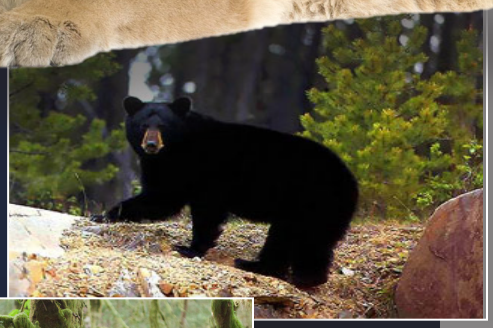
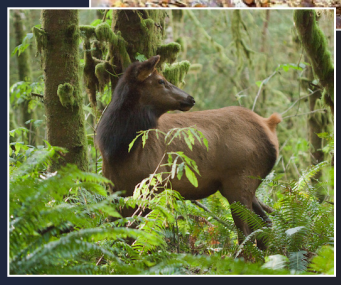
Large Mammals in the Lower Coos Watershed

CLW DATA SOURCE

Summary:

- *The exact number of large mammals in the project area is unknown, but statewide abundance trends are apparent.*
- *Local elk populations are likely stable and may even be increasing. They exceed management objectives that are designed to protect elk while providing quality hunting opportunities.*
- *Disease and habitat loss are likely the drivers of declining deer populations across the state.*
- *Oregon's cougar population has recovered from near extinction in the 1960s.*





Photos:
Cougar: ODFW
Bear: Brian Wolitski
Elk: Vickie Lewis

Evaluation

Available data suggest that Roosevelt elk populations are generally increasing within the project area.

Evaluation

Available data suggest black tailed deer populations may be declining at the state level due to habitat loss and disease.

Evaluation

More information is needed to evaluate the status of bear populations in the project area.

DATA GAP

Evaluation

More information is needed to evaluate the status of cougar populations in the project area.

DATA GAP

What's happening?

This data summary focuses on population trends of large mammals within the project area, habitat immediately adjacent to the project area boundary (i.e., < 20 miles), and statewide. These species include Roosevelt elk (*Cervus canadensis roosevelti*), black-tailed deer (*Odocoileus hemionus columbianus*), black bear (*Ursus americanus*), and cougar (*Puma concolor*). Although other deer and elk species such as the Rocky Mountain Elk (*Cervus canadensis nelsoni*) and mule deer (*Odocoileus hemionus*) occur elsewhere in Oregon (e.g., central and eastern Oregon), they are not discussed extensively in this data summary. Where possible, data are presented for each Game Management Unit (Figure 2). However, due to the limitations of survey methods, data are often available only on a statewide scale (see Chapter Summary for data limitations).

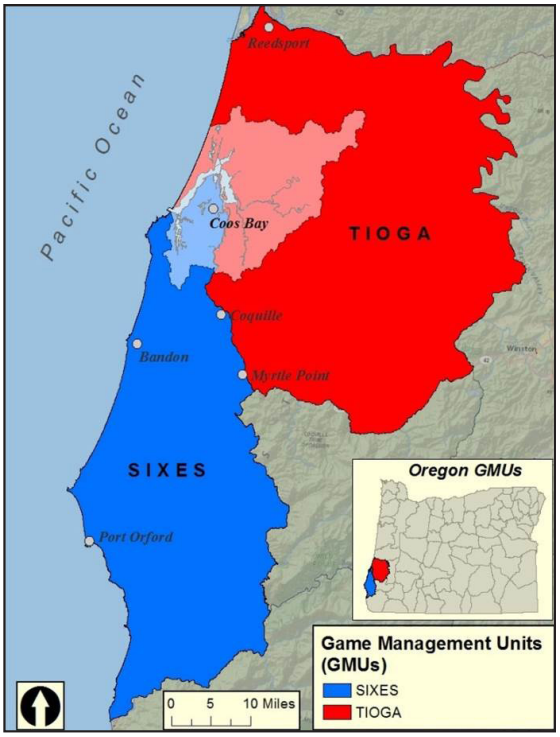


Figure 2. Game Management Units in proximity to the project area (white). The project area contains part of both the Sixes (blue) and the Tioga (red) GMU. Data: ODFW 2010.

