thirds of the west slope Cascade Mountains, 1,030 mi^2 of the southeast portion of the Cascades (Keno WMU), the northern portion of the Siskiyou Mountains in Oregon, the Rogue Valley, Umpqua Valley, and a portion of the Willamette Valley. Eight WMUs make up this zone. Zone B includes 3 wilderness areas, 2 national wildlife refuges, two national monuments, several municipal watersheds and roadless areas, (2,300 mi^2) and a portion of Crater Lake National Park. Elevations range from approximately 200 feet to the 9,475-foot peak of Mount McLoughlin. Habitats are diverse, ranging from flat agricultural lands in valley floors to alpine habitats at high elevations above extensive mixed conifer forests (Figure 6). This zone has the second highest human population of any cougar management zone. Human population centers include Springfield, Roseburg, Grants Pass, Medford, Ashland, and portions of Klamath Falls. There are numerous other smaller communities located primarily in valley floors. Primary industries include construction, ranching, farming, timber, and recreation.

Based on population modeling, cougar population density in Zone B increased from 10.0 cougars/100 mi^2 in 1994 to 12.6 cougars/100 mi^2 of habitat in 2003 (Oregon Department of Fish and Wildlife, unpublished data). From 2001 through 2003, 13.9% of the cougar mortality in the zone was adult (3 yr+) females with an average age of 4.4 years (Oregon Department of Fish and Wildlife, unpublished data). Cougar-human conflict in Zone B increased substantially since the early 1990's due to increasing cougar numbers and increasing human population. Non-hunting mortality in response to livestock and human safety/pet complaints increased in the zone from 11 in 1994 to 43 in 2003 (Appendix G). Since 1995, non-hunting mortality has been higher than hunter harvest (Table 15).

Cougar complaints increased from 153 (69 livestock, 84 human safety/pets) in 1994, climbed to a high of 379 in 1999, and declined to 248 in 2003 (Appendix H). A major reason for the decline since 1999 was cougar sightings were recorded separately from complaints. For example in 2003, 60 sightings were recorded separately and not included in the complaint total

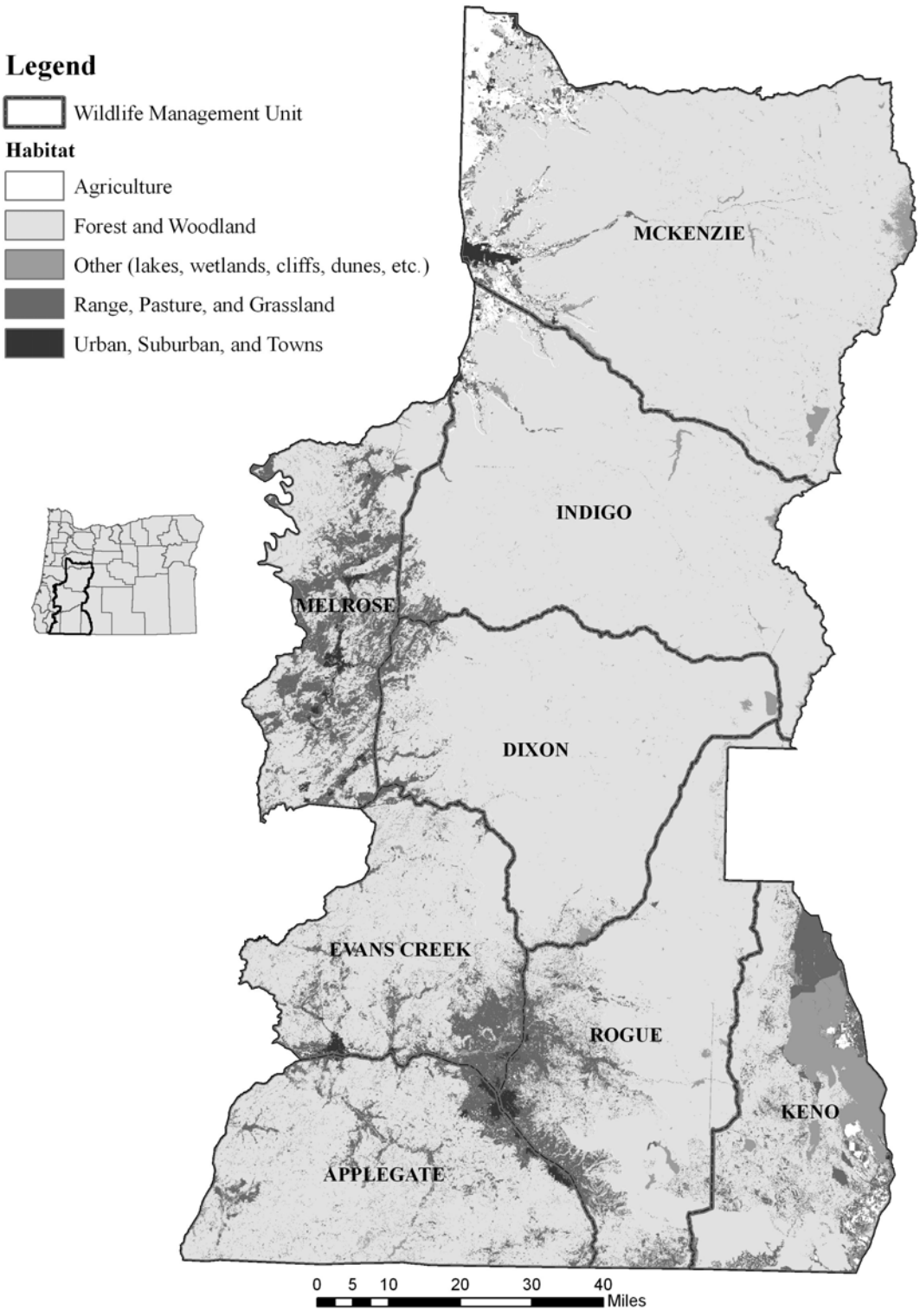

Figure 6. Habitat characteristics of cougar management zone B.

(Appendix H). Complaints include concerns for human safety and pets, as cougars are seen on private property, near residences, and in city limits, and concerns for livestock safety and loss.

Elk populations in Zone B have been increasing for several decades. In recent years, elk populations in several WMUs have been stabilized with antlerless elk hunts to control populations at Management Objective. Spring calf ratios have not shown a declining trend (Oregon Department of Fish and Wildlife 2003b) and have been above the ratio of 23 calves:100 cows necessary to maintain elk herds in the absence of antlerless elk hunting. The forage base necessary to support elk populations at current levels appears to be declining in much of the zone as a result of changes in forest management on public and private lands (Oregon State University 2005). On public lands there has been a reduction of timber harvest as well as a shift from clear-cut logging to selective cutting. On private timberlands, timber management has become more intensive. The result is less forage available on forested lands. Elk populations in Zone B currently have calf ratios above maintenance levels and do not appear limited by cougar predation, although ODFW is aware that cougars prey on elk and elk calves in this zone. Elk populations, particularly on public lands, could decline over the next several decades if the forage base declines because of forest management. If elk numbers decline enough, cougar predation could create a predator pit and limit population recovery.

Declining harvest levels, hunter success rates, and annual spring inventories suggest deer have been declining in Zone B for many years. As with elk, the forage base necessary to support deer appears to be declining as a result of changes in forest management (Oregon State University 2005). On public lands, there has been a reduction of timber harvest as well as a shift from clear-cut logging to selective cutting. On private lands, intensive timber management has resulted in a quick conversion of potential early seral stage habitats into established timber production. The result has been less deer forage available on both public and private forest lands. In the southern portion of this zone, black-tailed deer migrate from higher elevation summer range in the Cascades and Siskiyou Mountains to winter range in the lower elevations of valley sub-floors. This is particularly apparent in Jackson and portions of Josephine and Klamath counties. With increasing urban development, deer winter range is decreasing. Beginning about 1998, DHLS became evident in northwestern Oregon and spread south throughout some of the lower elevations of this zone, mostly in Lane, Douglas, and Josephine counties in approximately four years. AHD has also been detected and in some places mortality loss may have been high. If DHLS and AHD problems subside, as is typical of most disease concerns, cougar predation could potentially limit deer population recovery if deer numbers decline and a predator pit situation develops.

As populations of people and cougars have increased in this zone, cougar-human conflicts have increased. After Measure 18 banned using dogs to hunt cougars in 1994, hunting seasons for cougars were liberalized in an attempt to control cougar population growth. A harvest quota was established at a level intended to stabilize the population at the 1994 level. Liberalization of cougar hunting has proven inadequate to control cougar population growth and resulting cougar-human conflicts. Hunter harvest has ranged from 18% to 36% of the zone quota over the last 5 years. One of the challenges is that much of the conflict occurs on private property and access for hunters is limited. Much of the hunter harvest in this zone occurs in forested areas well away from high conflict areas. Landowner options for damage control have proven inadequate. Although dogs and trapping can still be used for damage control, landowners

are limited to their own property for any control efforts while cougars often leave their property after the damage occurs. WS programs, which provide some control options on adjacent properties, are only partially funded in most of the zone and not funded in Jackson and Josephine counties. This leaves landowners limited options to deal with cougar conflicts. A challenge in Zone B will be to increase effectiveness of non-lethal methods to reduce conflict, and lethal cougar control to reduce cougar numbers in high conflict areas.

Adaptive management may be used to reduce conflict to 1994 levels, as measured by non-hunting mortality and complaints. Mortality quotas will include all known mortalities due to human causes. The minimum cougar population for Zone B is 1,200. Modeling indicates a total human caused mortality of 165 cougars/year (Table 14) for 5 years could occur without reducing cougar numbers below the minimum population of 1,200. If total human caused mortality reaches 165/yr for 5 years, subsequent mortality would need reduced to approximately 116 cougars/year to prevent the population from declining below the minimum. Conflict will be monitored with established measurement criteria and management will be adjusted based on results. Areas with limited public access, which account for approximately 20% of the zone, will receive little or no harvest. Other areas will be managed more intensively to achieve objectives for cougar-human conflicts. Particular attention will be given to areas around human habitation, where cougar-human conflicts have been documented. Intensive cougar management in targeted areas should meet objectives for reducing cougar–human conflict. Moderate cougar harvest in much of the zone and limited harvest in areas of restricted hunter access will maintain cougar populations at or above minimum levels.

Cougar Management in Zone B

If criteria defined in Table 17 are met, total cougar mortality may be increased in targeted areas throughout Zone B. Areas of human habitation with elevated or recurring cougar–human conflict may be identified for more intensive cougar management. Currently this applies to the foothill fringe and valley floor of the Rogue Valley, Umpqua Valley, and the Southeast portion of the Willamette Valley. Desired outcomes include a decrease in cougar-human conflicts measured by non-hunting mortality and cougar complaints. Results will be monitored and hunting or cougar removal programs modified to meet desired outcomes for the zone (Table 17).

Excluding Applegate WMU, areas with 3-year average elk calf ratios below maintenance level of 23 calves/100 cows may be targeted for intensive cougar harvest. Of 8 WMUs in the zone, none currently have elk or deer populations at levels that might trigger intensive cougar control. If data indicate cougar predation is affecting ODFW's ability to meet deer or elk population objectives, some areas may be targeted for intensive cougar control (Table 17).

ODFW may consider transplanting certain wildlife species within Zone B. Columbia white-tailed deer populations within the zone have increased and recently were removed from both the state and federal endangered species lists. Additional recovery efforts could involve establishing new sub-populations within the zone. ODFW is restoring mountain goats to historic habitats throughout the state, and several release sites are identified in the zone. When evidence indicates cougar predation threatens transplant success or viability, release areas may be targeted for intensive cougar control.

Table 17. Adaptive management parameters for Cougar Management Zone B: Southwest Cascades..

Management Concern	Indicator	Objectives	Criteria Triggering Targeted Area Management
Sustain Populations	Cougar population	Cougar population estimate >1,200 cougars for the zone	Cougar population estimate <1,200 cougars will result in harvest reductions in the zone.
	Cougar mortality	Do not exceed total mortality quota	If zone quotas are met, hunting and target area harvest will end. Response to livestock damage and human safety/pet complaints will continue.
Human Interactions	Non-hunting mortality related to livestock and human safety/pet	< 11 cougars killed per year for the zone	>11 cougars killed/yr could trigger control in areas around human habitation or livestock operations.
	Human safety and pet complaints	< 84 complaints per year for the zone	> 84 complaints/yr could trigger control in areas around human habitation.
	Livestock complaints	< 69 complaints per year for the zone	> 69 complaints/yr could trigger control in areas around livestock operations.
Ungulate Populations	Elk	Maintain 3 year mean calf ratios comparable to 1994 levels which averaged approximately 30 - 40 calves/100 cows	Units with < 23 calves/100 cows for 3 years and below population Management Objective for 3 years.
	Deer	Maintain healthy populations with little evidence of disease that support optimum deer populations	Target only when evidence indicates cougar predation threatens viability of the deer population.
	Ungulate transplants	Insure viable transplants	Target only when evidence indicates cougar predation threatens success or viability of transplant.

Zone C – Southeast Cascades

The Southeast Cascade Cougar Management Zone (Figure 1) includes approximately 10,627 mi^2, 66% of which is public land. This zone includes 4 wilderness areas (294 mi^2), 4 roadless areas (221 mi^2), 3 national parks or monuments (212 mi^2), 3 national wildlife refuges (71 mi^2), and 4 large winter road closures designed to protect wintering mule deer from human harassment and poaching (443 mi^2). Seven WMUs make up this zone. Elevations range from approximately 3,000 feet in the vicinity of Bend to over 9,000 feet at the crest of the Cascades. Valleys are high elevation relative to the rest of Oregon. Klamath Basin, Summer Lake Valley, and Warner Valley are approximately 4,200 feet. Goose Lake Valley is approximately 5,000 feet. Habitats are diverse, ranging from sagebrush steppe at drier, lower elevation sites to alpine habitats at highest elevations. The most abundant habitats are typical eastside ponderosa pine forest with white fir and a shrub understory, or lodgepole pine/bitterbrush associated with Mt. Mazama ash soils (Figure 7). The cities of Bend, Redmond, and portions of Klamath Falls are in this zone. There are numerous small towns and other rural communities throughout the zone.

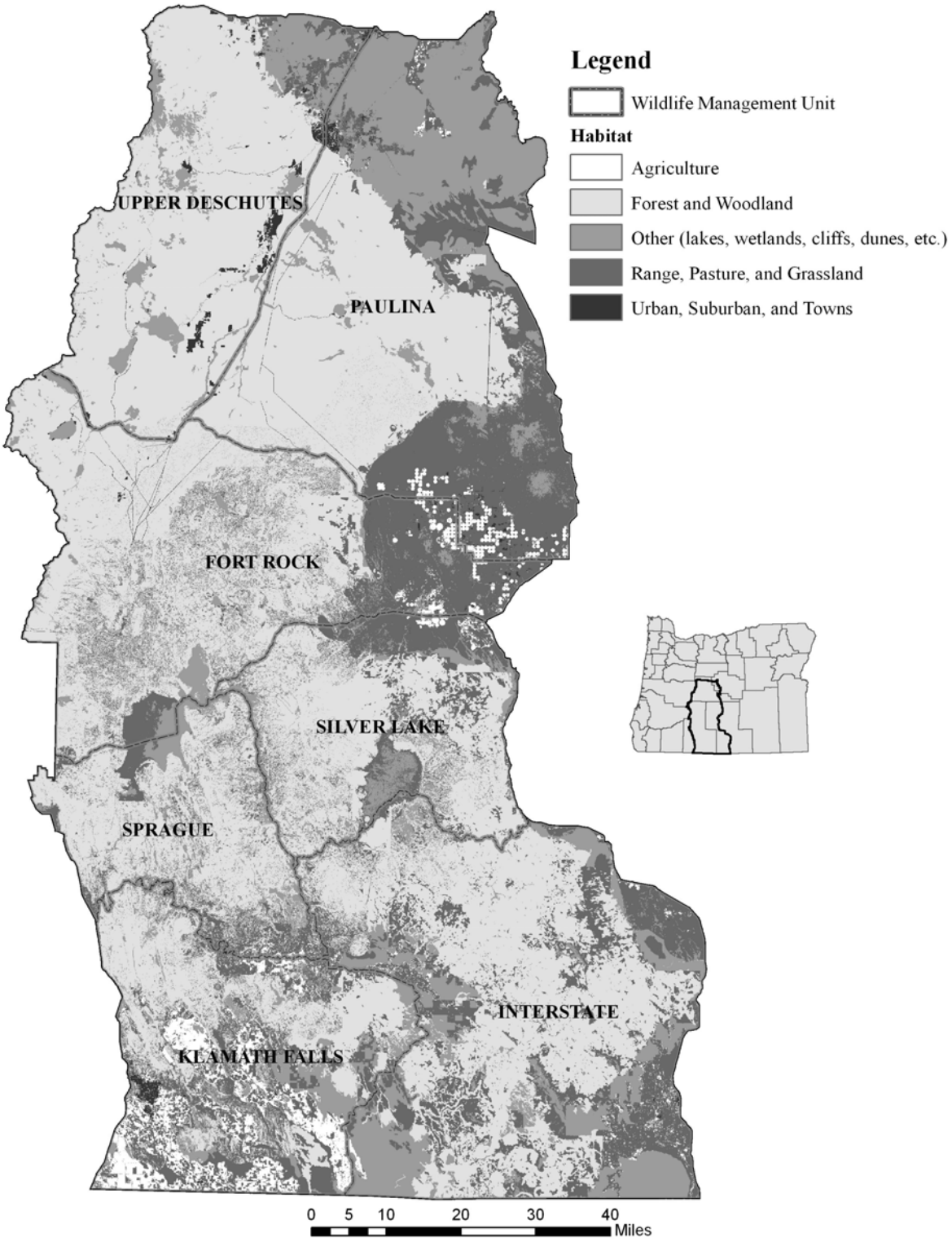

Figure 7. Habitat characteristics of cougar management zone C.

Primary industries include ranching, farming, timber, recreation, government, (E.g. resource management agencies such as the U.S. Forest Service and Bureau of Land Management), and service businesses associated with the larger cities.

Based on population modeling, cougar density of Zone C has increased from 1.2 cougars/100 mi^2 in 1994 to 3.2 cougars/100 mi^2 in 2003. Evaluation of mortality and age data in zone C suggests a relatively recent increase in the cougar population in this Zone. From 2001 through 2003, 16.8% of the cougar mortality was adult (3+) females with an average age of 7.6 years (Oregon Department of Fish and Wildlife, unpublished data). Cougar-human conflict has increased substantially since the early 1990's. Non-hunting mortality in response to livestock and human safety/pet complaints increased from 1 in 1994 to 5 in 2003 (Appendix G). While cougar-human conflict has increased, the ability to address specific problems has decreased since Lake County (8,359 mi^2 in Zones C and F) has not had a WS agent since 2002. cougar mortality was adult (3 yr+) females with an average age of 7.6 years (Oregon Department of Fish and Wildlife, unpublished data). Cougar-human conflict has increased substantially since the early 1990's. Non-hunting mortality in response to livestock and human safety/pet complaints increased from 1 in 1994 to 5 in 2003 (Appendix G). While cougar-human conflict has increased, the ability to address specific problems has decreased since Lake County (8,359 mi^2 in Zones C and F) has not had a WS agent since 2002.