Elk and Deer

The Oregon Department of Fish and Wildlife (ODFW) conducts annual surveys of both elk and deer in the Game Management Units (GMUs or Units) across the state (Figure 2). The purpose of these surveys is to generate both herd composition and population trend data (see sidebar).

Elk population estimates suggest that herds statewide appear to be stable and even increasing from the 1970s to 2001 (Figure 3) (ODFW 2003a). More recent data indicate that this trend has continued since 1991 (Figure 4)(Oregon Forest Resources Institute 2013). Elk population trend data suggest that herds in proximity to the project area exceed (Sixes) or nearly meet (Tioga) their total pop-

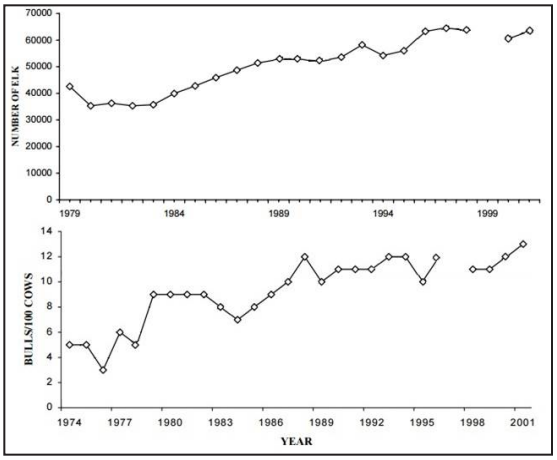


Figure 3. Statewide elk population trend (top) and post-hunting season bull elk ratio (bottom) from the mid-to-late 1970s to 2001 show a general trend of increasing abundance. Figure modified from: ODFW 2003a.

Monitoring and Managing Deer and Elk Populations

As a supplement to total population estimates, wildlife managers collect herd composition data, which are used to assess the status and demographic trends in deer and elk populations. For example, demographic data are commonly used to calculate the "buck ratio" or "bull ratio" (i.e., ratio of males per 100 females) as well as the ratio of juveniles to females. These indicators are particularly useful to wildlife managers, because they can be used to estimate determinants of herd size, including the overwinter survival of juveniles and adult "escapement" (i.e., number of deer and elk surviving hunting season). A well-informed understanding of herd demographics helps wildlife managers maintain the proper mix of males to females, which allows for quality recreational opportunities while insuring that deer and elk populations reach their full reproductive potential.

Sources: S. Love, pers. comm., April 29, 2015; Bender 2006; ODFW 2008

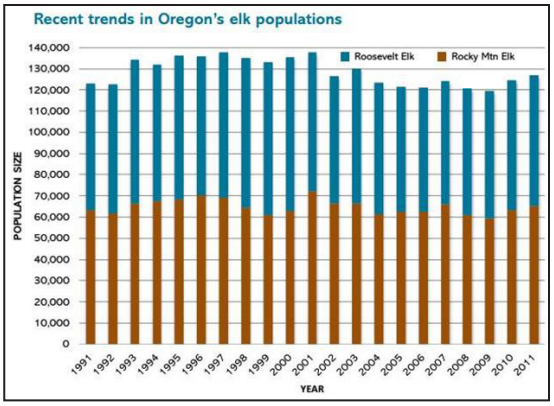


Figure 4. The historic (1970-2000) trend of stable or generally increasing elk populations statewide has continued in the most recent decade. Rocky Mountain elk (*Cervus Canadensis nelsoni*) is a distinct subspecies of elk that does not occur in the project area. Figure: Oregon Forest Resources Institute 2013.

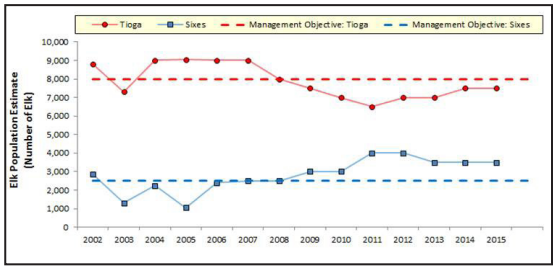


Figure 5. Populations trend data (2002-2015) in the Tioga (red) and Sixes (blue) Units shown relative to the management objectives (dashed) for each GMU. Management Objectives vary by GMU, because hunting regulations are different in the Tioga Unit than they are in the Sixes Unit. Data: ODFW 2015b.

ulation management objectives (Figure 5). Herd composition data for both the Tioga and Sixes unit show that bull ratios have met their management objectives for over 20 years and suggest that local populations are likely increasing (Figure 6)(ODFW 2015b). It's important to note the bull ratio data (Figure 6) are a much more reliable indicator of overall population trends than the data presented in Figure 5 (See Chapter Summary for data limitations)(S. Love, pers. comm., April 29, 2015).

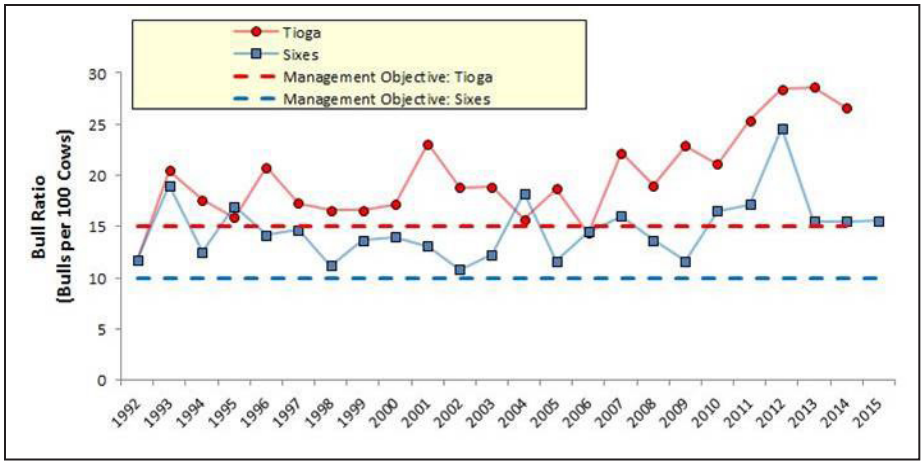


Figure 6. Bull ratio of elk populations (2004-2015) in the Tioga (red) and Sixes (blue) Units shown relative to the management objectives (dashed) for each GMU. Management Objectives vary by GMU, because hunting regulations differ between the two Units. Data: ODFW 2015b

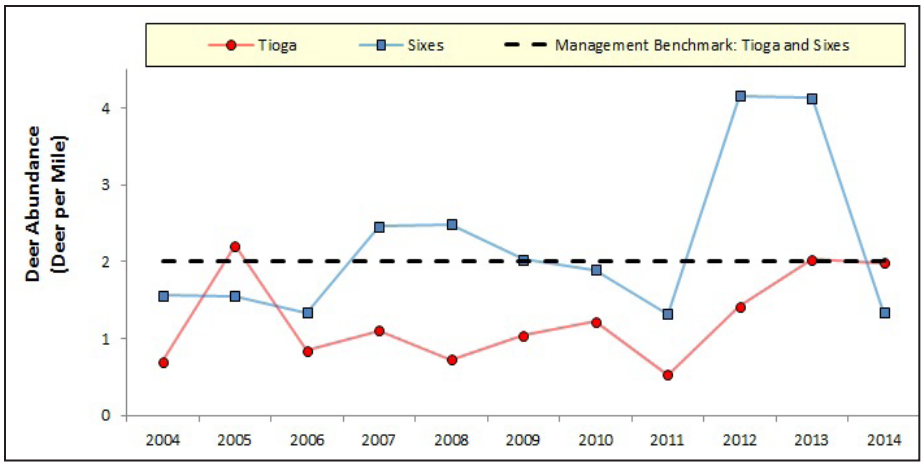


Figure 7. Deer densities (2004-2104) in the Tioga (red) and Sixes (blue) Units shown relative to the general management benchmark (dashed). Data are deer per linear mile. Data: ODFW 2015b.