Cougar complaints reported annually to ODFW have fluctuated from 40 (12 livestock, 28 human safety/pets) in 1994 to 46 in 2003 (Appendix H). Complaints include concerns for human safety, as cougars are more frequently seen on private property, near residences, and within city limits, and concerns for livestock safety and loss. Elk densities in Zone C are low relative to other areas in Oregon. MO's for elk were first set in 1994 and although population monitoring data are poor, it does not appear elk numbers have ever approached population MO. Between 1988 and 1993, ODFW radio-marked and monitored 77 elk (72 cows, 5 bulls) within Zone C (Oregon Department of Fish and Wildlife, 1994 unpublished report). Thirty-seven elk were resident and 40 were relocated from Baker County. Cougar predation accounted for 10 of 54 elk deaths (19%). Mortality attributed to cougars for resident elk was 11% (2 of 18) and 22% (8 of 36) for relocated elk. Relocated elk were probably more susceptible to cougar predation because for the first 3 months following release they did not join resident herds and were usually solitary. In the southern half of the zone, disease (suspected clostridium) accounted for most mortality. Currently there is no indication of cougar predation impacting elk calf recruitment or populations. However, if future information indicates cougar predation is substantially limiting elk numbers in the zone, increased cougar control may be implemented.

Zone C has some of the largest mule deer populations in Oregon. Spring trend surveys suggest populations throughout the zone have been below MO since 1994. Silver Lake WMU (2 years), Fort Rock WMU (1 year), and Paulina WMU (1 year) are the only WMUs that have met or exceeded MO between 1994 and 2004. AHD has affected populations in portions of the Upper Deschutes and Paulina WMU's. Throughout the remainder of Zone C, habitat conditions have stayed relatively constant or have improved since 1994. ODFW suspects cougar predation may be limiting fawn recruitment, thus preventing mule deer populations from reaching population MOs. ODFW believes 35 fawns:100 adults in the spring are needed to maintain deer numbers in this zone. Fawn recruitment is substantially affected by winter severity, drought, and coyote predation, as well as cougar predation. Because fawn recruitment is affected by several variables, population trend and abundance is the best indicator of herd health within a WMU. To

quantify the effect of cougar predation on deer abundance, it will be necessary to measure adult mortality and cause. There have been no mule deer research projects in the zone since the early 1970's. In July, 2005 ODFW began research on deer that winter in the Silver Lake, Fort Rock, and southern portion of the Paulina WMUs. One objective of this research is to measure amount and cause of adult mule deer mortality. Consequently, this study will provide critical information regarding cougar predation on deer that can be used for adaptive management in Zone C.

Hadley Butte and the Devils Garden are the only bighorn herd ranges within the zone. The Hadley Butte herd was established in 1984 when 8 California bighorn sheep were re-introduced, and supplemented with 18 in 1995. In 1999, 74 sheep were observed during spring census. By 2004 the herd had declined, and only 8 sheep were observed. Based on the number of cougar killed bighorn found and the increase in cougar damage complaints on private land immediately below the sheep range, ODFW believes this decline is due to cougar predation. The Devils Garden herd was established in 1995 with re-introduction of 16 California bighorn sheep. There have been 3 supplemental releases since then, totaling 40 sheep into 2 different areas of the range. The 2005 population estimate for this herd was 20 bighorn. The level of cougar predation on this herd is unknown but believed significant. Observational information has documented several adult cougars living in close proximity to these bighorn herds. Necropsies on numerous radio-marked and unmarked carcasses indicated cougar predation as the cause of death. Cougar predation is not the sole cause of decline of this bighorn herd. However, ODFW believes it to be one of the most significant causes of adult bighorn sheep mortality. The zone includes several pronghorn herds. In 1995, these populations were very low following several years of poor recruitment. Since 1995, pronghorn herds have increased substantially. There is no evidence cougar predation on pronghorn is limiting populations.

Adaptive management may be employed to reduce conflict to 2000 levels, as measured by non-hunting mortality and complaints. Mortality quotas will include all known mortalities due to human causes. The minimum cougar population for Zone C is 120. Modeling indicates that a total human caused mortality of 65 cougars/year for 5 years (Table 14) could occur without reducing cougar numbers below the minimum population of 120. If total human caused mortality reaches 65 cougars/year for 5 years, subsequent mortality would need reduced to approximately 30 cougars/year to prevent the population from declining below the zone minimum. Conflict will be monitored with established measurement criteria and management will be adjusted based on results. Areas with restricted access such as wilderness and roadless areas, national parks and wildlife refuges, and winter road closures will receive little or no harvest. These areas account for approximately 12% of the entire zone or 1,241 mi^2. Other areas will be managed more intensively to achieve objectives for cougar-human conflicts and deer or bighorn populations. Particular attention will be given to areas around human habitation, with elevated or recurring cougar-human conflicts. Some bighorn sheep populations and new ungulate transplants may be targeted for intensive cougar harvest if cougar predation is identified as a possible limiting factor (Oregon Department of Fish and Wildlife 2003a). More intensive cougar harvest in targeted areas, while maintaining moderate levels of cougar harvest throughout most of the zone, and little harvest in areas with restricted human access is expected to meet objectives for cougar conflict, and maintain cougar populations at or above minimum levels.

Cougar Management in Zone C

Those WMUs in which mule deer herds have declined by 20% over the last 5 years or below 60% of MO for 3 years may be targeted for more intensive cougar harvest (Table 18). Of 7 WMUs in the zone, 4 met these criteria in 2005 (Klamath, Sprague, Upper Deschutes, and Interstate). Areas of human habitation with elevated levels of cougar-human conflict, as defined by cougar non-hunting mortality and complaints greater than the 2000 level, may be targeted for more intensive cougar harvest (Table 18). To maintain bighorn sheep populations, intensive cougar harvest may be implemented on established bighorn herd ranges if evidence indicates cougar predation is limiting the population. Desired outcomes include a decrease in cougar-human conflicts measured by non-hunter mortality and complaints, maintenance of bighorn herds at desired levels, and an increase in deer populations to MO (Table 18). Outcomes will be monitored and hunting programs modified to meet zone objectives.

Table 18. Adaptive management parameters for Cougar Management Zone C: Southeast Cascades.

Management Concern	Indicator	Objectives	Criteria Triggering Targeted Area Management
Sustain Populations	Cougar population	Cougar population estimate >120 cougars for the zone	Cougar population estimate <120 cougars will result in harvest reductions in the zone.
	Cougar mortality	Do not exceed total mortality quota	If zone quotas are met, hunting and target area harvest will end. Response to livestock damage and human safety/pet complaints will continue.
Human Interactions	Non-hunting mortality related to livestock and human safety/pet	< 5 cougars killed/yr for the zone	>5 cougars killed/yr could trigger control in areas around human habitation and livestock operations.
	Human Safety and Pet Complaints	< 28 per year for the zone	> 28complaints/yr could trigger control in areas around human habitation.
	Livestock Complaints	< 24 complaints per year for the zone	> 24 complaints/yr could trigger control in areas around livestock operations.
Ungulate Populations	Elk	Raise 3-year mean calf ratio to at least the 1994 levels. > 31 – 35 calves/100 cows.	Units with < 23 calves/100 cows for 3 years and below population Management Objective for 3 years.
	Deer	Increase populations to MO levels	Units declining by 20% over the last 5 years or below 60% of MO for 3 years.
	Bighorn sheep	Maintain populations at or near social or habitat capability	Establish target areas for bighorn herds where evidence indicates cougar predation is a limiting factor.
	Ungulate transplants	Insure viable transplants	Target release areas when evidence indicates that cougar predation threatens transplant success or viability.

Zone D – Columbia Basin

Zone D (Figure 1) includes approximately 8,465 mi^2 (13% public land) with one wilderness area and two scenic waterways. Five WMUs make up this zone: Columbia Basin, Biggs, Fossil, Grizzly, and Maupin. Elevation ranges from 72 ft along the Columbia River to 5,800 ft in the mountains. Zone D habitats generally fall into three broad classifications: (1) low elevation shrub-steppe and grasslands heavily dominated by active farming; (2) foothill and canyon shrub-steppe/grassland; and (3) mixed conifer forest in the southernmost portion of the zone (Figure 8). Small rural towns occur throughout the zone but the highest human densities occur in the southwest portion of the zone in Prineville, Redmond, and Madras. However, the majority of the human population lives in rural communities and towns located along Interstate 84 such as The Dalles, Hermiston, and Pendleton. Primary occupations include farming, ranching, timber, and government services. Industry also plays a larger role in the vicinity of the larger cities and ports.

An estimated 60% of this zone (primarily the northern two-thirds) is lower-elevation grass and shrubland with a significant portion converted to agriculture. This portion of the zone is generally considered poor cougar habitat. Based on hunter harvest, recorded cougar-human conflicts, and irregular observations, cougars are believed to occupy this portion of the zone in very low densities with much of this type being devoid of cougars. An estimated 9% of the zone is considered sub-optimal cougar habitat. This type is primarily located within the larger canyon corridors and tributaries of the Deschutes and John Day Rivers, which provides resident habitat and travel corridors for movement and dispersal. The area also includes some foothill shrub-steppe and grasslands. Cougars regularly occupy this type but they occur at an intermediate density. The remaining 31% of the Zone is considered optimal cougar habitat and encompasses much of the Fossil and Grizzly WMUs. The majority of cougars occupying this zone reside within these two WMU's.

Based on population modeling, cougar density has increased from 0.9 cougars/100 mi^2 in 1994 to 3.8 cougars/100 mi^2 in 2003. Evaluation of mortality and age data in zone D suggests a relatively recent increase in the cougar population in this Zone. From 2001 through 2003, 21.9% of the cougar mortality was adult (3 yr+) females with an average age of 5.0 years (Oregon Department of Fish and Wildlife, unpublished data). While densities may be lower than many other cougar management zones, it is important to recognize that approximately 60% of this zone is considered poor cougar habitat. ODFW believes the population has potential to continue increasing. However, as optimal and sub-optimal habitats become fully occupied it is unreasonable to assume cougars will occupy remaining poor habitats at a comparable density. Thus, even at maximum cougar density a large portion of this zone will continue to have few resident cougars.

Cougar-human conflict has increased substantially since the early 1990's. Non-hunting mortality in response to livestock and human safety/pet complaints increased in the zone from 0 in 1994 to 7 in 2003 (Appendix G). It is important to note, from 1994 to 2003, 76% of all cougars harvested were taken in the Fossil and Grizzly WMUs. This further suggests higher cougar densities in this portion of the zone. Cougar complaints reported annually to ODFW have increased from 7 (5 livestock, 2 human safety/pets) in 1994 to 34 in 2003 (Appendix H). Complaints include concerns for human safety, as cougars are more frequently seen on private property, near residences, and within city limits, and concerns for livestock safety and loss.

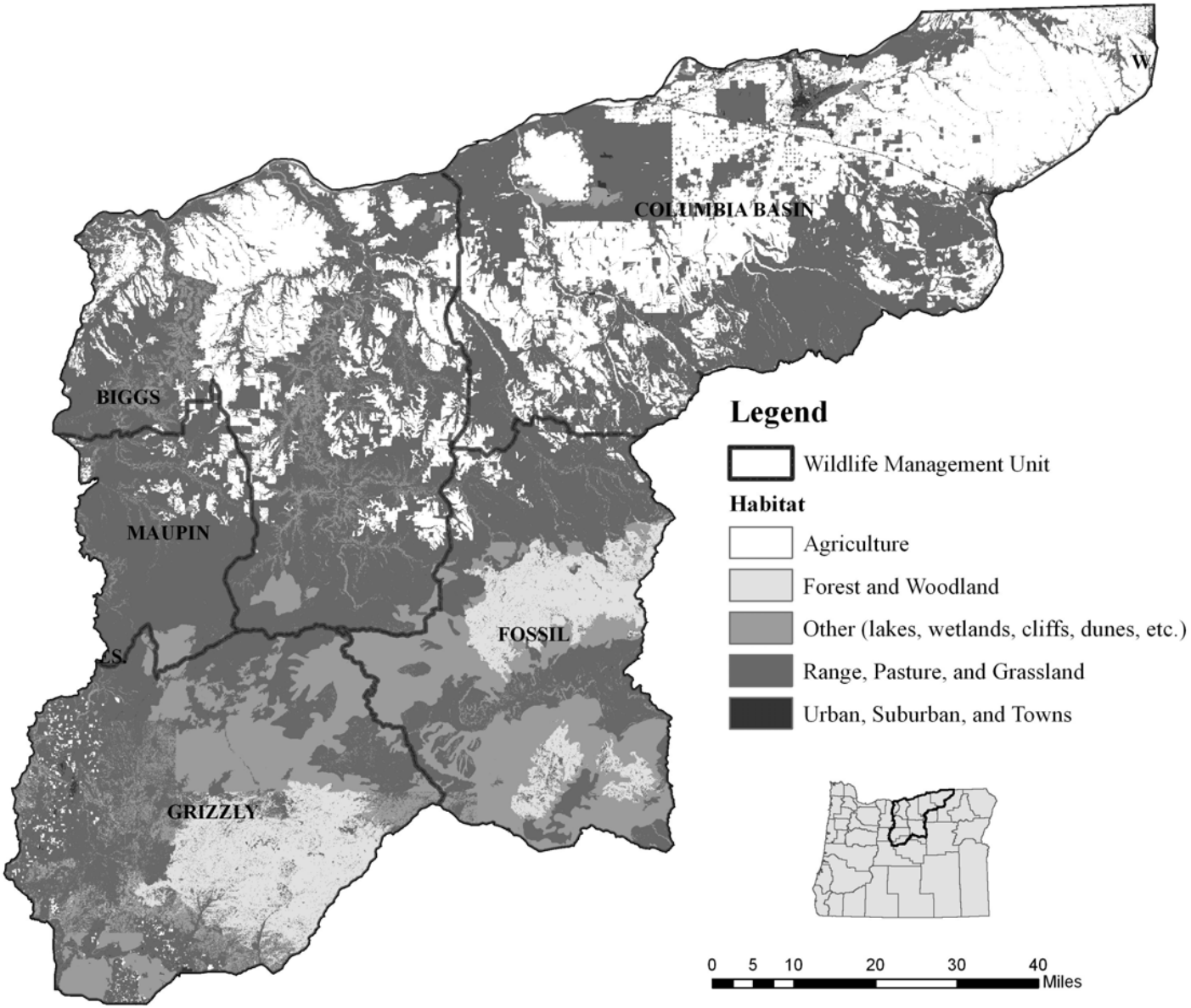

Figure 8. Habitat characteristics of cougar management zone D.

Zone D has not historically had many elk. Elk populations began building in the Grizzly and Fossil WMUs in the 1970's and 1980's. In the 1990's, elk began to occupy lower elevation canyon and farmlands in the northern two-thirds of the zone. As a result of this expansion and resulting damage caused by elk in these areas, ODFW initiated a de-emphasis management strategy for elk in the Columbia Basin, Biggs, and Maupin WMUs. Cougar predation of elk in these 3 WMU's is not significant for management of either species. In the Fossil WMU, elk calf recruitment has dropped from 46 calves:100 cows in 1994 to a low of 15 calves:100 cows in 2005. Consistent with recent studies in northeast Oregon, cougar predation is believed to be the primary cause of calf mortality. Continued low calf recruitment and relatively aggressive elk harvest strategies have reduced this elk population significantly. The Fossil WMU continues to be over established elk population MO but is declining. The Grizzly WMU does not appear to be experiencing severe cougar predation on elk as calf ratios have remained relatively high through the 10-year period (39 calves:100 cows in 2004). However, as more cougar habitat becomes occupied, it is anticipated that predation on elk will increase similar to neighboring units in northeast Oregon.

Most mule deer occur in vast expanses of habitat with few or no cougars. While fawn recruitment within Zone D has declined from 38 fawns:100 adults in 1994 to 20 fawns:100 adults in 2004, the decline has been variable across the zone. In the Fossil WMU spring deer fawn ratios have declined from 51 fawns:100 adults in 1994 to 22 fawns:100 adults in 2004. However, within specific portions of the Fossil WMU (e.g., the 1997 Wheeler Point fire) fawn recruitment continues to be relatively high. This suggests other factors such as habitat and weather (i.e. drought) may play an important role in the overall decline of mule deer in this WMU. In addition, coyotes are ubiquitous across this zone and coyote predation also may effect mule deer fawn survival. With cougar numbers increasing in the Fossil WMU, cougar predation combined with other factors may substantially impact mule deer population size. Currently, all WMUs within the zone are below established mule deer population management objectives.

Bighorn sheep are found in the lower John Day River and Deschutes River canyons, with a small population along the Columbia River in the Biggs WMU. California bighorn sheep were reintroduced to the Lower John Day River in 1989 and the Lower Deschutes River in 1993 when cougars were rarely found in these areas. Although cougar numbers have increased since bighorn sheep reintroductions, cougars are not currently impacting bighorn sheep populations in Zone D. Bighorn populations are expanding in range and number in both river canyons and lamb ratios have ranged from 35 – 55 lambs:100 ewes over the last 10 years. As cougar populations increase, however, they may cause bighorn sheep population declines or cause redistribution of animals away from traditional lambing ranges resulting in lower lamb survival.

Adaptive management may be used to reduce cougar-human conflict to 2000 levels, as measured by non-hunting mortality and complaints. Mortality quotas will include all known mortalities due to human causes. The minimum cougar population for Zone D is 80. Modeling indicates that a total human caused mortality of 62 cougars/year for 5 years (Table 14) could occur without reducing cougar numbers below the minimum population of 80. If total human caused mortality reaches 62/year for 5 years, subsequent mortality would need reduced to approximately 24 cougars/year to prevent the population from declining below the zone minimum. Conflict will be monitored with established measurement criteria and management will be adjusted based on results. Areas with restricted access such as wilderness and scenic waterways, will receive little or no harvest. These areas account for approximately 1.3% of the

entire zone or 108 square miles. Other areas will be managed more intensively to achieve objectives for cougar-human conflicts and elk, deer, or bighorn populations. Particular attention will be given to areas around human habitation, with elevated or recurring cougar-human conflicts. Target areas may be identified for some bighorn sheep populations if cougar predation is identified as a possible limiting factor (Oregon Department of Fish and Wildlife 2003a). Intensive cougar harvest in target areas, while maintaining moderate levels of cougar harvest throughout most of the zone, and little harvest in areas with restricted human access is expected to meet objectives for cougar conflict, and maintain cougar populations at or above minimum levels.

Cougar Management in Zone D

The Fossil WMU may be targeted for intensive cougar harvest if the population falls below elk population MO because calf ratios are below maintenance level of 23 calves:100 cows (Table 19). Those WMUs where mule deer herds have declined by 20% over the last 5 years or are 60% below MO for 3 years may be targeted for intensive cougar harvest. Areas of human habitation with elevated levels of cougar-human conflict as defined by cougar non-hunter mortality and complaints greater than the 2000 level may also be targeted for intensive cougar harvest (Table 19). To maintain bighorn sheep populations, intensive cougar harvest may be implemented on established bighorn herd ranges if evidence indicates cougar predation is limiting the population. Desired outcomes include a decrease in cougar-human conflicts, as measured by non-hunter mortality and complaints, an increase in deer populations to MO levels, and an increase in elk calf survival to approximately 1994 levels (Table 19). Outcomes will be monitored and hunting programs modified to meet zone objectives.

Zone E - Blue Mountains

Zone E (Figure 1) includes approximately 15,929 mi^2, 49% of which is public land. This zone includes 8 wilderness areas (1,404 mi^2), 81 roadless areas (1,534 mi^2), and 14 wild and scenic areas (97 mi^2). ODFW has four WAs that provide critical winter ranges for big game in this zone (Bridge Creek, Elkhorn, Ladd Marsh, and Wenaha). Twenty WMUs make up this zone. Elevations range from approximately 1,500 ft in the Snake River Canyon to 10,000-foot peaks in the Wallowa, Elkhorn, and Strawberry Mountains. Habitats are diverse, ranging from sagebrush steppe at drier, lower elevation sites to alpine habitats at higher elevations. The most abundant habitat is mixed conifer forests (Figure 9). Major communities include Enterprise, La Grande, Baker City, and John Day. There are numerous other small towns located primarily in the valleys. Primary industries include ranching, farming, timber, support services, and government (resource management agencies such as the U.S. Forest Service and Bureau of Land Management).

Based on population modeling, cougar population density in Zone E increased from 6.2 cougars/100 mi^2 in 1994 to 10.5 cougars/100 mi^2 in 2003. From 2001 to 2003, an average of 24.7% of the cougar mortality was comprised of adult (3 yr+) females with an average age of 5.3 years (Oregon Department of Fish and Wildlife unpublished data).

Cougar-human conflict has increased substantially since the early 1990's. Non-hunting mortality in response to livestock and human safety/pet complaints increased in the zone from 13 in 1994 to 23 in 2003 (Appendix G). While cougar-human problems have increased, the ability to address those problems has decreased with three counties in the zone (Union, Baker, and Grant) without a WS agent. Complaints have increased from 47 (25 livestock, 22 human

Table 19. Adaptive management parameters for Cougar Management Zone D: Columbia Basin..

Management Concern	Indicator	Objectives	Criteria Triggering Targeted Area Management
Sustain Populations	Cougar population	Cougar population estimate >80 cougars for the zone	Cougar population estimate <80 cougars will result in harvest reductions in the zone.
	Cougar mortality	Do not exceed total mortality quota	If zone quotas are met, hunting and target area harvest will end. Response to livestock damage and human safety/pet complaints will continue.
Human Interactions	Non-hunting mortality related to livestock and human safety/pet	< 5 cougars killed/yr for the zone	>5 cougars killed/yr could trigger control in areas around human habitation and livestock operations.
	Human Safety and Pet Complaints	< 20 per year for the zone	> 20 complaints/yr could trigger control in areas around human habitation.
	Livestock Complaints	< 12 complaints per year for the zone	> 12 complaints/yr could trigger control in areas around livestock operations.
Ungulate Populations	Elk	Raise 3-year mean calf ratio to at least the 1994 levels. > 31 – 35 calves/100 cows	Units with < 23 calves/100 cows for 3 years and below population Management Objective for 3 years.
	Deer	Increase populations to MO levels	Units declining by 20% over the last 5 years or below 60% of MO for 3 years.
	Bighorn sheep	Maintain populations at or near social or habitat capability	Establish target areas for bighorn herds where evidence indicates cougar predation is a limiting factor.
	Ungulate transplants	Insure viable transplants	Target release areas when evidence indicates that cougar predation threatens transplant success or viability.

safety/pets) in 1994 to 94 in 2003. Complaints include concerns for human safety, as cougars are more frequently seen on private property, near residences, and in city limits, and concerns for livestock safety and loss.

The Blue Mountains in Zone E have long been known as the premier elk area of Oregon. This status has changed in recent years. Spring calf ratios have gradually declined since the 1970s (Oregon Department of Fish and Wildlife 2003b) from 47 calves:100 cows in 1970 to 31:100 cows in 1994 and 25:100 cows by 2003. Based on elk population modeling and case histories, ODFW believes 23 calves:100 cows is necessary to maintain an elk herd in the absence of antlerless elk hunting. Of 20 WMUs in Zone E, 5 WMUs (20%) were below population MO in 1994, but 9 WMUs were below MO in 2003, in spite of continued major reductions in hunting opportunity instituted to reverse declining elk population trends. While other factors affect elk populations, ODFW believes cougar predation is impacting calf survival. In response to declines

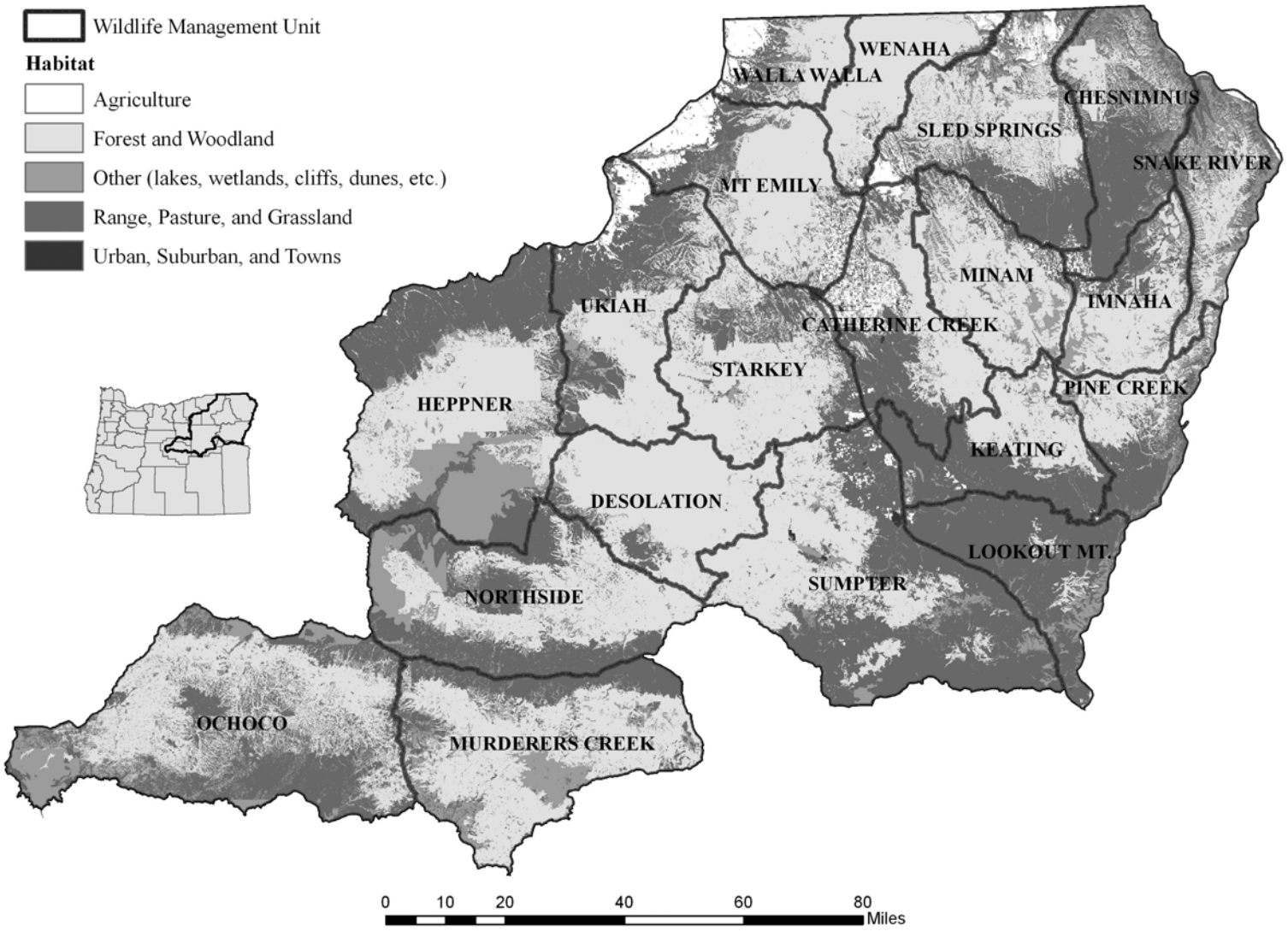

Figure 9. Habitat characteristics of cougar management zone E.

in observed calf:cow ratios, ODFW initiated a research project in northeast Oregon to evaluate declines in elk calf recruitment. Preliminary data show cougar predation is the primary cause of calf mortality.

A 3-year study in NE Oregon found cougar predation of adult mule deer to be the leading cause of mortality, accounting for 33% of all known mortality (Mathews and Coggins 1997). A study of a wintering mule deer herd in Hells Canyon showed a 25% mortality rate for adult does from 1999-2001 (Edelmann 2003). The primary cause of adult doe mortality was cougar predation. Improvements in adult and fawn survival are necessary to meet established MOs for mule deer. While cougar predation has had a demonstrated effect on mule deer populations, several other factors have also been important. Those factors include coyote predation and weather, including periodic severe winters and drought. In addition, cougar predation affects adult survival. Therefore, ODFW does not believe fawn ratio alone is a good indicator of cougar density. Total population is the best indicator of deer population health.

ODFW began bighorn recovery in Zone E in the 1970s. Twelve separate Rocky Mountain bighorn herds and 3 California bighorn herds are now established with a 2003 population estimate of approximately 900 animals. Although total populations have increased, rates of increase have been reduced and some herds have declined. Recent monitoring of radio-collared bighorns in Hells Canyon found the primary causes of mortality to be disease followed by cougar predation (Cassirer 2004). During a 7-year period, 61 of 154 radio-collared sheep died and cougar predation accounted for 27% of all known mortalities. Further, the Minam reintroduction effort was likely compromised by cougar predation in 2000.

Adaptive management may be used to reduce conflict to 1994 levels, as measured by non-hunting mortality and complaints. Mortality quotas include all known mortalities due to human causes. The minimum cougar population for Zone E is 900. Modeling indicates a total human caused mortality of 245 cougars/year (Table 14) for 5 years could occur without reducing cougar numbers below the minimum population of 900. If total human caused mortality reaches 245 cougars/yr for 5 years, subsequent mortality would need reduced to approximately 90 cougars/year to prevent the population from declining below the zone minimum. Conflict will be monitored with established measurement criteria and management will be adjusted based on results. Wilderness, roadless, and wild and scenic areas will have little or no harvest. These areas account for approximately 19% of the entire zone or approximately 3,035 mi^2. Some areas and WMUs will be managed more intensively to achieve objectives for cougar-human conflicts and elk or deer populations. Particular attention will be given to areas around human habitation, with elevated or recurring cougar-human conflicts. Some bighorn sheep populations and recent transplants of other native species may be targeted if cougar predation is identified as a limiting factor (Oregon Department of Fish and Wildlife 2003a). Areas not experiencing elevated cougar-human conflicts or depressed ungulate populations will receive moderate cougar harvest. More intensive cougar harvest in targeted WMU's and areas around human habitation with recurring conflict, while maintaining moderate levels of cougar harvest in other areas, and little harvest in roadless areas is expected to meet objectives for cougar conflict, and maintain cougar populations at or above minimum levels.

Cougar Management in Zone E

Those WMUs with a 3-year average calf ratio below maintenance level of 23 calves:100 cows and a 3-year average population index below MO may be targeted for more intensive

cougar harvest (Table 20). Of 20 WMUs in the zone, five met these criteria in 2005 (Wenaha, Snake River, Walla Walla, Ukiah, and Heppner). Those WMUs where the deer population has declined >20% over the last 5 years or is 60% below MO may be targeted for more intensive cougars harvest. Areas of human habitation with elevated levels of cougar-human conflict, as defined by non-hunter mortality and complaints greater than the 1994 level, may also be targeted for more intensive cougar harvest (Table 20). At this time, no established bighorn sheep herds are limited solely by cougar predation and none will be targeted for intensive cougar management. However, if a bighorn sheep herd is found to be declining with cougar predation identified as the limiting factor, the herd range may be targeted for more intensive cougar control. In addition, cougars may be targeted in new transplant areas when cougar predation threatens success or viability of the transplant (Oregon Department of Fish and Wildlife 2003a).

Table 20. Adaptive management parameters for Cougar Management Zone E: Blue Mountains..

Management Concern	Indicator	Objectives	Criteria Triggering Targeted Area Management
Sustain Populations	Cougar population	Cougar population estimate >900 cougars for the zone	Cougar population estimate <900 cougars will result in harvest reductions in the zone.
	Cougar mortality	Do not exceed total mortality quota	If zone quotas are met, hunting and target area harvest will cease. Response to livestock damage and human safety/pet complaints will continue.
Human Interactions	Non-hunting mortality related to livestock and human safety/pet	< 13 cougars killed/yr for the zone	>13 cougars killed/yr could trigger control in areas around human habitation and livestock operations.
	Human Safety and Pet Complaints	<22 per year for the zone	> 22complaints/yr could trigger control in areas around human habitation.
	Livestock Complaints	< 25complaints per year for the zone	> 25 complaints/yr could trigger control in areas around livestock operations.
Ungulate Populations	Elk	Raise 3 year mean calf ratio to at least the 1994 levels. > 31 – 35 calves/100 cows	Units with < 23 calves/100 cows for 3 years and below population Management Objective for 3 years.
	Deer	Increase populations to MO levels	Units declining by 20% over the last 5 years or below 60% of MO for 3 years.
	Bighorn sheep	Maintain populations at or near social or habitat capability	Establish target areas for bighorn herds where evidence indicates cougar predation is a limiting factor.
	Ungulate transplants	Insure viable transplants	Target release areas when evidence indicates that cougar predation threatens transplant success or viability.
	Wildlife Areas (WA)	Meet Management Objectives of the Area	Target WA if cougars prevent achieving WA objectives.

Desired outcomes include a decrease in cougar-human conflicts, as measured by non-hunter mortality and complaints, and an increase in elk calf survival to approximately 1994 levels (Table 20). Outcomes will be monitored and hunting programs modified to meet zone objectives.

Zone F – Southeast Oregon

Zone F (Figure 1) includes approximately 28,003 mi^2 (64% public land) in 11 WMUs (Whitehorse, Owyhee, Malheur River, Steens Mountain, Juniper, Beatys Butte, Warner, Wagontire, Maury, Silvies, and Beulah) of which 26,409 mi^2 is considered to be cougar habitat. Zone F includes three wild and scenic rivers, two designated wilderness areas, several wilderness study areas, two national wildlife refuges, and one state owned wildlife area managed for big game (Riverside). Elevations range from approximately 2,200 feet at Ontario to 9,670 feet on Steens Mountain. Overall human population density is low compared to other parts of the state. Local economies are primarily based on agriculture, livestock, timber, and support services. Major towns include Lakeview, Burns/Hines, Jordan Valley, Vale, Nyssa, and Ontario. Habitat in this zone consists primarily of sagebrush habitats (Figure 10), which generally support mule deer, pronghorn, and bighorn sheep as a prey base at relatively low densities compared to mixed conifer habitats in other zones. However, there are areas within these units which support more diverse habitats and higher densities of prey. Examples include Steens Mountain, Trout Creek Mountains, Mahogany Mountain, Abert Rim, and Hart Mountain. Portions of the Warner, Maury, Silvies, Malheur River, and Beulah WMU's are composed of mixed conifer habitats and subsequently support a more abundant and diverse prey base of deer and elk compared to more homogenous sagebrush habitats, which support low densities of pronghorn and mule deer.

Based on population modeling, cougar population density in Zone F has increased from 1.2 cougars/100 mi^2 in 1994 to 2.7 cougars/100 mi^2 in 2003. Evaluation of mortality and age data in zone F suggests a relatively recent increase in the cougar population in this Zone. From 2001 to 2003, an average of 24.2% of the cougar mortality was adult (3 yr+) females with an average age of 5.0 years (Oregon Department of Fish and Wildlife unpublished data).

Cougar-human conflict has increased substantially since the early 1990's. Non-hunting mortality in response to livestock and human safety/pet complaints increased from 0 in 1994 to 12 in 2003 (Appendix G). Cougar complaints reported annually to ODFW have fluctuated from a low of 14 (10 livestock, 4 human safety/pets) in 1994 to 39 in 2003 (Appendix H). Complaints include concerns for human safety, as cougars are more frequently seen on private property, near residences, and within city limits, and concerns for livestock safety and loss. While cougar-human conflict has increased, the ability to address specific problems has decreased since Lake County (8,359 mi^2 in Zones C and F) has not had a WS agent since 2002.

Elk numbers have remained somewhat stable over the last 10 years although calf survival and recruitment has declined in WMU's in the northern portion of the zone (Silvies, Malheur River, Beulah) where most elk in the zone reside. Spring calf ratios have declined in recent years from 50-55 calves:100 cows in 1994 to 30-35 calves:100 cows in 2004. At present, elk productivity and survival is sufficient to maintain elk herds at MO and no intensive cougar management is warranted.

Habitat conditions in Zone F were stable or improved between 1994 and 2004, and winters were relatively mild. ODFW suspects cougar predation was an important factor in the

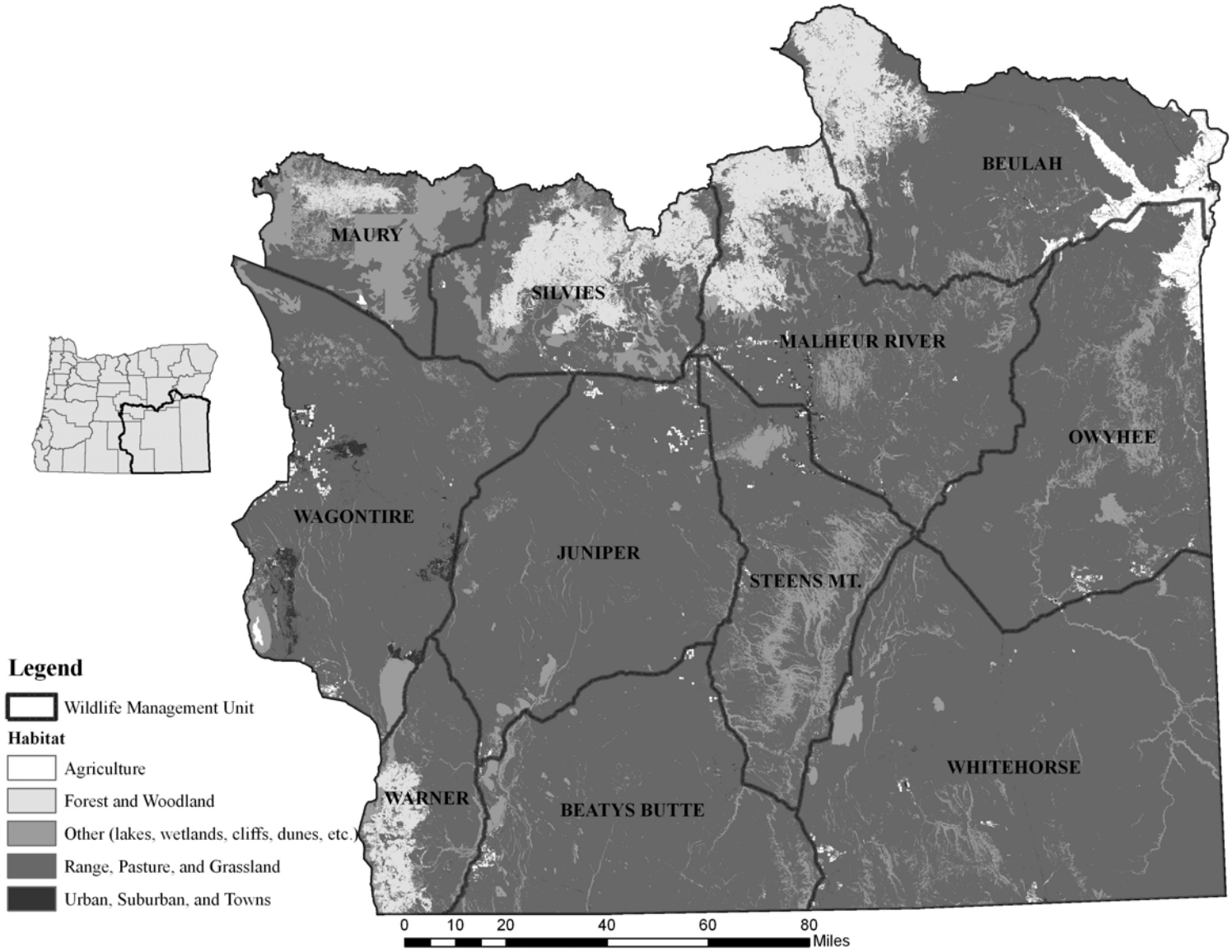

Figure 10. Habitat characteristics of cougar management zone F.

failure of Zone F deer populations to reach MO. Population modeling suggests 35 fawns:100 adults in the spring are needed to maintain deer populations in this zone. Fawn recruitment is substantially affected by winter severity, drought, coyote predation, and cougar predation. Therefore, fawn ratios are not as reliable an indicator of cougar numbers as calf elk ratios. Spring fawn ratios in most units in this zone have generally been at or below 35 fawns/100 adults since 1994 which means fawn recruitment has been below herd maintenance level. Therefore, if adult mortality is excessive the overall deer population will decline. Adult mortality in portions of this zone is believed to be high and partially responsible for the observed decline in mule deer numbers. A recent study in Hells Canyon found the annual mortality rate of adult does to be 25% (Edelmann 2003), most of which was due to cougar predation. This deer herd is currently in decline because of the combination of low fawn recruitment and high adult mortality. At present, deer population levels in 6 of 11 WMUs in this zone are below 60% of management objective (Steens Mountain, Whitehorse, Owyhee, Wagontire, Beatys Butte, and Warner) and may be targeted for more intensive cougar management.