Black-tailed deer populations have declined across the state in recent decades. ODFW (2008) estimates that Oregon supported a population of approximately 452,000 black-tailed deer statewide in 1979. Although Oregon's black-tailed deer population varied between 4-500,000 deer from 1979-1989, researchers have documented a clearly declining trend across Oregon throughout the 1990s, resulting in statewide population estimates as low as 320,000 deer in 2004 (ODFW 2008). Despite a trend of general decline, it appears that some herds may be increasing in areas with adequate resource availability, and although the western Oregon deer population is still low, buck ratios met their 2013 benchmarks in most GMUs (Oregon Forest Resources Institute 2013, ODFW 2014). ODFW (2014) reports that deer populations in Coos County "appear to be stable" with some indication that deer are becoming more abundant in parts of the Sixes and Tioga Units. Unlike elk (for which specific management objectives have been set), deer management is guided by more general "benchmarks" (S. Love, pers. comm., April 29, 2015). In both the Tioga

and Sixes Unit, wildlife managers attempt to maintain an average density of approximately 2 deer per linear mile in both the Tioga and Sixes Unit (Figure 7).

Bears

Bear populations appear to be stable and even increasing throughout their range (ODFW 2012). Estimates indicate that the North American population of bears has increased substantially over the last decade and is currently between 750,000-918,000 bears (Pelton 2000, Herrero et al. 2011, ODFW 2012). Bears have also become increasingly abundant in Oregon. Historic estimates suggest that Oregon supported approximately 9,000 bears in the 1930s (Bailey 1936). By the 1980s, the estimated size of the Oregon bear population had approximately doubled to reach 18,000 bears (ODFW 1987). This trend has continued in recent decades with the bear population reaching 25,000 in the 1990s and remaining between 25-35,000 statewide in the 2000s. (ODFW 1993, ODFW n.d.a.). Due to the limitations of survey methods, bear population estimates are not available for individual GMUs (see Chapter Summary for data limitations).

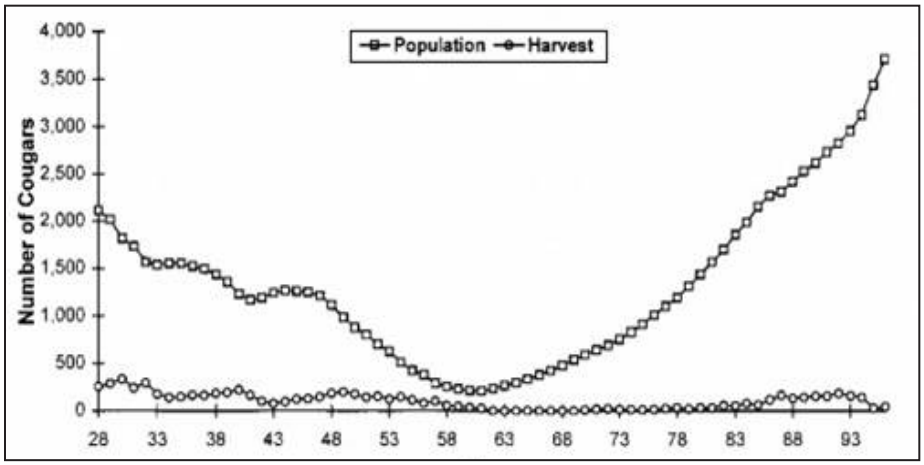


Figure 8. Oregon cougar population, as determined from simulation modeling and harvest, 1929-1992. Cougars were bountied until 1961. The season was closed until 1970 when limited hunting began. Caption and Figure: Keister and Van Dyke 2002