California bighorn sheep were extirpated from Oregon by 1916 (Bailey 1936, Oregon Department of Fish and Wildlife 2003a). ODFW has actively reintroduced bighorn sheep in Zone F since 1954 when the first reintroduction occurred on Hart Mountain. Thirty-six reintroductions have been made to re-establish populations throughout much of their historic range in the zone. Most transplants appeared successful until the severe winter of 1992-93. Since 1993, decreasing population trends have been observed in several herds. Parasites and disease were investigated but not identified as causing these declines and cougar predation was suspected. To determine the cause for the decline, two studies have been initiated in this zone in recent years (Leslie Gulch and Hart Mountain, see Chapter III). Based on results in Leslie Gulch and on Hart Mountain, cougar predation is affecting population growth rates.

Zone F includes many pronghorn herds. In 1995 populations of these herds were very low following several years of poor recruitment. Since 1995, pronghorn herds have increased substantially due to improved fawn recruitment. There is no evidence cougar predation on pronghorn is having a significant impact on populations.

Adaptive management may be used to reduce cougar-human conflict to 2000 levels, as measured by non-hunting mortality and complaints. Mortality quotas will include all known mortalities due to human causes. The minimum cougar population for Zone F is 300. Modeling indicates a total human caused mortality of 120 cougars/year for 5years (Table 14) could occur without reducing cougar numbers below the minimum population of 300. If total human caused mortality reaches 120/yr for 5 years, subsequent mortality would need to be reduced to approximately 28 cougars/year to prevent the population from declining below the zone minimum. Conflict will be monitored with established measurement criteria and management will be adjusted based on results. Areas with restricted access such as wilderness, wilderness study areas, and national wildlife refuges will receive little or no harvest. These areas account for 16.4% of the entire zone or 4,603 mi^2. Other areas will be managed more intensively to achieve objectives for cougar-human conflicts and deer or bighorn populations. Particular attention will be given to areas around human habitation, with elevated or recurring cougar-human conflicts. Some bighorn sheep populations and recent transplants of native species may be targeted if cougar predation is identified as a limiting factor (Oregon Department of Fish and Wildlife 2003a). Other areas not experiencing elevated cougar-human conflicts or depressed ungulate populations will receive moderate cougar harvest. More intensive cougar harvest in

targeted WMU's and areas around human habitation, while maintaining moderate levels of cougar harvest in other areas, and little harvest in roadless areas is expected to meet objectives for cougar conflict, and maintain cougar populations at or above minimum levels.

Cougar Management in Zone F

Those WMUs in which mule deer herds have declined by 20% over the last 5 years or are 60% below MO for 3 years may be targeted for more intensive cougar harvest (Table 21). Areas of human habitation with elevated levels of cougar-human conflict, as defined by cougar complaints and non-hunter mortality > 2000 levels, may also be targeted for more intensive cougar harvest (Table 21). To maintain bighorn sheep populations, intensive cougar harvest may be implemented on established bighorn herd ranges if evidence indicates cougar predation is

Table 21. Adaptive management parameters for Cougar Management Zone F: Southeast Oregon.

Management Concern	Indicator	Objectives	Criteria Triggering Targeted Area Management
Sustain Populations	Cougar population	Cougar population estimate >300 cougars for the zone	Cougar population estimate < 300 cougars will result in harvest reductions in the zone.
	Cougar mortality	Do not exceed total mortality quota	If zone quotas are met, hunting and target area harvest will cease. Response to livestock damage and human safety/pet complaints will continue.
Human Interactions	Non-hunting mortality related to livestock and human safety/pet	< 11 cougars killed/yr for the zone	>11 cougars killed/yr could trigger control in areas around human habitation and livestock operations.
	Human Safety and Pet Complaints	<5 per year for the zone	> 5 complaints/yr could trigger control in areas around human habitation.
	Livestock Complaints	< 27 complaints per year for the zone	> 27 complaints/yr could trigger control in areas around livestock operations.
Ungulate Populations	Elk	Raise 3 year mean calf ratio to at least the 1994 levels. > 50 – 55 calves/100 cows	Units with < 23 calves/100 cows for 3 years and below population Management Objective for 3 years.
	Deer	Increase populations to MO levels	Units declining by 20% over the last 5 years or below 60% of MO for 3 years.
	Bighorn sheep	Maintain populations at or near social or habitat capability	Establish target areas for bighorn herds where evidence indicates cougar predation is a limiting factor.
	Ungulate transplants	Insure viable transplants	Target release areas when evidence indicates that cougar predation threatens transplant success or viability.
	Wildlife Areas (WA)	Meet Management Objectives of the Area	Target WA if cougars prevent achieving WA objectives.

limiting the population. Desired outcomes include a decrease in cougar-human conflicts as measured by non-hunter mortality and complaints, an increase in deer populations to MO levels, and successful bighorn sheep transplants (Table 21). Outcomes will be monitored and hunting programs modified to meet zone objectives.

CHAPTER VII: ECONOMIC CONSIDERATIONS RELATED TO COUGAR CONSERVATION AND MANAGEMENT

This chapter describes economic values, economic impacts and fiscal impacts related to cougar populations and their management and conservation. Wildlife values are reflected in social attitudes and actions that are linked to its use and management. Until recently, negative economic impacts of cougars on livestock ranching and hunting dominated social perceptions of the species. Yet, economic activities and their relative importance change with social norms and practices. The initiative that prohibited use of dogs to hunt cougars is an example of a significant shift in wildlife management. The following sections identify and discuss issues and economic approaches related to cougar management including:

1) social values and impacts of cougar hunts;
2) concerns related to livestock depredation;
3) concerns related to impacts on other big game hunts;
4) social perceptions, especially positive and negative existence values; and
5) Oregon Department of Fish and Wildlife revenue impacts.

Unfortunately, data required to quantify many of these relationships are either limited or not available. Due to this uncertainty, some issues are considered conceptually or based on examples in related literature.

Cougar Hunting Impacts

Direct use values are related to hunting, the value individuals place on the hunting experience, and the opportunity to take a trophy. Three general economic elements include: economic value of cougar hunting; economic impacts directly related to cougar hunting; and agency revenues. Cougar hunting provides economic value derived from satisfaction related to the hunting experience. Economic impacts are generated by hunters' expenditures on related equipment and travel. Fiscal impacts such as license and tag revenue are indirectly influenced by hunter values. Fiscal information provides context to agency actions such as budgets, research, and management that are costs borne by the user and by society.

ODFW tag fees revenues have varied over time as cougar hunting has changed. Resident cougar tag fees have generally decreased over time from $50 (1988-1997) to the current $10 fee established in 1998 (Table 22). The recent decrease in cougar tag prices have generally followed changes in cougar hunting seasons from use of dogs and controlled hunts before 1995 to general seasons without use of dogs from 1995 to 2005.

Table 22. Cougar tag fees 1975-2005. Note agent fees and the application fee of $3.00 required before 1995 are not included.

Tag Type and Year	Price
Resident 1975-1979	$10.00
Resident 1980-1987	$20.00
Resident 1988-1997	$50.00
Resident 1998-2005	$10.00
Sport Pac equivalent (approx.) 1998-2005	$7.65
Nonresident 1975-1979	$10.00
Nonresident 1980-1993	$150.00
Nonresident 1994-1999	$225.00
Nonresident 2000-2005	$150.00

Cougar tag sales and associated revenue have increased since cougar hunting began (Table 23). However, cougar tag revenues are a small percentage (approximately 1.5%) of total

wildlife license and tag revenue. The greatest revenue impacts resulted from the change from controlled to a general tag in 1995, and the decrease in resident tag price from $50.00 to $10.00 in 1998. Cougar tag sales jumped from less than 1,000 in 1997 to nearly 10,000 tags in 1998. General season cougar tag sales has remained relatively constant, between 9,000–11,500 tags from 1998 to 2004. Another major change was development of the Sports Pac combined license and tags package in 1998, which includes a general season cougar tag. The prorated price of a cougar tag in the Sports Pac is $7.65. As Sports Pac sales have increased during the last seven years, total cougar tag sales has increased to approximately 35,000. However, actual hunter numbers using the tag may be small compared to those buying individual tags.

Agency revenue from individual tag sales increased from approximately $47,000 in 1997 to an average of approximately $100,000 following the price reduction. The ten-fold increase in tag sales from 19997 to 1998 indicates the lower tag price had a greater impact on sales than the change to general season tags in 1995. Sports pac sales, which include a general cougar tag, have increased from 1,830 in 1998 to a 24,357 in 2004. The 2004 sports pac sales level translates into approximately $186,000 in ODFW revenue.

Table 23. Cougar tag sales and associated revenue. Tag numbers from 1975 to 1980 are the number authorized and not necessarily sold.

Year	Cougar	Sports Pac	Nonresident	Revenue
1975	95			$ 950
1976	125			$ 1,250
1977	140			$ 1,400
1978	130			$ 1,300
1979	140			$ 1,400
1980	160			$ 3,200
1981	141			$ 2,820
1982	163			$ 3,260
1983	188			$ 3,760
1984	263			$ 5,260
1985	362			$ 7,240
1986	462			$ 9,240
1987	462		4	$ 9,840
1988	421		8	$ 22,250
1989	438		20	$ 24,900
1990	446		22	$ 25,600
1991	446		39	$ 28,150
1992	499		12	$ 26,750
1993	552		16	$ 30,000
1994	576		16	$ 32,400
1995	380		5	$ 20,125
1996	794		6	$ 41,050
1997	931		4	$ 47,450
1998	9,921	1,830	14	$116,360
1999	9,128	6,311	16	$143,159
2000	9,817	12,542	27	$198,166
2001	11,420	16,964	37	$249,525
2002	10,511	21,565	40	$276,082
2003	10,604	23,718	37	$293,032
2004	11,323	24,357	31	$304,211

Before 1995, cougar hunting was closely controlled with a limited number tags and hunting areas available. Since 1998, cougar hunts are characterized by restrictions on cougar hunting methods, a lower cougar tag price, and greater availability of general hunt tags either sold individually or as part of the Sports Pac. Cougar hunting has changed from directed to opportunistic in character. Instead of hundreds of participants with a relatively high success rate, tag holders include thousands of potential participants with an overall low success rate. A large proportion of successful cougar hunters are actually targeting other species (Oregon Department of Fish and Wildlife, unpublished data).

When considering economic values and impacts of cougar hunting, a large proportion of satisfaction results from species such as deer and elk. The possibility of also hunting cougar on a given trip may enhance the hunting experience, but the bulk of net benefits and expenditures are

not directly related to cougar hunting (Table 24). Hunting satisfaction and associated willingness to pay may increase with the possibility of harvesting a cougar, but for most trips and individuals it is a small portion of net benefits or value associated with the hunting experience.

Table 24. Average total hunting activity and net benefits of deer and elk hunting in the Blue Mountain region of Oregon, 1992–2002.

Species	Hunters/Yr	# Taken/Yr	Mean Field Days/yr	Total net benefit/yr
Deer archery/ rifle	52,357	20,408	282,688	$15.8 million
Rocky Mt Elk archery/rifle	68,583	14,345	398,528	$30.3 million

The change in economic value or level of net benefits due to cougar hunting is reflected in the change in participation when the tag price was changed in 1998. Cougar tag demand can be defined as the inverse relationship between tag price and participation. Consumers of tags (hunters) gain consumer benefits defined as the area under the demand curve, but above the price paid for the tag. Although data are not available to calculate the demand function, the increase in number of participants and associated net benefits were significant in 1998. When the tag price was decreased, net benefits increased by the amount current participants (those who purchased tags before the decrease in tag prices) saved from the lower price, and the net benefits gained by new participants. Hunters were responsive to the change in the cougar tag price with an increase of individual tag sales in 1998 from 931 to 9,921.

With respect to economic impacts associated with expenditures, it is unlikely significant additional trip and equipment expenditures are linked to possession of a cougar tag when the hunter is acting opportunistically. In other words, hunters would have spent similar amounts for the species they were already targeting such as deer and elk without possession of a cougar tag.

On the other hand, net benefits and economic impacts of individuals who target cougar exclusively on a given trip can be fully attributed to satisfaction derived from cougar hunting. Although different, net benefits are likely in the same order of magnitude as other hunting experiences such as elk at $75 per day, or deer at $56 per day (USFWS 2003a). In addition, economic impacts such as trip expenditures would also be fully attributable to cougar hunts with likely ranges between $60 and $70 per day (Carter Undated). The number of individuals in this category is likely relatively small. It might be assumed that number of hunters who continued hunting at high tag fees after hunting with dogs was banned, between 316 and 863 during the 1995 to 1997 period, is indicative of the relative magnitude of this group.

With respect to Sports Pac sales, it is likely a significant portion of hunters who bought the tag as part of the package are unlikely to use the cougar tag or even intend to harvest a cougar. Other Sport Pac purchasers may be opportunistic when hunting other target species while a small portion may target cougar exclusively. The actual breakdown of Sport Pac purchasers is unknown, but it is likely only a small portion of Sports Pac purchasers is in the group that hunts cougar exclusively.

Depredation

There are two main potential costs associated with livestock depredation: 1) direct costs of livestock losses to producers; and 2) costs of management actions incurred by private individuals, counties, ODFW, or Wildlife Services. Losses associated with cougar predation are generally small relative to the total industry, but consequences are potentially serious for specific areas or individual ranches where chronic problems occur. Average cougar related losses

reported to Wildlife Services between 1996 and 2002 were 215 sheep, 58 cattle and 16 horses. These averages are lower than those reported by the NASS surveys that provide breakdowns of cattle, calves, sheep and lambs and associated approximate value (Table 25, NASS 1995, 2000). Although depredation rates generally increase with cougar population size, without more detailed information accurate current and potential losses, especially loses associated with management practices in Oregon are uncertain (Table 25, NASS 1995, 2000).

Table 25. Livestock losses in Oregon attributed to cougars (sheep and lambs) and cougars and bobcats (cattle and calves; NASS 1995, 1996, 2000, 2001)

Year and Livestock	Number lost	% of all predator losses	Approximate Value
Cattle 2000	100	33.3%	$ 66,800
Calves 2000	500	12.2%	$139,500
Sheep 1999	500	15.2%	$ 40,000
Lambs 1999	800	10.7%	$ 32,000
Cattle 1995	100	33.3%	$ 62,000
Calves 1995	300	6.8%	$ 91,500
Sheep 1994	450	10.5%	$ 29,700
Lamb 1994	1,625	12.4%	$ 58,500

For areas that incur depredation, farm level costs may increase because avoidance, harassment, and other methods are used to decrease depredation levels. Farm-level costs also may increase if remote areas become too risky for use. These areas may lose value for livestock leasing although changes in practices and values in other regions are difficult to quantify. According to an Oregon Cattlemen's Association (2002) survey, 58% of respondents answered that their cattle are pastured on range not closely attended during part or all of the year.

Control methods are potentially costly depending on need and specific situation. Non-lethal methods to prevent loss may include guard dogs, exclusion fencing, herding, and night penning. Many of these methods are currently employed for carnivores such as coyotes, cougar, and bear. Lethal methods and services are often provided by government agencies such as Wildlife Services. It is not possible to provide costs of control solely attributable to cougar.

Deer and Elk Hunting

Whether on public or private land, the public asserts its implied rights under the Public Trust Doctrine for fisheries and wildlife protection. In essence, this doctrine assigns rights to use fish and wildlife to citizens of the state, not to landowners (Loomis 1993). Rights to use or appreciate these resources are controlled by state and federal agencies, and are not often bought and sold in a competitive market. Although recreational days are not obtained at a market price, hunting and viewing experiences may be highly valued. Private hunting operations and guide services attempt to capture a portion of this value relative to public hunting opportunities. No market prices exist to indicate how society values wildlife resources, or suggest to society as a resource producer how much should be supplied. Yet non-market values are embodied in people's choices such as time spent, travel expenditures, lodging, and related goods. Choices also are made among many recreational possibilities depending on individual preferences.

License fees, tag fees, travel, and equipment expenditures capture only a portion of the total value of the hunting experience. Hunters are willing to pay at least as much or more than the total paid for these items. Economists use the concept of "willingness to pay" to explain consumer benefits from use of goods or experiences. The difference between willingness to pay and amount consumers actually pay is termed consumer surplus, or net benefits. It can be conceptualized as the amount consumers save by buying at the price they paid instead of the greatest price they would be willing to pay. Many techniques have been devised to assess values

indirectly by using travel cost, contingent valuation (directly asking how much people are willing to pay for the activity), and discrete choice models (how people compare this experience against other experiences that can be valued monetarily).

Cougar predation on elk and deer may negatively impact related hunting activities in terms of quantity and quality of hunting days. Demand and associated value of hunting-days is dependent on many factors such as expected success rate, hunter congestion or crowding, quality and type of potential harvested animals, hunt location, and other characteristics of the experience. Therefore, the value of a hunting-day will change as characteristics of the experience change.

Even more basic is availability or supply of hunting opportunities if allowable harvest decreases. Although there is a decreasing trend in number of hunting licenses sold as a proportion of the total population, demand for big game hunts in eastern Oregon is generally greater than opportunities supplied. As elk and deer populations change, tag numbers and other management measures or regulations adjust to control harvests. More stringent management translates into fewer hunter-days in the field and loss of net economic benefits directly related to the loss of hunter-days. These changes can be examined with bioeconomic analyses that consider biology and economics assuming the following relationships: Cougar population changes → Impacts on prey populations → Changes in allowable hunter harvest → Change in number and or quality of hunter-days → Change in the net benefits of hunting

If one could reliably forecast changes in prey populations resulting from cougar predation, it would be possible to estimate changes in number of hunter-days according to past experiences with resource fluctuations. Change in the number of days in the field could then be linked to value of a hunting-day to estimate the change in net benefits of hunting.

The average net economic value of elk hunting in Oregon was $76/day in 2001 (U. S. Fish and Wildlife Service 2003). Using this value, a loss of 1,000 hunter-days would result in a net economic loss to society of $76,000. This may be an overestimate depending on type and characteristics of the hunt. As noted earlier, changes in characteristics of the hunting experience will change demand and associated values of a hunting-day. Although uncertainty exists regarding the level of reduction in number of hunting days and hunting day values, the most difficult challenge involves defining and quantifying sources of prey population fluctuations.

Economic impacts, a measure of economic activity, are generated by hunting expenditures. Hunter expenditures were estimated for hunts on the Starkey Experimental Forest in 1989 – 1991 (Table 26). A portion of the hunters came from western Oregon, thus hunter expenditures and associated impacts on total personal income were partitioned into statewide and eastern Oregon impacts. Using eastern Oregon income impact estimates inflated to 2003 levels, it is possible to approximate the personal income impact of deer and elk hunting in eastern Oregon WMUs. If resulting change in number of days in the field can be calculated, the change in expenditures and other economic impacts can be considered.

Assuming eastern Oregon impacts per hunter-day from Starkey Experimental Forest apply elsewhere in the region and state, estimated total income impacts of deer and elk hunting can be calculated (Table 27). As with economic values and net benefits, if resulting changes in number of days in the field can be calculated, change in expenditures and other economic impacts can be inferred. Currently, cougar impacts on prey species such as elk and deer are not

possible to estimate reliably, but ranges of costs to the hunting sector may become possible as research progresses.

Table 26. Mean hunter-day expenditures and associated impacts on total personal income for elk and deer hunters in Starkey Experimental Forest.

Hunt period	# Usable Responses	x | Trip Expenditures/ Hunter day	State Level Income Impacts	Mean Eastern Oregon Expend./ hunter day	Eastern Oregon Income Impact
Elk Hunts					
1989	37	$ 48.95	$ 36.55	$ 18.49	$ 8.58
August, 1990	129	$ 46.40	$ 35.23	$ 26.32	$ 12.95
December, 1990	37	$ 71.13	$ 54.31	$ 42.81	$ 21.56
August, 1991	138	$ 51.18	$ 38.44	$ 27.17	$ 12.38
December, 1991	95	$ 60.46	$ 45.68	$ 31.22	$ 14.25
Weighted Average	436	$ 53.29	$ 40.25	$ 28.39	$ 13.41
Weighted Average, 2003 $		$ 66.67	$ 50.35	$ 35.52	$ 16.78
Deer Hunts					
1989	68	$ 46.29	$ 35.05	$ 21.25	$ 9.03
October, 1990	20	$ 48.09	$ 34.12	$ 20.95	$ 8.25
October, 1991	19	$ 57.18	$ 42.98	$ 36.82	$ 17.48
Weighted Average	107	$ 48.56	$ 36.28	$ 23.96	$ 10.38
Weighted Average, 2003 $		$60.75	$45.39	$29.97	$12.98

Source: ODFW unpublished data from Chris Carter, former staff economist.

Existence Values

Another broad value category involves nonuse values or existence value. Existence value is the benefit people gain from knowing something exists, even in cases where they may never visit or benefit directly (Krutilla 1967). These values often are associated with a historical place or building, a natural area, or preservation of a species. Two reasons people may hold values unrelated to their current use pattern include preservation of options for future use, and bequeathing natural resources to one's heirs (Krutilla 1967). Economists use terms such as existence, bequest, generational, preservation, and intrinsic values to define this general category. Although difficult to assess, these values are reflected in expression of social and cultural values. There is broad agreement among economists that these values exist and ignoring them could lead to serious errors and resource misallocations (Freeman 1993). However, there also is disagreement regarding appropriate terminology and how to measure these values empirically (Freeman 1993). These values are usually investigated by asking hypothetical questions regarding willingness to pay for the existence of the subject in question.

Although the existence of cougars is not threatened, people generally value the existence of cougar in their natural habitat and the manner in which they are managed. For example, using hounds as a public hunting method was perceived as inhumane by some members of the Oregon public. These values were manifested in Ballot Measure 18 that passed in 1994 with 52% of the vote. A Colorado study showed approximately 80% of people had positive attitudes toward cougars (Zinn and Manfredo 1996). Of those with positive attitudes, 96% agreed it was important to them to know cougars exist while 80% of individuals with neutral

Table 27. Estimated total economic impact (in millions of $) of elk and deer hunting for the Blue Mountain region and the state of Oregon.

Hunt	Total days	Regional		State	
		Expenditure	Personal Income	Expenditure	Personal Income
Deer	282,688	$8.5	$3.7	$17.2	$12.8
Elk	398,528	$14.2	$6.7	$26.6	$20.1

or negative feelings toward cougars agreed that it is important to know they exist (Zinn and Manfredo 1996).

It should also be noted there is willingness to pay for reducing cougar populations and excluding cougars from specific areas. These values are partially captured in hunting and depredation losses. There also are individuals who do not directly incur damage but would be willing to pay for reduced cougar numbers. This may be related to human safety concerns or other perceptions about cougars. A Washington study of resident's opinions and attitudes toward hunting and game species management found support for predator control. Nearly 70% of respondents strongly or moderately supported reducing the number of predators in situations to prevent loss of domestic animals such as livestock or pets (Duda et al. 2002). Significant moderate or strong support to reduce predators was also found for protection of threatened or endangered species from predators (76%), increasing game populations (40%), and for addressing human safety (87%; Duda et al. 2002). A survey of Southwest Oregon residents provided a similar split in opinions. Respondents were generally positive about the opportunity to see a cougar in the wild (Chinitz 2002). However, questions involving cougar and the relative health of the environment, quality of life, decline of elk and deer, hunting, and management showed significant numbers of respondents are on both sides of the question (Chinitz 2002).

Negative feelings or beliefs are likely related to fear of a cougar encounter, perceived and actual impacts on local economies, and resistance to external control or regulation. It is likely rural inhabitants place a high value on their way of life and attributes related to independence and self-sufficiency. Many of these elements are not directly related to cougar hunting, but involve a larger set of social concerns and perceptions. In order to identify and calculate these values, additional work specific to Oregon would be required.

Survey design and sufficient sample size are important considerations when evaluating studies of social values. However, regional studies suggest three important factors should also be considered: 1) there is public support and potentially large net benefits associated with cougar conservation in Oregon; 2) with the right mechanisms, potential willingness to pay may translate into significant program financing; and 3) opinions are likely to vary between and within regions of the state.

Public Agency Costs

The Oregon Department of Fish and Wildlife expends resources for cougar management in three general areas:

- Data collection for statewide management purposes,
- Damage and human safety complaints or inquires, and
- Research projects in the Southwest and Northeastern portions of the state.

Costs of current cougar management were compiled for each of six cougar zones that include 21 wildlife districts statewide. ODFW annually transfers $45,000 to WS under a contract for responding to cougar and bear damage. In addition, approximately $205,000/year in personal services and supplies costs are used for work related to cougar management by ODFW. The focus of ODFW activities includes human safety, wildlife damage and cougar management. Staff check-in cougar taken by hunters, process biological samples and analyze results as part of

cougar related management responsibilities. In contrast to management, cougar research is short-term with temporary costs linked to the life of the project.

The magnitude of cougar plan costs would depend on the scope of work to be conducted such as the number and size of potential target areas. By reviewing the potential scope of work, ODFW was able to develop an estimate of the costs to provide for additional Wildlife Services personnel to assist in the plan implementation. Existing wildlife services personnel would in some instances shift their primary focus from a case-by-case reactive response to a proactive targeted response. These activities would most likely occur in areas where they have historically conducted some level of cougar damage control. In order to meet the new workload requirements, Wildlife Services estimates an additional $186,420 per year ($372,840 per biennium) would be required. This would cover the costs for two full-time positions whose focus would be to implement proactive cougar removal programs in approved targeted areas. The level of those costs would be fixed and not dependent of the number of target areas implemented by ODFW.

Likewise ODFW would expect to incur an increase in costs associated with management programs to implement and monitor any approved target areas (Table 28). These costs would include the additional time needed to develop, implement and monitor target area activities. In some cases it may also require ODFW personnel to provide on the ground assistance for cougar removal. These costs would be variable and depend on the number and characteristics of target areas approved for implementation. ODFW costs would be likely to range from the current level at $205,000 /year to $358,000 /year (additional $153,000/year that would be redirected from existing programs).

Table 28. Current and anticipated annual costs associated with cougar plan implementation.

Agency	Current Costs	Additional Costs (Low end of range)	Total Costs (Low end of range)[c]	Additional costs (High end of range)	Total costs (High end of range)[c]
ODFW[a]	$205,000	$0	$205,000	$153,000	$358,000
Wildlife Services[b]	$45,000	$186,420	$231,420	$186,420	$231,420
Totals	$250,000	$186,420	$436,420	$339,420	$589,420

[a] Additional ODFW costs would range from $0 at the low end to $153,000 at the high end of the range depending on the number of target areas implemented.

[b] Additional Wildlife Services costs would be the same for both low and high end estimates at $186,420.

[c] Total costs include both current and additional costs.

All of these costs would be born by ODFW and would require a shift in priorities of existing programs. The bulk of costs would come from redirecting existing damage budgets implemented at the Regional level. Additional costs for public education efforts that would be incurred by the Information and Education Division should also be considered.

Conclusion

Integration and use of social sciences such as economics, sociology, psychology and anthropology can improve our understanding of individual values and preferences. These values are reflected in actions of individuals as they participate in diverse activities such as markets, recreation and voting. Biology provides management constraints for a given issue because of population and ecological realities. However, within the range of feasible population levels,

policies are dictated by social values. Eventual cougar population levels and methods of population management will depend on evolving social values.

Two general social elements will be needed as these issues are debated. First, in addition to improving our understanding of biology, bioeconomic efforts are needed to integrate biological outcomes with economic costs and benefits. Public debate can be focused if dependable information can be brought forward to estimate livestock industry, hunting and other social costs and benefits. Second, a public process that recognizes social diversity and the need to air different public attitudes is needed. Complete agreement among all interests may not be attainable, but a process that provides a forum for divergent views can foster cooperation. Although this process can be extremely difficult, the alternative is often driven by special interest effects and micromanagement from both sides of the political spectrum.

CHAPTER VIII: LITERATURE CITED

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APPENDICIES

APPENDIX A: History of Cougar Management in Oregon

1843-1912: First bounty offered by territorial government in 1843. Bounty in 1911 was $10.

1913-1961: Cooperative government hunter program began in 1915. Between 1915 and 1961, federal hunters killed 442 cougar. Bounty increased from $10 to $25 in 1925. The depression forced a reduction to $20 in 1933. Bounty increased to $50 in 1939 and was paid until 1961.

1962-1967: Government hunters took 31 cougar on damage complaints. Hunting became more popular as road construction increased and more efficient snow travel equipment was developed. The 1967 Oregon Legislature granted the Oregon State Game Commission authority to declare cougar a game animal in areas where damage was not expected. Bounties were no longer in effect (ORS 610.205).

1968-1969: Hunting for cougar was closed. A total of 26 cougar were taken on damage complaints.

1970: The Department authorized controlled season for 25 tags from December 1-31 in parts of Wallowa County. Ten animals were harvested with 8 classified as immature. The price of a cougar tag was $5.

1971-1974: The Department continued to offer controlled hunts with all or varying portions of the state open to hunting. In 1974, the bag limit was changed from one cougar to "one cougar except kittens and females with spotted kittens are protected."

1974: The Department developed a draft Strategic Plan for cougar management in Oregon.

1975: The cougar tag fee was increased to $10.

1975-1987: Controlled hunts continued. Varying parts of the state were open.

1987: The first Oregon Cougar Management Plan developed and adopted. The Oregon Legislature approved legislation that increased the price of a cougar tag to $50 (effective 1/1/88).

1987-1992: Controlled hunts continued. Number of hunts and tags increased in response to an expanding cougar population and increasing cougar damage complaints.

1989: The Department initiated the Catherine Creek Cougar Study.

1992: The Department initiated the Southwest Oregon Cougar Study.

1993: The Department and the Fish and Wildlife Commission revised the Cougar Management Plan to guide management through 1998.

1994: Measure 18, a citizen Ballot Initiative, was passed during the November general election making it unlawful for hunters to pursue cougars with dogs (ORS 498.164). Employees of county, state, and federal governments are specifically exempted allowing agencies to use hounds as part of their normal duties.

1995: The Department changed cougar hunting from a controlled hunt system with a limited number of highly successful hunters with hounds to a statewide, unlimited general season to compensate for the expected dramatic decline in hunter success rates. The

season dates also were expanded from 2 ½-4 months to 7 months. The Department instituted a quota-based system of harvest management.

1996: Measure 34, also a citizen Ballot Initiative, was voted on during the November general election but failed to pass. Measure 34 would have repealed statutes enacted by Measure 18.

1997: The Oregon Legislature dropped the price of a cougar tag to $10.00. Corresponding cougar tag sales increased from 937 in 1997 to 11,761 in 1998. The Oregon Legislature also creates the Sport Pac license for Oregon residents that automatically issues a cougar tag with purchase of the license package.

1998: The Department institutes year round cougar hunting seasons in four areas of southwest Oregon to help address ongoing levels of high cougar damage.

1999: High interest in the Sport Pac license results in a dramatic increase in number of cougar tags from 14,564 in 1999 to 22,386 in 2000. The Oregon Legislature included a note to the Department's biennial budget directing the Department to study the impacts of cougar populations in northeastern Oregon.

2000: Cougar season open only for 5 months in the fall to allow for change into a calendar year framework. The Department conducts an Environmental Assessment regarding the proposed Elk-Nutrition-Predation study in NE and SW Oregon.

2001: Cougar season changed to a split 10 month season to run January 1 – May 31 and August 1 – December 31. The Oregon Fish and Wildlife Commission adopted changes to the bag limit in Blue Mountain Quota Zone to allow take of second cougar with purchase of an additional tag. The Oregon Legislature adopted legislation formally stating that it is legal for persons to take a cougar posing a threat to human safety without a permit (ORS 498.166). The USFWS found no significant impact for the proposed Elk-Nutrition-Predation study in NE and SW Oregon, approved the study design, and allocated the funding.

2002: Field work began on the Elk-Nutrition-Predation study. Sierra Club et al. filed a temporary restraining order halting the treatment portion of the Elk-Nutrition-Predation study and sued the USFWS in an attempt to halt funding for the project. The 9th Circuit Court of Appeals issued a split decision on the suit against USFWS allowing all of the Elk-Nutrition-Predation study to proceed except for treatment in the form of cougar removals in the study areas.

2003: The Oregon Legislature modified the damage statute (ORS 498.012) to allow take of wildlife including bears and cougars posing a public health risk or that is a public nuisance. The USFWS filed an Intent to Appeal the 2002 court decision.

APPENDIX B: Cougar Incident Response Guidelines

Cougar populations are generally healthy and increasing throughout Western North America, and Oregon is no exception. Cougars have now occupied all of what biologists have identified as cougar habitat. As cougar populations have increased, individual animals are now establishing home ranges in and around valley floors, suburbs, and other locations that bring them into close and regular contact with humans. Evidence suggests this is not a function of cougar wandering out of more traditional ranges, but is an expected development given current cougar population trends.

With this trend, contacts between humans and cougars are increasing. While statistically there is a low probability of attack or danger to human beings, recent events in California, Colorado, and British Columbia where fatal attacks on people have occurred indicate that a cautious approach to cougar management is warranted. Therefore, ODFW will utilize the following guidelines when dealing with cougar/human interactions and damage situations involving cougars:

1) When sightings are reported by the public, without clear evidence of damage or any aggressive behavior (see "Behavior Pattern Criteria" listed in 2) below), ODFW will utilize this contact as an opportunity to educate the public about cougars, their population increase, the fact that people and cougars now occupy more and more of the same habitat, and safety precautions people can take to minimize cougar-human conflicts. *ODFW will not attempt to remove cougars because of incidental sightings*. The public should be referred to the brochure "Living With Mountain Lions" for more information on this topic.

2) When "Behavior Pattern Criteria" as listed below do indicate a concern and it is practical to do so, ODFW will attempt to remove offending cougars. *All animals contacted under these circumstances will be humanely euthanized*. Under no circumstances will ODFW or its agents attempt to trap and re-locate cougars, because a chance of human attack and/or continuing damage or human conflict exists.

   If one or more of the following criteria are satisfied, the decision to destroy the animal due to concerns over human safety is justified.

   Behavior Pattern Criteria:

   a) Aggressive actions directed toward a person or persons, including but not limited to charging, false charging, growling, teeth popping and snarling;

   b) Breaking into, or attempting to break into, a residence;

   c) Attacking a pet or domestic animal as defined in ORS 167.310;

   d) Loss of wariness of humans, displayed through repeated sightings of the animal during the day near a permanent structure, permanent corral or mobile dwelling used by humans at an agricultural, timber management, ranching or construction site.

3) Where cougar(s) are causing damage, being a public nuisance, or posing a public health risk, and ODFW personnel or its agents are called to respond, the animal will be humanely euthanized. *Under no circumstances will consideration be given to re-location of cougars*.

4) In the case of lethal removal of a lactating female cougar, all reasonable attempts will be made to locate juveniles and capture these animals alive. If successful, juveniles shall first be offered to any bona fide educational facility (member: AZA) for display and/or educational purposes. *If no such permanent home can be found, juvenile(s) shall be humanely euthanized*. Because of potential for future human interactions and danger, no attempt shall be made to rehabilitate and release juvenile cougars in Oregon.

5) Under no circumstance will attempts be made to rehabilitate any cougar for release into Oregon. *All animals contacted by ODFW or its' agents as a result of disease, injury, vehicle accident, or other causes, shall be humanely euthanized*. Attempts will be made to place captured juveniles as in 4) above. However, if unsuccessful, juveniles will be humanely destroyed.

All opportunities to explain and educate the public about the rationale behind lethal removal shall be utilized. These include not only the potential for future danger, but also cougar population biology (particularly territoriality and intra-specific competition and mortality), legal liability, and our policy of not moving a potential problem animal to another location where someone else's pets, livestock, or family could be put at risk. All efforts to prepare and respond in a positive manner will be made by all personnel involved in public contacts related to cougar management activities.

APPENDIX C: Captive Cougar Kitten Guidelines, April 2005

Young wildlife naively or illegally taken from the wild and brought home by the public each year create many challenges for managers to produce an acceptable outcome for those animals. Once an animal is removed from the wild prompt action is required including deciding whether the animal can be returned to the wild immediately, and if not, is there an adequate placement facility or alternatives if a placement facility is not available.

Except for fish hatchery facilities and game bird holding pens on state owned wildlife management units, the Oregon Department of Fish and Wildlife (ODFW) is not equipped to hold wildlife species in a USDA approved captive facility nor is it ODFW's desire to act as a part-time zoo or rehabilitation facility for wildlife. ODFW's mission is to "protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations." Within this mission, ODFW is committed to protecting and managing wild species in the wild habitats and pristine environments they occupy.

Under Oregon Administrative Rule (OAR) 635-044-0015 " no game mammal….may be captured and held in captivity, except as authorized by the director. However, under OAR 635-044-0200 members of the public can rehabilitate mammals if they acquire a Rehabilitation Holding Permit. If injured, sick or immature mammals are not capable of survival in the wild if returned, they can be released to an organization, educational institution, museum or publicly funded zoo, or as determined by the department (OAR 635-044-205).

In almost all cases, cougar kittens of any age will not survive when returned to the wild unless returned to their birth mother. Further, returning wild kittens to their birth mother's is rarely possible. If this is not possible, the animal must be released to a zoo facility or humanely euthanized when a zoo facility is not available. Where facilities are available, ODFW is interested in only the highest standard of care for those cougar kittens that may become captive.

Previous ODFW guidelines dated August 19, 1997 provided a logical protocol stating that in the case of captive cougar kittens "….juveniles shall first be offered to a bona fide educational facility (member: AZA – American Zoo and Aquarium Association) for display and/or educational purposes. If no such permanent home can be found, juvenile(s) shall be humanely destroyed. Because of potential future human interactions and danger, no attempt shall be made to rehabilitate and release juvenile mountain lions in Oregon."

These guidelines are designed to specifically address issues pertaining to captive cougar kittens. The hope of refining this process is to provide managers a procedure to efficiently and effectively act on situations involving captive cougar kittens.