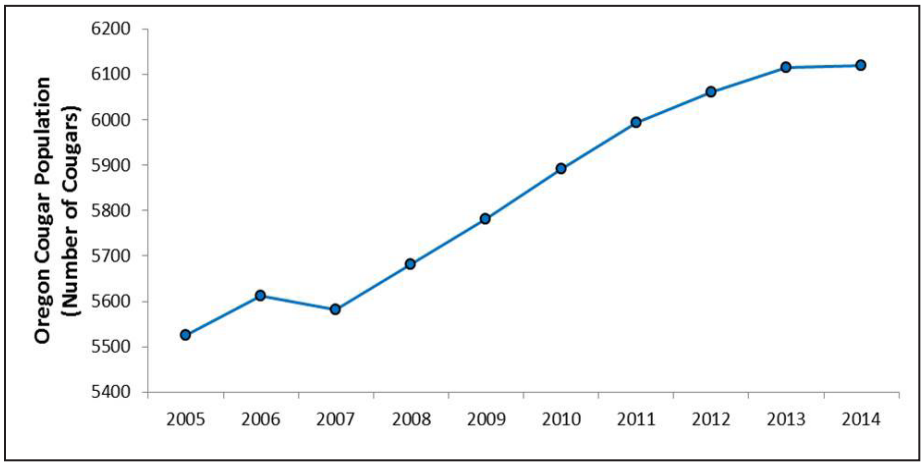


Figure 9. Population modeling suggests that cougars are becoming more abundant in recent years (2005-2014). Currently, Oregon supports over 6,000 cougars. Data: ODFW 2015b

Cougars

The historic range of cougars is one of the most extensive of any North American wildlife species (Nowak 1999). Despite their historic abundance, Oregon's cougar population declined dramatically through the first half of the 20th century largely as a result of bounty hunting programs (see Why is it happening?). By 1960, an estimated population of only 200 cougars remained statewide (ODFW 2006).

Since the 1960s, cougar populations have recovered, expanding their range and becoming more abundant in Oregon (Keister and Van Dyke 2002, ODFW 2006)(Figure 8), a trend which has continued in recent years. Researchers estimate that Oregon currently hosts a cougar population of over 6,000 animals statewide (Figure 9)(ODFW 2015b, n.d.b.). Due to the limitations of survey methods, cougar population estimates are not available for individual GMUs (see Chapter Summary for data limitations).

Why is it happening?

The abundance and distribution of large mammals is determined by the complex interaction of a number of factors, including predator-prey relationships, disease and parasites, human dimensions (i.e., both hunting and non-hunting factors such as livestock damage, human/pet safety, and vehicle collisions), and habitat availability.

Predation

The population distribution and abundance of cougars, bears, deer, and elk are all directly related (Cougar Management Guidelines Working Group 2005, Neal et al. 1987, White et al. 2010, Yarkovich et al. 2011). Deer and elk populations are affected by predation from both cougars (Neal et al. 1987) and bears (White et al. 2010, Yarkovich et al. 2011). Although cougars prey on a variety of species, it's universally accepted that deer are their primary food staple even when other prey species (e.g., elk, pronghorn, and big horn sheep) are available (Ackerman et al. 1984, Anderson 1983, Robinette et al. 1959, Cashman et al. 1992, Beier and Barrett 1993, Logan et al. 1996, ODFW 2006). The amount of prey consumed by a cougar depends on the characteristics of each animal, including the cougar's sex, age, size, and reproductive status, as well as weather conditions and competition/scavenging by other species (e.g., bears, birds, and coyotes)(Iriarte et al. 1990, ODFW 2006).

High cougar predation rates reduce the size of deer and elk populations. Sustained predation of small deer populations may jeopardize their ability to persist, particularly when high predation rates overlap with other stressors (e.g., harsh winter conditions or habitat loss) (Neal et al. 1987). In addition to cougar predation, deer fawns are consumed by coyotes (*Canis latrans*), bobcats (*Lynx rufus*), and bear (Pamplin 2003). In rare cases, deer have also been killed by domestic dogs (ODFW 2008).

Diseases and Parasites

Oregon deer and elk populations are vulnerable to a number of diseases and parasites, including Deer Hair Loss Syndrome (DHLS), Adenovirus Hemorrhagic Disease (AHD), and Chronic Wasting Disease (CWD)(see sidebar). DHLS appears to occur in deer throughout western Oregon and the prevalence of DHLS varies widely (from 2-46% of deer sampled) by GMU (ODFW 2006). Recent data show that DHLS is currently affecting deer in both the Tioga Unit (27% of deer sampled) and Sixes Unit (12% of deer sampled)(ODFW 2015b). From 2003-2005 alone, ODFW (2006) documented 153 AHD-positive deer and 2 AHD-positive elk occurring in 21 GMUs across the state, including the Tioga Unit (Figure 10). CWD has been prevalent in Colorado and Wyoming since the 1990s, but it has not been documented in Oregon; wildlife managers continue monitoring deer and elk populations across the state for the presence of CWD (ODFW 2008; S. Love, pers. comm., April 29, 2015).

Bears are exposed to a number of pathogens, including bacterial (brucellosis, plague, Salmon Poisoning Disease), viral (infectious canine hepatitis, parvovirus), fungal, and parasitic diseases (Trichinella, Giardia, tapeworms, and ectoparasites such as ticks and fleas)(Samuel et al. 2001, ODFW 2012). ODFW (2012) reports that parasites are the most commonly observed pathogens in Oregon bears. They add that, "while there is no evidence to suggest that parasites are a significant cause of mortality in bears… [some parasites found in bears] may present a public health risk for

Diseases in Black-tailed Deer

Deer Hair Loss Syndrome (DHLS) results from an abnormally heavy infestation of parasitic lice. First documented in Washington in 1996, the disease has since moved south, affecting deer populations in western Oregon and northern California. DHLS produces hair discoloration, hair loss, weight loss, diarrhea, and lethargy; it can result in death, primarily from exposure. Although the louse has been detected on elk in southwestern Oregon, DHLS has not affected them.

Adenovirus Hemorrhagic Disease (AHD) is a viral infection causing rapid breathing, foaming at the mouth, diarrhea, weakness, ulcers, and ultimately death. First identified in California in 1994, the disease was first documented in SW Oregon in 2001.

Chronic Wasting Disease (CWD), present in Colorado and Wyoming for over 20 years, is a neurological disease that produces brain lesions in both deer and elk. Although no cases of CWD have been documented in Oregon, ODFW has been testing for the disease since 1996.

Sources: ODFW 2003b, 2008; S. Love, pers. comm., April 29, 2015

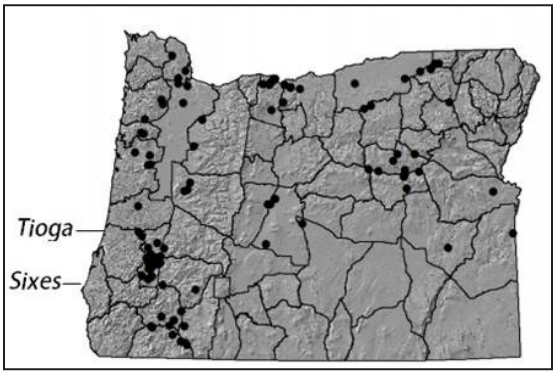


Figure 10. Location of serologically positive AHD samples collected from deer, elk, and captive reindeer in Oregon (2003-2005. Caption and Figure: ODFW 2006

humans." Salmon Poisoning Disease (SPD) is **specific to bears** in the Pacific Northwest. SPD is caused by a bacterium (*Nanophyetus salmincola*), which is carried by salmonids and can be transferred to bears upon consumption of an infected fish (ODFW 2012). Symptoms of SPD in bears includes lethargy, diarrhea, and anorexia (Rogers and Rogers 1976, Foreyt 2001). SPD may be fatal to bears, but there is no evidence to suggest that it poses a risk to humans (ODFW 2012).