AZA Accredited Institution

AZA accredited facilities are considered to provide the highest level of care for captive animals. AZA accredited facilities are almost exclusively zoological parks or aquariums that serve as permanent cultural institutions. Under the AZA definition of these institutions they "own and maintain wildlife, under the direction of a professional staff, provide its collection with appropriate care and exhibit them in an aesthetic manner to the public on a regularly scheduled, predictable basis. They are defined as having as their primary business the exhibition, conservation, and preservation of the earth's fauna in an educational and scientific manner. Accreditation or certification is good for five years. Standards are subject to continuous review and enhancement, requiring increased levels of professional commitment to achieve and

maintain accreditation or certification. Once accredited or certified, an organization is expected to continuously advance its professional operation and constantly maintain, or surpass, all professional standards, policies, guidelines, or resolutions adopted by the American Zoo and Aquarium Association."

An organization may become certified as a related AZA facility. These organizations hold wildlife, but are not open to the public on a regularly scheduled, predictable basis. They include wildlife ranches, wildlife refuges or rehab centers, research facilities, sanctuaries, survival centers, breeding farms, and educational outreach organizations.

Oregon cougar kittens should only be sent to an AZA accredited institution, not related or affiliated facilities. The rationale behind this discrimination is that many of the available AZA related facilities, though adequate and inspected by the AZA, are primarily privately owned. If a private facility losses its certification or becomes financially insolvent the animals could theoretically be sold to the highest bidder by the family or corporation. Therefore, one of Oregon's cougars could end up at a roadside zoo in sub-optimal care. AZA accredited facilities are established inspected zoos that often have municipality backing. In the unlikely event that an AZA accredited facility would become financially unable to operate, its animals would likely transfer to another AZA accredited facility.

Cougar Kitten Placement Procedure

When a cougar kitten is brought into captivity because of illegal or unfortunate events, ODFW will 1) determine within 48 hours whether an AZA accredited facility is available and place the animal, or 2) humanely euthanize the animal. The contact for placement is Michele Shireman, AZA Felid Taxon Advisory Group Puma Population Manager, Oregon Zoo Hospital & Quarantine Keeper 503-226-1561 x5231.

Available facilities are predetermined via frequent AZA meetings and kept in a record that identifies which AZA accredited facilities are requesting a cougar and when they are able to receive the animal. If a facility is available, the Puma Population Manager will assist ODFW with timely arrangements and transport details concerning the receiving facility. All required permits, and associated costs will be assumed by the receiving institution.

Cougar Kitten Handling Procedures

When a cougar kitten comes into the possession of ODFW it will be immediately transported to the ODFW veterinarian or a cooperating local veterinarian for care and health assessment.

Cougar kittens that come into ODFW control will not be allowed direct contact with ODFW employees or their family members or pets. Photographs should not be taken and employee contact with the animal should be kept to minimum to reduce habituation, stress, and unnecessary emotional attachment. The employee responsible for feeding and cleaning will be the only direct contact until a decision is made on the outcome of the animal's future. All public contact and media attention will be avoided.

Care and Health Assessment

The health status should be assessed as soon as is practical by the ODFW veterinarian or a local cooperating veterinarian. If the kitten is not healthy, or tests positive to specific diseases of concern for domestic and wild felids in Oregon, it should be euthanized and a necropsy

preformed with samples taken and sent to the diagnostic lab as directed by the ODFW veterinarian. The carcass can be disposed of routinely by burying, landfill, or incineration.

The animal will be euthanized using standard humane euthanasia methods, preferably by pentobarbital sodium at 1 cc per 10 pounds body weight. A pre-anesthetic should be administered to render the animal unconscious prior to euthanasia.

A necropsy should be preformed by the attending veterinarian and resulting findings recorded in the animals record.

Option 1: Animals held for placement in an AZA accredited facility:

1) Weight should be taken daily.
2) The animal can be kept in a large pet carrier with a litter box with shredded newspaper. Old towels and blankets serve as bedding.
3) The animal should be kept out of view and placed in a vacant room or out building.
4) Latex gloves should be worn at all times. Avoid scratches and bites. Wear animal handling gloves when picking up the animal. The infectious health status is unknown and the kitten should be considered a wild mammal with a potential for rabies, flea-borne diseases (plague, tularemia) and any number of the cat viruses (FIV, FeLv, FIP, panleukopenia, calicivirus, rhinotracheitis, chlamydia, ringworm) that can be spread to pets. Cat scratch disease caused by the pathogen *Bartonella* can cause systemic infections and serious *Pasteurella* infections can be anticipated from a cat bite wound.
5) If an AZA accredited facility is available, a thorough health check should be conducted by a veterinarian and vaccinations (Fel-O-Vax Lv-K IV) and deworming (Pyrantel poamate, fenbedazole, etc.) administered as per the request of the receiving facility.
6) Foods and Feeding for Young Kittens: A wide variety of different formulas are used for feeding young felines (≤ 2 months old). Esbilac™ canine milk substitute from Bordon is one of the most common formulas. It is available in two forms, liquid and powder, and must be mixed with water. It is not recommended unless prepared using an electric blender because it has a tendency to clump and settle at the bottom of the bottle. It has also been known to separate in the kitten's stomach and cause a blockage. The liquid formula is available in 8 and 12 oz cans and although somewhat lower in fat content than natural feline milk, if fed for such a short time, its ease of use makes this formula a good choice. Another suitable formula is Pet-Ag's Zoologic Milk Matrix.Another formula, KMR™ feline milk substitute by Bordon, is also widely used. Many food products can be found at local pet food markets including Petco or PetSmart, etc. If there are questions about feeding or listed foods are difficult to locate, please contact the ODFW veterinarian or the Oregon Zoo at 503-226-1561 x5231.
7) Foods and Feeding for Older Kittens: Older kittens (≥ 2 months) should have solid feline diets added gradually to their formula; recipes include commercial feline preparations made by Zupreem™, Spectrum™, Dallas Crown and Nebraska™, as well as human baby foods such as Gerber's™ and Beech-nut™ stage 1 strained chicken and turkey. Commercial feline products should be mixed with formula in a blender and strained as needed to facilitate good flow through the nipple. Because human baby foods lack proper vitamins and calcium, they should be supplemented with additives like Poly-

Visol™ liquid vitamin or Neo-Calglucon™ liquid calcium supplement. There is some concern that Gerber's™ brands were recently reformulated and now contain onion powder. Onion powder is contra-indicated in felines in large doses but because of the short time that kittens are fed this, it is probably not cause for alarm. (Note: I fed 7-8 pound kittens 3-4 freshly killed mice per day acquired from a pet store. Day old chicks can also be used to supplement the kitten diet with more natural food, providing higher levels of protein and calcium – C. Gillin).

8) Volume fed: Infant felids are easily overfed, especially smaller species and their body weight should be monitored daily. Total daily consumption should be limited to no more than 30% of its total body weight.

9) Feeding position: When feeding young felids, they should be placed on their stomach on a flat surface (table). There is a tendency to want to hold the kitten in your arms when feeding which, unfortunately, results in the kitten not being in the correct position. Holding the kitten in your arms usually ends up with it in an upright or head back position, which increases chances of aspiration and death. It is best to immediately start feeding the kitten on a table with the animal in a sternal position (i.e. laying on its stomach). At first the kitten will tend to peddle forward, but in time it will become adjusted to this routine.

10) Elimination: Elimination should occur several times a day for very young (< 6 weeks old) kittens. To accomplish this, the kitten should be held in a sternal position and the region extending from the belly to the anus gently stroked with a warm, moist cloth. Only slight pressure is needed to help guide the fecal material through the digestive tract and out the anal canal. If the kitten is awaiting transfer to an AZA accredited institution, this procedure can be reduced to two times a day after a week. After the young begins eating solid food, this procedure can be reduced to one time per day. Most young will defecate on their own at 8 - 10 weeks, if not sooner.

Option 2: No AZA accredited institution is available to accept the animal(s):

Animals should be humanely euthanized as quickly as possible if no facility is available to accept the animal. This decision should be made jointly by the field biologist/district supervisor and department veterinarian. If the animal is not already in the custody of the ODFW veterinarian, the animal can be transported to the ODFW veterinarian for the euthanasia procedure or other arrangements can be made through a cooperating veterinarian.

The events leading to the final outcome of placement or euthanasia will be recorded in daily notes by the keeper of the animal and forwarded to the regional supervisor and Division headquarters (Wildlife Division Administrator, Deputy Administrator, Game Program Manager, and Cougar Program Staff Biologist). The regional communications coordinator and ODFW veterinarian will field any questions via the following talking points and knowledge of the case.

- Although people often feel they are protecting or saving animals they feel may be orphaned, it is in fact illegal to remove any live wildlife from the wild in Oregon. Further, most animals though to be orphaned are actually not orphaned and removing them from the wild ultimate is the least humane thing that can be done.

- It is ODFW's responsibility to manage Oregon's wildlife populations with sound biological practices for their long-term health and sustainability.

- ODFW contacted the Puma Taxon Advisory Group of the American Zoological Association (AZA) to find a facility approved by the organization that would take the kitten. No AZA-accredited facility is currently available to accept the animal into its collection.

- Because the young cougar become habituated to humans and there is no AZA-accredited facility willing to take it, ODFW was forced to take unfortunate action and euthanize it. The decision was not taken lightly and was a sad situation for all involved. However, any other action would have been irresponsible and contradictory to ODFW's mission.

- While releasing one cougar kitten back into the wild may seem a relatively harmless act, predators that have become habituated to humans can create serious human and pet safety problems. ODFW would be acting negligently to allow such a situation to occur.

- ODFW releases animals to AZA-accredited facilities because they provide the highest standard of care and most humane treatment for the animals, and because the organization was established primarily for conservation and education purposes. AZA-accredited zoos and aquariums undergo a rigorous six-month long review as well as an on-site inspection by a team of experts who examine the animal collection, veterinary care, the exhibits and physical facilities, safety, security, finances, staffing, and involvement in education, conservation, and research. Once awarded, accreditation must be renewed every five years.

- ODFW does not manage an AZA-accredited holding facility for cougars and could not hold the animal.

- The unfortunate loss of this cougar does not pose a threat to the health of the overall cougar population. ODFW estimated a minimum of 5,000 cougars in Oregon in 2003.

- Individual wild animals must be kept wild to protect the health of the entire population. While it is understandable that people are tempted to pick up animals that are, or appear to be, orphaned, it is always better to call wildlife authorities with the animal's location before taking action. State laws are designed to protect and manage wild animals in their natural environments for enjoyment by all as a public resource. The laws also serve to protect the health and safety of people.

APPENDIX D: Current Oregon Statutes Associated with Cougars
Note: Includes only relevant sections to maintain brevity in presentation of related statutes.

496.004 Definitions. As used in the wildlife laws, unless the context requires otherwise:

(9) "Game mammal" means antelope, black bear, cougar, deer, elk, moose, mountain goat, mountain sheep and silver gray squirrel.

(10) "Hunt" means to take or attempt to take any wildlife by means involving the use of a weapon or with the assistance of any mammal or bird.

(11) "Manage" means to protect, preserve, propagate, promote, utilize and control wildlife.

(12) "Optimum level" means wildlife population levels that provide self-sustaining species as well as taking, nonconsumptive and recreational opportunities.

496.012 **Wildlife policy**. It is the policy of the State of Oregon that wildlife shall be managed to prevent serious depletion of any indigenous species and to provide the optimum recreational and aesthetic benefits for present and future generations of the citizens of this state. In furtherance of this policy, the State Fish and Wildlife Commission shall represent the public interest of the State of Oregon and implement the following coequal goals of wildlife management:

(1) To maintain all species of wildlife at optimum levels.

(2) To develop and manage the lands and waters of this state in a manner that will enhance the production and public enjoyment of wildlife.

(3) To permit an orderly and equitable utilization of available wildlife.

(4) To develop and maintain public access to the lands and waters of the state and the wildlife resources thereon.

(5) To regulate wildlife populations and the public enjoyment of wildlife in a manner that is compatible with primary uses of the lands and waters of the state.

(6) To provide optimum recreational benefits.

(7) To make decisions that affect wildlife resources of the state for the benefit of the wildlife resources and to make decisions that allow for the best social, economic and recreational utilization of wildlife resources by all user groups.

496.162 Establishing seasons, amounts and manner of taking wildlife; rules. (1) After investigation of the supply and condition of wildlife, the State Fish and Wildlife Commission, at appropriate times each year, shall by rule: (a) prescribe the times, places and manner in which wildlife may be taken by angling, hunting, trapping or other method and the amounts of each of those wildlife species that may be taken and possessed. (b) Prescribe such other restrictions or procedures regarding the angling, taking, hunting, trapping or possessing of wildlife as the commission determines will carry out the provisions of wildlife laws. [also subsection 2, 3 and 4].

496.306 Compensation for damage done by bear and cougar not to be paid from State Wildlife Fund. If the State Department of Fish and Wildlife is required to pay compensation for damage activities of bear and cougar to people, real property, livestock, or agricultural or

forest products, the compensation, and any attorney fees, shall not be paid from the State Wildlife Fund, but shall be paid from such other moneys as shall be available therefore.

496.992 Penalties. (1) Except as otherwise provided by ORS 153.022 and other law, violation of any provision of the wildlife laws, or any rule promulgated pursuant thereto, is a Class A misdemeanor when the offense is committed with a culpable mental state as defined in ORS 161.085. If the defendant is sentenced to pay a fine, failure to pay the fine, or any portion thereof, shall be treated as provided in ORS 161.685.

(2) Except as otherwise provided by ORS 153.022 and other law, violation of any provision of the wildlife laws or any rule promulgated pursuant thereto is punishable as a Class A violation in the manner prescribed in ORS chapter 153 when the offense is committed with no culpable mental state as defined in ORS 161.085.

(3) The second and each subsequent conviction within a 10-year period for the taking of game fish with a total value of $200 or more or the taking of antelope, black bear, cougar, deer, elk, moose, mountain goat or mountain sheep in violation of the wildlife laws or any rule promulgated pursuant thereto which occurs more than one hour prior to or more than one hour subsequent to a season established for the lawful taking of such game mammals or game fish is a Class C felony when the offense is committed with a culpable mental state as defined in ORS 161.085

497.112 Hunting tags; fees; restrictions. (1) The State Fish and Wildlife Commission is authorized to issue, upon application, to persons desiring to hunt wildlife the following general tags and shall charge therefor the following fees:

(l) Resident annual cougar tag to hunt cougar, $10.

(m) Nonresident annual cougar tag to hunt cougar, $150.

497.132 Combined licenses for residents; fee. (1) In lieu of issuing to resident persons separate licenses for angling and hunting, the State Fish and Wildlife Commission is authorized to issue resident annual combination angling and hunting licenses, and charge therefor a fee of $38. (2)(a) In lieu of issuing to resident persons separate licenses and tags for various hunting and angling activities, the commission is authorized to issue resident annual sportsperson's licenses and shall charge therefor a fee of $125. The purchaser of each such license is authorized to engage in those hunting and angling activities for which the following licenses and tags are required:

(C) Cougar tag;

497.350 Hunting restriction; generally. (1) No person younger than 12 years of age shall hunt antelope, black bear, cougar, deer, elk, mountain goat, mountain sheep or moose. (2) No person younger than 14 years of age shall hunt with a firearm or bow and arrow unless the person is accompanied by an adult, or is hunting on land owned by the parent or legal guardian of the person.

498.012 Taking wildlife causing damage, posing public health risk or that is public nuisance. (1) Nothing in the wildlife laws is intended to prevent any person from taking any wildlife that is causing damage, is a public nuisance or poses a public health risk on land that the person owns or lawfully occupies. However, no person shall take, pursuant to this subsection, at a time or under circumstances when such taking is prohibited by the State Fish and Wildlife

Commission, any game mammal or game bird, fur-bearing mammal or nongame wildlife species, unless the person first obtains a permit for such taking from the commission.

(2)(a) Nothing in subsection (1) of this section requires a permit for the taking of cougar, bobcat, red fox or bear pursuant to that subsection. However, any person who takes a cougar, bobcat, red fox or bear must have in possession written authority therefor from the landowner or lawful occupant of the land that complies with subsection (4) of this section.

(b) Nothing in subsection (1) of this section requires the commission to issue a permit for the taking of any wildlife species for which a U. S. Fish and Wildlife Service permit is required pursuant to the Migratory Bird Treaty Act (16 U.S.C. §§703 to 711), as amended.

(3) Any person who takes, pursuant to subsection (1) of this section, any cougar, bobcat, red fox, bear, game mammal, game bird, fur-bearing mammal or wildlife species whose survival the commission determines is endangered shall immediately report the taking to a person authorized to enforce the wildlife laws, and shall dispose of the wildlife in such manner as the commission directs. In determining procedures for disposal of bear and cougar, the commission shall direct the State Department of Fish and Wildlife to first offer the animal to the landowner incurring the damage.

(4) The written authority from the landowner or lawful occupant of the land required by subsection (2) of this section for the taking of cougar, bobcat, red fox or bear must set forth all of the following:

(a) The date of issuance of the authorization;

(b) The name, address, telephone number and signature of the person granting the authorization;

(c) The name, address and telephone number of the person to whom the authorization is granted;

(d) The wildlife damage control activities to be conducted, whether for bear, cougar, red fox or bobcat; and

(e) The expiration date of the authorization, which shall be not later than one year from the date of issuance of the authorization.

(5) Any regional office of the State Department of Fish and Wildlife ordering the disposal of an animal under subsection (3) of this section shall file a report with the State Fish and Wildlife Director within 30 days after the disposal. The report shall include but need not be limited to the loss incurred, the financial impact and the disposition of the animal. The director shall compile all reports received under this subsection on a bimonthly basis. The reports compiled by the director shall be available to the public upon request.

(6) As used in this section:

(a) "Damage" means loss of or harm inflicted on land, livestock or agricultural or forest crops.

(b) "Nongame wildlife" has the meaning given that term in ORS 496.375.

(c) "Public nuisance" means loss of or harm inflicted on gardens, ornamental plants, ornamental trees, pets, vehicles, boats, structures or other personal property.

498.164 Use of dogs or bait to hunt black bears or cougars; prohibitions; exemptions; penalties. (1) Except as provided in subsections (2) and (3) of this section, a person may not use bait to attract or take black bears or use one or more dogs to hunt or pursue black bears or cougars.

(2) Nothing in subsection (1) of this section prohibits the use of bait or one or more dogs by employees or agents of county, state, or federal agencies while acting in their official capacities.

(3) Nothing in subsection (1) of this section prohibits the use of bait or dogs by persons for the taking of black bears or cougars in accordance with the provisions of ORS 498.012 relating to taking wildlife that is causing damage.

(4) Any person who violates subsection (1) of this section commits a Class A misdemeanor and, upon conviction, shall in addition to appropriate criminal penalties have his or her privilege to apply for any hunting license suspended for a period of five years for a first offense and permanently suspended for any subsequent offense.

(5) For the purposes of this section, "bait" means any material placed for the purpose of attracting or attempting to attract bears.

498.166 Bears or cougars posing threat to human safety. (1) Notwithstanding the licensing and tag requirements of ORS 497.102 and 497.112, a person may take a cougar or bear that poses a threat to human safety.

(2) Any person who takes a cougar or bear pursuant to subsection (1) of this section shall immediately report the taking to a person authorized to enforce the wildlife laws and shall dispose of the animal in such manner as the State Fish and Wildlife Commission directs.

(3) Any regional office of the department ordering the disposal of an animal under subsection (2) of this section shall file a report with the State Fish and Wildlife Director within 30 days after the disposal. The report shall include but need not be limited to the disposition of the animal, the events leading to the taking of the animal and any injury caused by the animal to humans or domesticated animals. The director shall compile all reports received under this subsection on a bimonthly basis. The reports compiled by the director shall be available to the public upon request.

(4) As used in this section:

(a) "Structure" includes a building being used as a residence, a building located on land actively used for agricultural, timber management, ranching or construction purposes or a building used as part of a business.