Relatively little is known about diseases, parasites, and other pathogens in wild cougars. Many pathogens that are found in domestic cats may also be found in cougars, and there are rare, isolated instances of diseases appearing in Oregon cougars (ODFW 2006). Although several parasites have been documented in cougars throughout the northwest, ultimately very little is known about the effect of parasites in Oregon cougars (ODFW 2006).

Human Dimensions: Hunting

From 2003-2011, the deer hunting effort in the Tioga Unit has been sustained at high levels while deer harvest has decreased. During the same time period, hunting effort and harvest in the Sixes Unit has been consistent but at levels below those reported in the Tioga Unit. Figure 11 summarizes deer harvest and hunting effort for the two GMUs in the project area. Although local deer populations are affected by hunting, ODFW (2008) does not believe that deer harvest is a significant contributing factor to the decline of deer in Oregon. Rather, they attribute this decline primarily to habitat and disease issues, which are discussed in detail elsewhere in this data

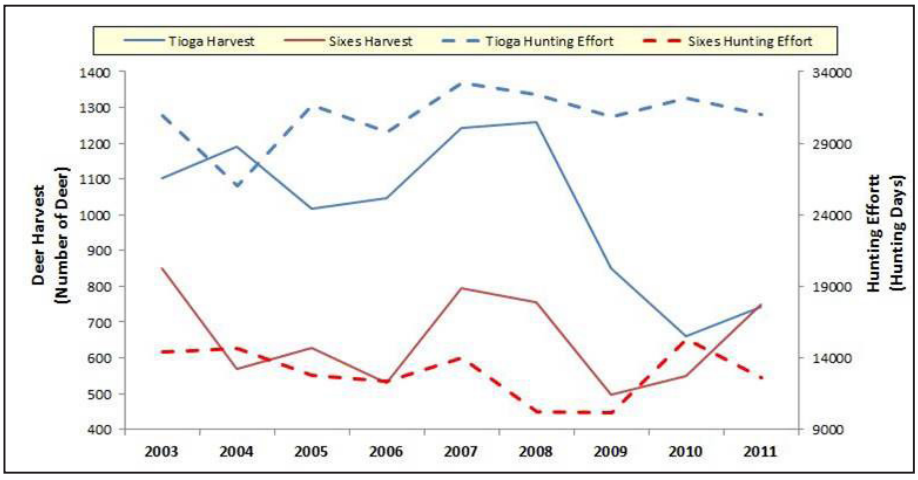


Figure 11. Deer harvest (solid) and hunting effort (dashed) in both the Tioga (blue) and Sixes (red) GMUs. Data: ODFW 2011.