(b) "Threat to human safety" means the exhibition by a cougar or bear of one or more of the following behaviors:

(A) Aggressive actions directed toward a person or persons, including but not limited to charging, false charging, growling, teeth popping and snarling.

(B) Breaking into, or attempting to break into, a residence.

(C) Attacking a pet or domestic animal as defined in ORS 167.310.

(D) Loss of wariness of humans, displayed through repeated sightings of the animal during the day near a permanent structure, permanent corral or mobile dwelling used by humans at an agricultural, timber management, ranching or construction site.

APPENDIX E: Proposed Cougar and Bear Complaint Form ID CB####

Cougar & Bear Damage and Safety Complaint Form

RECEIVED BY_____ OFFICE CODE_____ DATE_____

COMPLAINANT INFORMATION

Name: Last_____ First_____ MI_____ Business/Company_____

Address_____ E-mail_____

City_____ State_____ Zip_____ Home Phone_____ Work Phone_____

COMPLAINT INFORMATION

Location Description (Required): Map Zone:_____ UTM: Easting _____ Northing _____

County Code_____ County Name_____

Cougar Management Zone (A – F): _____ Wildlife Management Unit #_____ Watershed District _____

Description of conflict _____

_____

_____

_____

_____

_____

Species _____ _____ Number Seen _____ Visible Markings _____

(code) (description)

VERIFICATION: Site Visited: □ No □ Yes If Yes, By Whom_____

Verified as Cougar/Bear: □ No □ Yes If Yes, how:_____

TYPE OF COMPLAINT: (Circle only one 1-3)

1. Human Safety: (Circle all that apply a-d)
   a) Acting aggressive towards a person, including but not limited to charging, false charging, growling, teeth popping and snarling.
   b) Breaking into, or attempting to break into, a residence
   c) Attacking a pet or domestic animal as defined in ORS 167.310
      Species_____ Number dead _____ injured _____
   d) Loss of wariness of humans displayed through repeated sightings of the animal during the day near a permanent corral or mobile dwelling or building used by humans at an agricultural, timber management, ranching or construction site.
2. Damage (Circle all that apply a-g)
   a) Landscaping (Example: Gardens, Fruit trees)
   b) Public Nuisance (Example: Garbage , Pet Food, Bird Feeder)
   c) Public Health Risk (Example: Potential Disease Transmission)
   d) Agricultural: Crop type _____ Acres Affected_____ Crop type_____ Acres Affected_____
   e) Livestock/Poultry: Species_____ # dead ____ # injured____ Species _____# dead _____ # injured _____
   f) Timber Damage
   g) Non-residential Structure damage (Example: Fencing, Bee hives, Other Structures)
3. Other (Circle all that apply a-c)
   a) Seen or Verified in Close Proximity to People
   b) Seen or Verified in Close Proximity to Livestock.
   c) Other (Specify) _____

ACTION TAKEN: (Circle only one)

1. Advice _____
2. Live trap and relocate (Bears Only)
3. Trap and kill
4. Hazed by landowner/agent
5. Killed by landowner/agent through damage provisions
6. Killed by landowner/agent through hunting provisions
7. Hazed by employee or agent of ODFW
8. Killed by employee or agent of ODFW

DAMAGE HANDLED BY: (Circle One)

1. ODFW
2. Wildlife Services
3. County
4. State
5. Private
6. Other

FINANCIAL LOSS $_____ Enter value even if zero or check here _____ if no estimate given by complainant

ANIMAL DISPOSITION

1. No animal to dispose of
2. Animal relocated & released
3. Carcass kept by landowner
4. Carcass salvaged (soup kitchen)
5. Buried
6. Rehab Facility
7. Educational Facility
8. Other_____
9. Seal #: _____

Proposed Protocol

1. Description of Conflict in "Complaint Information" section: Provide detailed description of conflict to supplement any details not captured in "Type of Complaint".
2. "Verification" : Identify who verified and using what type of evidence (i.e. tracks, claw marks, hair, picture, report of reliable observer, etc)
3. TYPE OF COMPLAINT: Circle most appropriate one of categories 1-3 but circle all that apply in subcategories a-d of category 1, a–f of category 2, and a–c of category 3.
4. Sightings are no longer recorded unless there is a human safety or damage concern. List number of animals seen in COMPLAINT INFORMATION section. If a cougar/bear sighting is reported in a populated area and it does not fit any of the criteria for statutorily defined human safety situations (Category 1 a-d), list under Other (category 3). Use this category when caller is concerned for safety or when cougar/bear is in a populated area where ODFW is concerned about cougar/bear-human conflict potential but the situation does not meet the statutory definition of category 1.
5. Under ACTION TAKEN, circle advice when that is the only action taken. For incidents where advice and one of the other actions is taken, just list the other action.
6. In the DAMAGE HANDLED BY section, the agencies listed should all be encouraged to use this form. All forms should be checked year to sort out duplicate reporting such as those created when complainant calls ODFW, we fill out report and refer them to WS and WS fills out second report for the same incident. Multiple incidents even just a few days apart should be treated as separate incidents. But, second- hand information (e.g. "my neighbor says he saw ….") should not be treated as a separate incident.

APPENDIX F: Management Concerns, strategies, and Implementation From the 1993 Plan

1. THE DEPARTMENT HAS A CONTINUED NEED FOR INFORMATION ON WHICH TO BASE COUGAR MANAGEMENT.

Strategies:

a. The Department will continue to authorize controlled cougar hunting seasons conducted in a manner that meets the agency's statutory mandates to maintain the species and provide consumptive and non-consumptive recreational opportunities. As it has done since 1970, the Department will use information from the hunter harvest, damage control, and illegal and accidental kill to monitor the health of the statewide cougar population.

b. The Department will continue to study cougar population characteristics as well as the impact of hunting on cougar populations. Research findings and new information will be used to update and/or amend management programs.

c. The Department will continue to apply population modeling to track the overall cougar population status. The cougar model will be updated as new information becomes available. Specific attention will be given to the information derived from special Oregon studies of the cougar population, reproduction, and age distribution.

d. The Department will continue the mandatory check of all hunter-harvested cougar and evaluate the information collected on population characteristics for use in setting harvest seasons.

e. The hunting season bag limit will remain "one cougar except spotted kittens and females with spotted kittens are protected."

f. The Department will continue development of a tooth aging (cementum annuli) technique.

Implemented Strategies:

ODFW eliminated the controlled hunting structure following the passage of Measure 18, which eliminated the use of dogs for cougar hunting. Since 1994 most cougar harvest has been incidental to hunting for other species. ODFW has continued to implement remaining strategies addressing this concern including: monitoring population characteristics, modeling the population, continuing mandatory check-in, maintaining the bag limit, and continued use of tooth annuli for aging cougars.

2. ILLEGAL HUNTING ACTIVITY HAS BEEN IDENTIFIED AND APPEARS TO BE RELATED TO THE INCREASE IN COUGAR POPULATIONS AS WELL AS THEIR AESTHETIC AND COMMERCIAL DESIRABILITY. ILLEGAL HUNTING HAS NOT BEEN FOUND TO THREATEN OVERALL COUGAR POPULATIONS.

Strategies:

a. The Department will continue to work with the Game Division of the OSP to monitor the level of illegal cougar hunting activity.

b. The Department and OSP will implement appropriate enforcement actions and make the necessary changes in regulations to reduce illegal cougar hunting.

c. The Department will continue the mandatory check-in of all hunter-harvested cougar.

d. The Department and OSP will continue to inspect taxidermist facilities and records to discourage and document the processing of cougar hides lacking Department seals.

Implemented Strategies:

ODFW has continued to implement all strategies identified in the 1993 plan to address poaching, including cooperating with Oregon State Police on enforcement activities and maintaining mandatory check-in.

3. POPULATION MODELING, HARVEST STATISTICS, DAMAGE COMPLAINTS, AND COUGAR SIGHTINGS INDICATE OREGON'S COUGAR POPULATION IS INCREASING. THIS, IN TURN, INCREASES THE POTENTIAL FOR FUTURE HUMAN-COUGAR CONFLICTS AND CREATES FEAR AMONG SOME CITIZENS.

Strategies:

a. The Department will provide information to the public about cougar distribution, management needs, behavior, etc., through various media and other available opportunities.

b. Where possible, the Department will attempt to solve human-cougar conflicts by non-lethal methods.

c. The Department will consider additional hunting seasons or increased hunter numbers in those areas where human-cougar conflicts develop.

d. The Department will manage for lower cougar population densities in areas of higher human occupancy.

Implemented Strategies:

ODFW has implemented all but one strategy identified to address this concern including: development of informational items to educate the public about managing cougars and cougar human conflicts, providing information on non-lethal methods such as livestock husbandry techniques to reduce conflicts, increasing hunter numbers by lowering the price of cougar tags, implementation of general cougar seasons, lengthening the cougar season, and allowing hunters to take two cougars/year in eastern Oregon. One 1993 strategy was to manage for lower cougar populations in areas of high human density. ODFW has placed a top priority on responding to cougar–human conflict. However, except in specific areas of southwest Oregon, cougar populations in more developed areas have not been specifically targeted.

4. THE ANNUAL COUGAR HARVEST IS ERRATIC BECAUSE THE AMOUNT AND TIMING OF SNOWFALL STRONGLY AFFECTS HUNTER SUCCESS. THIS, IN TURN, AFFECTS THE DEPARTMENT'S ABILITY TO MANAGE THE COUGAR POPULATION THROUGH HUNTING SEASONS.

Strategies:

a. Because annual fluctuations in the weather greatly influence the recreational cougar harvest, the Department will manage the species based on population *trends.* That is, the Department will *not* make regulation changes based on a single year's data collection, except in an emergency situation.

b. The Department will continue to regulate cougar hunting through controlled permit seasons.

c. The quota system will remain an option for regulating cougar harvest.

Implemented Strategies:

ODFW has implemented all but one strategy identified to address this concern including: managing cougar populations based on trends, and continuing the use of cougar quotas for management zones. Strategy "b" was not implemented. ODFW abandoned controlled hunts after Measure 18 was passed in 1994. Without the use of dogs, controlled hunts for cougars were no longer needed.

5. ALTHOUGH THE MOST SUCCESSFUL METHOD OF HUNTING COUGAR IS WITH THE USE OF TRAINED HOUNDS, MANY CITIZENS ARE CONCERNED ABOUT THE IMPACT DOGS MAY HAVE ON NON-TARGET SPECIES.

Strategies:

a. The Department will continue to allow the use of dogs to hunt cougar.

b. The Department will minimize the potential impacts of dogs on non-target species through regulation and education.

Implemented Strategies:

Strategies to address this concern were not implemented because Measure 18 made it illegal to use dogs for hunting cougars.

6. CURRENT STATUTES ALLOW PRIVATE AND PUBLIC LANDOWNERS TO TAKE DAMAGE-CAUSING COUGAR WITHOUT A DEPARTMENT PERMIT.

Strategies:

a. The Department will not seek changes to existing damage control statutes.

b. Department personnel will continue to work with landowners to encourage them to report potential damage before it occurs, with the goal of solving complaints by other than lethal means.

c. The Department will continue to emphasize that damage must occur before landowners or Department agents may remove an offending animal.

d. The Department will continue to encourage improved livestock husbandry practices as a means of reducing cougar damage on domestic livestock.

e. The Department will continue to work closely with personnel of APHIS and USDA, as well as private landowners to solve cougar depredation problems. The Department will continue coordination with ADC or Douglas County Predator Control through contract memorandum of understanding.

f. The Department will explore the application of sport hunting to control cougar damage, especially in counties that do not participate in the APHIS program.

g. All cougar taken to control damage will be reported to the Department as required by ORS 498.012, or the Department will initiate appropriate enforcement action

Implemented Strategies:

ODFW has continued to implement all strategies identified to address this concern, including: not proposing any changes to damage statutes, encouraging landowners to report concerns before livestock are lost, encouraging improved livestock husbandry practices, working closely with Wildlife Services, increasing the level of hunting, and maintaining mandatory check-in of cougars killed on damage.

7. BECAUSE COUGAR ARE GENERALLY VERY DEPENDENT ON DEER OR ELK AS THEIR PRIMARY FOOD SOURCE, THE BEST COUGAR HABITAT IS THAT WHICH SUPPORTS HEALTHY DEER OR ELK HERDS. HOWEVER, ADEQUATE DEER AND ELK HABITAT IS DECLINING IN SOME AREAS. IN ADDITION, SOME COMPONENTS OF COUGAR HABITAT APPEAR TO BE CRITICAL TO THEM WELFARE.

Strategies:

a. The Department will continue to work with landowners and public land managers to maintain satisfactory deer, elk and cougar habitat.

b. Where possible, the Department will evaluate the effects of human activities and human disturbance on cougar.

c. In areas where the Department determines human access is detrimental to the welfare of cougar or their prey base, it will take actions to correct the problem (such as coordinating with landowners to establish road closures).

Implemented Strategies:

ODFW has implemented all but one strategy identified to address this concern, including: working with land managers (private and public) to maintain habitat, and working with land managers to implement Cooperative Travel Management Areas to reduce disturbance where access is an issue. Strategy "b" was not implemented. ODFW has not specifically evaluated the effect of human activities and disturbance on cougars; however, responses of elk and deer to human activities have been evaluated (Rowland et al. 2000, Wisdom et al. 2004). ODFW has re-evaluated what constitutes usable cougar habitat.

8. OREGON CITIZENS AND VISITORS TO THE STATE INDICATE AN INCREASING DESIRE TO OBSERVE WILDLIFE, INCLUDING COUGAR.

Strategies: .

a. Opportunities for casual viewing of cougar are virtually nonexistent; however, the Department will make available information about where cougar can be found.

b. Cougar viewing and photography opportunities can be provided by treeing cougar with trained hounds. The Department will explain the regulations and opportunities pertaining to these activities to the public.

Implemented Strategies:

As noted in the 1993 plan, because of cougar behavior the opportunity to observe cougars is limited. ODFW has implemented the strategy of identifying areas where cougars are found. The strategy of providing information about opportunities to observe and photograph cougars treed by dogs was not implemented because Measure 18 made cougar pursuit with dogs illegal except for responding to human-cougar conflict.

9. COUGAR POPULATIONS MAY REDUCE LOCAL PREY POPULATIONS (DEER OR ELK) TO VERY LOW LEVELS.

Strategies:

a. The relationship between predator and prey populations means healthy cougar populations depend on healthy prey populations.

b. The Department will manage for healthy populations of *all* big game species.

Implemented Strategies:

Both 1993 strategies for this concern recognized that cougar populations depend on prey populations and directed ODFW to manage for sustainable populations of all big game species. ODFW has implemented these strategies by increasing cougar seasons and quotas as cougar populations have increased, and reducing hunting opportunity for deer and elk in an effort to maintain populations at management objective levels. ODFW has not succeeded in stabilizing the cougar population due to the inability of reaching quotas with current hunting strategies. Research information indicates that in some areas predation by cougars may reducing calf elk survival and contributing to population declines of deer and/or elk.

APPENDIX G: Non-hunting Mortality Classification, Statewide and by Cougar Management Zones A - F, 1987-2003

Table G-1. Statewide non-hunting mortality classification 1987-2003.

Year	Total	Roadkill	Livestock	Pets	Human Safety	Other
1987	13	1	8	0	2	2
1988	26	5	13	1	2	5
1989	29	7	15	0	1	6
1990	50	10	29	0	3	8
1991	38	4	22	0	4	8
1992	42	6	17	0	3	16
1993	48	15	20	1	6	6
1994	60	9	28	2	9	12
1995	75	7	41	0	22	5
1996	123	13	64	2	32	12
1997	120	9	82	0	20	9
1998	130	8	93	1	19	9
1999	155	13	91	4	35	12
2000	164	10	120	2	23	9
2001	145	12	97	3	22	11
2002	171	20	111	2	21	17
2003	164	16	111	4	24	9

Table G-2. Zone A non-hunting mortality classification 1987-2003.

Year	Total	Roadkill	Livestock	Pets	Human Safety	Other
1987	7	1	4	0	1	1
1988	6	1	3	0	0	2
1989	2	0	1	0	0	1
1990	14	2	8	0	0	4
1991	5	0	2	0	1	2
1992	12	1	7	0	2	2
1993	15	6	7	0	1	1
1994	18	2	12	0	3	1
1995	27	3	17	0	6	1
1996	41	5	26	1	5	4
1997	42	5	24	0	10	3
1998	35	2	29	0	4	0
1999	26	5	19	0	1	1
2000	50	2	44	0	2	2
2001	56	6	43	1	3	3
2002	56	7	44	1	2	2
2003	44	3	33	2	5	1

Table G-3. Zone B non-hunting mortality classification 1987-2003.

Year	Total	Roadkill	Livestock	Pets	Human Safety	Other
1987	3	0	2	0	1	0
1988	14	2	9	1	0	2
1989	15	5	8	0	0	2
1990	20	2	16	0	2	0
1991	18	3	10	0	1	4
1992	15	2	5	0	1	7
1993	21	7	8	1	2	3
1994	19	4	8	2	1	4
1995	24	3	14	0	6	1
1996	45	5	27	0	7	6
1997	31	2	25	0	4	0
1998	36	5	25	0	2	4
1999	37	1	31	1	3	1
2000	37	3	29	1	3	1
2001	38	5	22	0	6	5
2002	46	6	31	0	3	6
2003	50	6	41	1	1	1

Table G-4. Zone C non-hunting mortality classification 1987-2003.

Year	Total	Roadkill	Livestock	Pets	Human Safety	Other
1987	0	0	0	0	0	0
1988	0	0	0	0	0	0
1989	0	0	0	0	0	0
1990	2	2	0	0	0	0
1991	1	0	0	0	0	1
1992	3	1	1	0	0	1
1993	0	0	0	0	0	0
1994	3	2	0	0	0	1
1995	2	1	1	0	0	0
1996	4	0	0	0	3	1
1997	2	1	1	0	0	0
1998	2	1	1	0	0	0
1999	8	0	3	1	3	1
2000	8	1	4	1	0	2
2001	9	0	6	1	0	2
2002	8	0	3	0	5	0
2003	7	1	3	1	1	1

Table G-5. Zone D non-hunting mortality classification 1987-2003.

Year	Total	Roadkill	Livestock	Pets	Human Safety	Other
1987	0	0	0	0	0	0
1988	1	0	1	0	0	0
1989	1	0	0	0	0	1
1990	2	1	0	0	0	1
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	1	0	0	0	0	1
1994	0	0	0	0	0	0
1995	0	0	0	0	0	0
1996	3	0	0	0	3	0
1997	0	0	0	0	0	0
1998	1	0	1	0	0	0
1999	2	0		0	1	1
2000	6	1	4	0	1	0
2001	4	0	2	0	2	0
2002	5	1	4	0	0	0
2003	9	1	5	0	2	1

Table G-6. Zone E non-hunting mortality classification 1987-2003.

Year	Total	Roadkill	Livestock	Pets	Human Safety	Other
1987	2	0	2	0	0	0
1988	3	2	0	0	1	0
1989	11	2	6	0	1	2
1990	10	3	5	0	1	1
1991	14	1	10	0	2	1
1992	12	2	4	0	0	6
1993	10	2	5	0	2	1
1994	20	1	8	0	5	6
1995	21	0	9	0	9	3
1996	30	3	11	1	14	1
1997	43	1	31	0	5	6
1998	47	0	31	1	12	3
1999	66	7	29	2	20	8
2000	52	3	31	0	14	4
2001	27	1	14	0	11	1
2002	40	3	18	1	11	7
2003	33	5	13	0	10	5

Table G-7. Zone F non-hunting mortality classification 1987-2003.

Year	Total	Roadkill	Livestock	Pets	Human Safety	Other
1987	1	0	0	0	0	1
1988	2	0	0	0	1	1
1989	0	0	0	0	0	0
1990	2	0	0	0	0	2
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	1	0	0	0	1	0
1994	0	0	0	0	0	0
1995	1	0	0	0	1	0
1996	0	0	0	0		0
1997	2	0	1	0	1	0
1998	9	0	6	0	1	2
1999	16	0	9	0	7	0
2000	11	0	8	0	3	0
2001	11	0	10	1	0	0
2002	16	3	11	0	0	2
2003	21	0	16	0	5	0

APPENDIX H: Cougar Damage Complaints and Sightings by Zone, 1992-2003

Table H-1. Zone A cougar damage complaints and sightings 1992-2003.

Year	Livestock	Pets	Human Safety	Other	Total	Sightings
1992	36	3	4	40	83	
1993	54	6	7	86	153	
1994	102	15	176		293	
1995	128	26	218	11	383	
1996	134	32	259		425	
1997	110	17	223		350	
1998	118	19	250		387	
1999	96	30	261		387	
2000	118	24	220	6	368	51
2001	115	20	165	5	305	64
2002	91	11	142	3	247	89
2003	100	15	116	5	236	84

Table H-2. Zone B cougar damage complaints and sightings 1992-2003.

Year	Livestock	Pets	Human Safety	Other	Total	Sightings
1992	3		1	54	58	
1993	5	2		53	60	
1994	69	16	68		153	
1995	95	17	114		226	
1996	110	9	154		273	
1997	110	30	126		266	
1998	146	24	195		365	
1999	172	32	175		379	
2000	126	17	154	42	339	49
2001	106	28	133	20	287	55
2002	110	9	119	7	245	67
2003	113	9	124	2	248	60

Table H-3. Zone C cougar damage complaints and sightings 1992-2003.

Year	Livestock	Pets	Human Safety	Other	Total	Sightings
1992	1			6	7	
1993	4			3	7	
1994	12	2	26		40	
1995	9	5	15		29	
1996	9	3	25		37	
1997	14	1	25		40	
1998	17	3	29		49	
1999	15	6	17		38	
2000	24	2	26	0	52	6
2001	23	10	32	1	66	11
2002	30	10	42	1	83	12
2003	20	8	18		46	3

Table H-4. Zone D cougar damage complaints and sightings 1992-2003.

Year	Livestock	Pets	Human Safety	Other	Total	Sightings
1992	2			3	5	
1993	3			5	8	
1994	5		2		7	
1995	7	1	3		11	
1996	9		12		21	
1997	9		12		21	
1998	12	1	5		18	
1999	16	1	12		29	
2000	12	2	18	0	32	2
2001	16	1	14	0	31	6
2002	22	2	8	3	35	1
2003	21	5	7	1	34	2

Table H-5. Zone E cougar damage complaints and sightings 1992-2003.

Year	Livestock	Pets	Human Safety	Other	Total	Sightings
1992	24			5	29	
1993	27	1	3	14	45	
1994	25	3	19		47	
1995	44	1	30		75	
1996	41	4	30		75	
1997	61	2	36		99	
1998	67	2	41		110	
1999	91	24	83		198	
2000	62	4	45	8	119	27
2001	47	7	49	2	105	10
2002	60	6	52	4	122	21
2003	38	7	49		94	10

Table H-6. Zone F cougar damage complaints and sightings 1992-2003.

Year	Livestock	Pets	Human Safety	Other	Total	Sightings
1992	1			1	2	
1993	2			1	3	
1994	10	1	3		14	
1995	2		16		18	
1996	6	1	2		9	
1997	12	3	7		22	
1998	12	3	10		25	
1999	31	2	8		41	
2000	27	2	3	0	32	0
2001	23	6	6	0	35	5
2002	23	2	6	2	33	5
2003	28	3	8		39	3

APPENDIX I: Glossary – Definition of Terms

PLEASE NOTE: All terms included in this glossary are only applicable and defined as used in the 2006 Cougar Management Plan.

Adaptive management – a method of managing a wildlife species, applied on a large scale, which uses the current synthesis of knowledge to propose and test hypotheses. Treatments are implemented, outcomes are monitored, and management adjusted to meet objectives.

Administrative Removal – the removal of cougars by ODFW (or agents) to proactively reduce conflict within a target area.

Bag limit – as used for hunting, the specification of the number, gender, and/or age of a wildlife species that may be legally killed with an appropriate license or tag.

Controlled hunt – A season where the number or distribution of hunters is limited through a public drawing or other means. A legal hunting opportunity during a specified time period in a defined geographical area established by ODFW for the purpose of managing wildlife species. Individuals participating in the hunt are required to possess a harvest permit (tag) for the wildlife species being hunted.

Cougar – a large, tawny brown cat (*Puma concolor*) occurring throughout Oregon. Adults may be 7 feet long (nose to tip of tail). Young cougars have spotted pelage. In Oregon, cougars are defined by statue (ORS 496.004 (9)) as game mammals.

Cougar (damage) complaint – a report by the public of a concern regarding cougar(s) recorded by ODFW.

Cougar management zone – six defined geographical areas used for cougar management in Oregon.

Game mammal(s) – are pronghorn antelope, bighorn sheep, black bear, cougar, deer, elk, moose, Rocky Mountain goat, and western grey squirrel (as defined by ORS 496.004 (9)).

Harvest Quota – the maximum number of cougars allowed to be killed by hunters during a specified time, in a cougar management zone.

Livestock – Livestock is defined as in Oregon state agriculture laws (ORS 609.125) which defines "livestock" to mean: ratites, psittacine, horses, mules, jackasses, cattle, llamas, alpacas, sheep, goats, swine, domesticated fowl and any fur-bearing animal bred and maintained commercially or otherwise, within pens, cages and hutches.

Mortality Quota – the maximum number of known cougar mortalities from all causes in a cougar management zone, during a specified time. Once the mortality quota has been reached, hunting seasons and administrative removal will cease for the year. The only additional cougars allowed to be taken will be in response to specific damage or human safety concerns as specified in ORS 498.012 and ORS 498.166.

Non-hunting mortality – cougars that die from causes unrelated to legal sport-harvest and are reported to ODFW. These causes of death can be varied and include cougars killed by humans because of damage or human-safety concerns, roadkills, and all natural causes.

Tag – a document authorizing the taking (killing) of a wildlife species at a specified time and place.

Target Area - a defined geographical area established by ODFW where cougar numbers will be proactively reduced in response to established criteria (in this plan) for cougar conflicts

with humans, livestock, or other game mammals.

Ungulate – any of the group (*Ungulata*) consisting of the hoofed mammals (as pronghorn antelope, bighorn sheep, deer, elk, moose, and Rocky Mountain goat) of which many are herbivorous and many are horned.

Wildlife Management Unit (WMU) – A defined geographical area established by ODFW for management of wildlife species. The boundaries for each wildlife unit are described in "Oregon Big Game Regulations" booklets.

APPENDIX J: Organizations and representatives invited to participate in the Cougar Plan Revision Focus Group.

Wildlife Services
Dave Williams

Oregon Cattlemen's Assoc
Kevin Westfall

Oregon Hunter's Association
Don Schaller

Oregon Farm Bureau
Katie Fast

Oregon Dept of Agriculture
Rodger Huffman

Oregon Wool Growers
Richard Kosesan

Predator Defense Institute
Brooks Fahy

Sierra Club
Sally Mackler

Hells Canyon Preservation Council
Brett Brownscombe

Rocky Mountain Elk Foundation
Swede French

Foundation for North American Wild Sheep- Oregon Chapter
Larry Jacobs

USFS
Alan Christensen

BLM
George Buckner

Oregon United Sporting Dog Association
Rod Klawitter

Oregon State Police
Bruce Carne

The Wildlife Society- Oregon Chapter
Lori Hennings- President

Humane Society of the United States
Kelly Peterson

Confederated Tribes of Grand Ronde
Pete Wakeland

Confederated Tribes of Siletz
Mike Kennedy

Confederated Tribes of the Umatilla Indian Reservation
Audie Huber

Confederated Tribes of the Warm Springs Reservation
Robert "Bobby" Brunoe

Klamath Tribes
Elwood Miller, Jr.

County Commissioner
Dan Van Slyke

Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians
Howard Crombie

Coquille Indian Tribe
Dave Tovey

Laura Jones
Defenders of Wildlife

Dennis Luke
Deschutes County Commissioner

Safari Club International
Jerod Broadfoot

Burns Paiute Tribe
Tim Strahl

Cow Creek Band of Umpqua Indians
Amy Amoroso

APPENDIX K: Cougar managers, researchers, and scientists provided copies of the initial Draft Cougar Management Plan for peer review and comment on 22 June 2005 and 10 February 2006.

Reviewer	Affiliation	Expertise	Response
Dr. Becky Pierce[a]	California Department of Fish & Game	Cougar Researcher	Commented
Dr. Chuck Anderson	Wyoming Game & Fish Department	Cougar Researcher and Manager	Commented
Dr. Donny Martorello	Washington Department of Fish & Wildlife	Cougar Researcher and Manager	No Comments
Dr. Fred G. Lindzey[a]	Wyoming Coop. Fish & Wildlife Res. Unit, Retired	Cougar Researcher	Commented
Dr. Howard Quigley[a]	Beringia South	Independent Scientist	No Comments
Jeff Brendt	USDA Wildlife Services	Cougar Damage Manager	No Comments
Jerry Apker	Colorado Division of Wildlife	Cougar Manager	Commented
Jim Akenson	University of Idaho	Carnivore Researcher and Manager	Commented
Dr. Ken Logan[a]	Colorado Division of Wildlife	Cougar Researcher	No Comments
Rich Beausoleil	Washington Department of Fish & Wildlife	Cougar Researcher and Manager	No Comments
Steve Torres[a]	California Department of Fish & Game	Cougar Manager and Researcher	No Comments
Ted McKinney	Arizona Department Game & Fish Department	Cougar Manager	Commented
Mike Cox	Nevada Division of Wildlife	Cougar Manager	No Comments
Steve Nadeau	Idaho Department of Fish & Game	Carnivore Manager	No Comments
Dr. Paul Beier[a]	Northern Arizona University	Professor of Conservation Biology	No Comments

[a] Listed as one of the Co-authors of the 2005 Cougar Management Guidelines.

APPENDIX L: Process for Development and Selection of Cougar Target Areas

Target areas will be developed and/or reviewed annually as part of the big game regulations process. During this process, target areas will be submitted for approval by respective regions (April), Wildlife Division (May), and by the Fish and Wildlife Commission in the same manner as controlled big game hunts. This process will insure target areas will be available for public review and comment.

The process will begin with District Wildlife Biologist review of relevant data (cougar mortalities, cougar complaint trend, ungulate population data) relative to criteria in respective Zone Tables (Tables 16-21, Chapter 6). If a zone trigger has been met, biologists may develop individual target areas providing the information outlined below. Target area proposals will be submitted to Region along with big game hunt proposals and tag recommendations for approval and/or prioritization. Regions would present target area proposals to Wildlife Division at the April (Westside or Eastside) hunting season recommendations meetings.

Following approval and implementation respective biologists would be responsible for the following items:

1.) Update zone models to monitor population trend (Completed by Staff).

2.) Update non-hunting mortality and complaint data entry (Completed by Staff).

3.) Comparison with specific zone trigger criteria. (Completed by implementing district biologist).

4.) Complete target area monitoring report to evaluate effectiveness of implementation and determine if implementation needs to be continued (Completed by implementing district biologist).

COUGAR TARGET AREA PROPOSAL

DATE: _____ **BIOLOGIST:** _____

DISTRICT: _____ **WATERSHED:** _____

Target Area Information:

New Continued (circle one)

Target Area Name: _____

WMU(s) Involved: _____

Cougar Management Zone: _____

County(ies) Involved: _____

Target Area Size (mi^2, attach map): _____

Purpose of Target Area (conflict to be resolved): Human Safety Livestock Big Game Pets

Non-Hunting Mortality in Target Area (# cougar taken outside of hunting each of last 3 years):
Year_____ # Killed____ Year_____ # Killed____ Year_____ # Killed____

Hunting Mortality in Target Area (# cougar taken by hunting each of last 3 years):
Year_____ # Killed____ Year_____ # Killed____ Year_____ # Killed____

Complaints in Target Area (# and type of cougar complaints each of last 3 years):

Year	Human Safety	Pets	Livestock	Other
____	_____	_____	_____	_____
____	_____	_____	_____	_____
____	_____	_____	_____	_____

Ungulate Population Information (appropriate data for type of conflict to be addressed):

_____

_____

Cougar Removal Objective (first year of implementation): _____
(Evaluate effects on conflict prior to setting number in subsequent years)

Timing of Operation (period of year administrative removal would be conducted, be specific):

_____

Wildlife Service Program Available in County(ies) Involved: Yes No

Personnel Needs
(Estimated number of personnel (WS or ODFW) and hours to complete administrative removal):
Agency _____ # People _____ Class _____

Estimated Cost (PS and SS):
PS Cost $_____ SS Cost $_____

Zone Information

Current Cougar Density Estimate for the Zone (from zone model): _____

Current Cougar Population Estimate for the Zone (from zone model): _____

Minimum Cougar Population for the Zone (Objective 1, Zone Table in CMP): _____

Non-Hunting Mortality Index: _____
(non-hunting mortality last calendar year)/(Non-Hunting mortality trigger from Zone table)

Hunting Mortality (# cougar taken by hunting each of last 3 years):
Year_____ # Killed____ Year_____ # Killed____ Year_____ # Killed____

Damage Complaint Index (Specific to type of conflict being addressed): _____
(complaint number last calendar year)/(Complaint trigger from CMP)

Supporting Information/Justification (Briefly describe current conflict situation, expected challenges, other relevant information):

_____
_____
_____
_____
_____
_____

Monitoring Measures (zone and target area)

1.) Cougar Mortalities (Hunting and non-hunting).
2.) Damage Complaints by type within target area and zone.
3.) Cougar Population and Trend (model output, % adult females in harvest, average age of harvested cougars, catch per unit effort).
4.) Ungulate Population Measures.

APPROVALS

Region Approval	Division Approval
_____	_____
Date: _____	Date: _____

APPENDIX M: Monitoring Process

The draft 2006 Cougar Management Plan establishes five objectives and an Adaptive Management Strategy that seek to manage the state's cougar population at a level well above that required for long term viability while keeping cougar-human conflicts at acceptable levels. Management objectives and actions will be implemented and monitored at three levels: Statewide, by Zone, and by Target Area.

ODFW will use several sources of data to monitor progress toward established objectives including: 1) Trends in cougar mortality by source; 2) Cougar biological data; 3) Trends in cougar complaints by type; 4) Cougar research, and 5) Cougar population modeling. Each information source provides a different type of data, and if used alone is not adequate to manage cougars on a statewide basis. However, ODFW believes that when combined, the five sources of data provide the necessary information to effectively manage cougars.

Trends in cougar mortality by source

Monitoring mortalities is an important population assessment measure for most wildlife species and is certainly important for cougar management. In recent years (1995–2003), hunting has accounted for 45–70% of the known annual cougar mortality in Oregon. Non-hunting mortality includes all known cougar deaths not caused by hunting and includes cougars killed as a result of human safety, pet or livestock damage, road kills and natural mortality. Non-hunting mortality typically accounts for 30–55% of the known cougar mortality in Oregon with the bulk of this occurring in response to conflict. Hunters are required to check-in any cougar harvested within 10 days of harvest to a local ODFW office. Any person taking a cougar as a result of conflict shall immediately report that take to ODFW where biological samples are collected. During check-in, ODFW collects biological samples and records pertinent data including reason for kill, date of kill, method of kill, location of the kill, relative age of the animal, and sex of the animal. Additionally, ODFW attaches a seal to the hide that must remain with the hide until the hide is processed. Biological samples and relevant data are sent to the ODFW Wildlife Population Laboratory in Corvallis for analysis.

ODFW will monitor known cougar mortality by Zone to track progress toward Zone total mortality quotas, to monitor proportions of adult females in the total mortality, and to monitor cougar conflict levels within the Zone. Staff will compare total mortality in a zone with established total mortality quotas on a weekly basis. Hunting seasons will be closed in a zone when the total mortality quota has been reached. Proportion adult females in the total mortality also will be evaluated weekly as an index to relative affect of mortalities on the cougar population in the Zone. When the proportion of adult females exceeds 25%, research indicates the cougar population should begin to decline (Anderson and Lindzey 2005). Density of human-caused mortalities will also be monitored to help evaluate success of management treatments and define source and sink areas. C. R. Anderson (pers. commun.) suggests that source areas could experience half as much human-caused mortalities (mortalities/100 mi^2) as sink areas. Non-hunting mortality is less subjective than reported complaints. Thus, ODFW considers non-hunting mortality the best index of cougar-human conflict. For the purpose of monitoring cougar-human conflict, known mortalities as a result of human safety, pet or livestock conflict will be evaluated weekly.

Biological Data Collection

ODFW requires mandatory examination of all known mortalities. Regulations require any person taking a cougar to bring the head and hide from all cougars, and reproductive organs from females to ODFW. ODFW collects both upper premolar teeth (if present) and records other data specific to each cougar. These data and the biological samples are transferred to the ODFW Wildlife Population Laboratory in Corvallis. Analysis of reproductive organs allows ODFW biologists to determine average litter size at birth, proportion of reproductively active females, and age at first parturition. Analysis of teeth allows ODFW to determine age structure of cougar populations. These data will be summarized annually and used to update Zone population models for population assessment.

Cougar Complaints

Complaints involving cougars have been tracked by 3 primary categories since 1992. Livestock complaints include physical injuries and predation of livestock, and concerns for livestock safety in areas where a cougar or cougar sign has been observed. Human safety complaints include concerns for human safety where people have encountered a cougar or where a cougar or cougar sign is observed in populated areas. Pet complaints are recorded when pets are killed or injured by a cougar or when a cougar or cougar sign has been observed in close proximity to pets. Complaints not readily identifiable in one of these categories are counted as other.

The 2006 Cougar Management Plan makes tracking of public complaints regarding cougar damage and safety concerns more critical than in the past because reports will be used as an index to level of conflict for initiating control strategies, and for tracking success of these strategies. To improve consistency and use of complaints, ODFW will use a new form that facilitates recording more detail regarding conflicts involving cougars. These forms will allow comparison of future complaint levels to past complaint levels and allow more restrictive definitions of conflicts in the future. In addition to use as a secondary measure of trend in cougar-human conflict, damage complaints will be of use in helping to define the boundaries of targeted control areas.

Oregon Cougar Research

ODFW has been involved in 3 long-term cougar research projects, one with two separate study sites. Research has provided information for many biological parameters needed to model cougar populations. In addition, research results have provided the basis for establishing population density in different management zones. ODFW will continue to conduct research on cougars in Oregon as resources allow to further augment the information used for cougar management.

Cougar population modeling

ODFW will continue modeling cougar populations by Zone to insure cougar populations do not drop below Zone minimums. Data from mortality monitoring and biological sampling will be used to annually update each Zone model.

Adaptive Management

All monitoring and management activities will be carried out in an adaptive management approach, as suggested in the Cougar Management Guidelines (2005, pages 74 and 81).This

strategy allows annual changes in management based on results. Management strategies that are not successful at meeting stated objectives would be modified or discontinued. Numerous indicators will be used to monitor success. Total mortality, hunter harvest success rates, and biological data will continue to be collected. These data will contribute to population modeling for each Cougar Management Zone. Cougar-human conflict will continue to be monitored using non-hunting mortalities and reported complaints concerning human safety, pets, and livestock.

Herd composition, health and population status of deer, elk, bighorn sheep, and other game mammals will continue to be monitored. This information will be used to assess Objective 5.