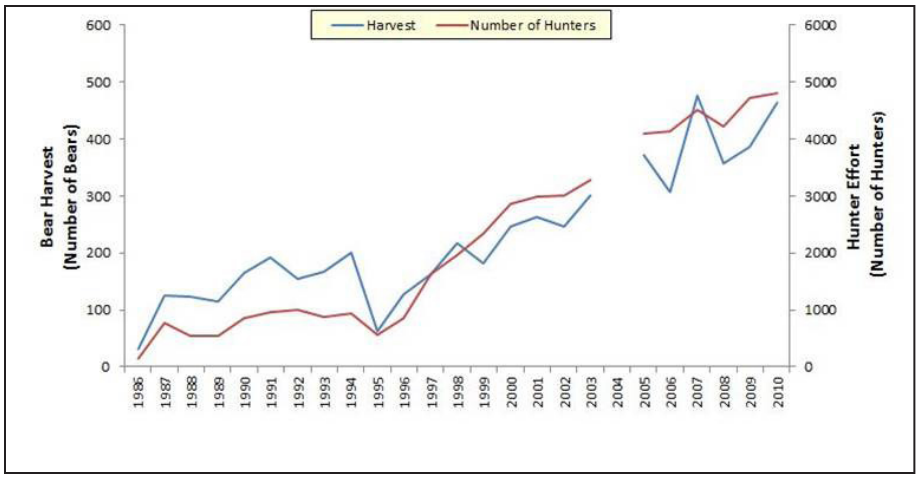


Figure 12. Bear harvest (blue) and hunting effort (red) in Oregon (1986-2010). Data: ODFW 2012

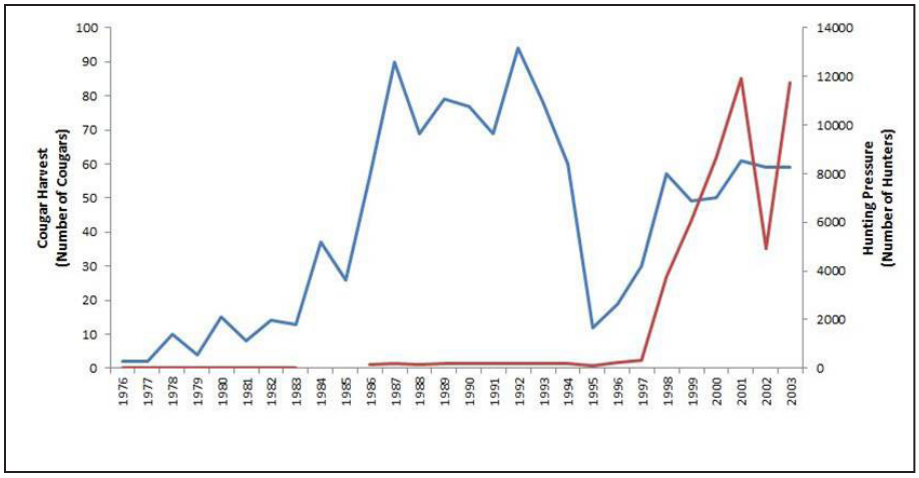


Figure 13. Cougar harvest (blue) and hunting effort (red) in Oregon (1976-2003). Generally, harvest has increased steadily since 1976 with the exception of a precipitous decline in 1994 following the prohibition of the use of dogs as cougar hunting aids in Oregon. Hunting participation ranged between approximately 20-30 hunters in the late-70s and early-80s. From 1986-1997, participation increased to approximately 150-200 hunters annually. The sharp increase in hunter participation beginning in the late 1990s likely reflects the availability of cougar tags, which increased dramatically during this same time. Data: ODFW 2006

summary (See Why is it happening?: Diseases and Parasites as well as Why is it happening?: Habitat).

Bear harvest in Oregon has increased steadily since the mid-1980s, with the exception of a sharp decline in 1994 when the use of dogs or bait for bear hunting was prohibited by law (Figure 12)(ODFW 2012). Hunting pressure on bears has also increased steadily over the past decades, with the total number of hunters increasing substantially while average effort per hunter (approximately 5-6 hunting days) has remained relatively unchanged from 1995 levels (ODFW 2012).

Cougar harvest for sport has been permitted under carefully regulated conditions since 1970 (Keister and Van Dyke 2002). Although some hunters specifically target cougars,

most cougars are harvested by hunters (holding cougar tags) who encounter cougars by chance while hunting for other species (ODFW 2006). In western Oregon, cougar harvest has increased steadily over the past few decades coupled with substantial increases in hunting pressure beginning in the late 1990s (Figure 13). Due to their high reproductive potential and rapid growth, cougars are resilient to hunting pressure, especially if the harvest of adult females is carefully regulated (Anderson and Lindzey 2005, ODFW 2006).

The illegal harvest of large mammals is an on-going management concern in the state of Oregon. Unfortunately, the effects of poaching on deer, elk, bear, and cougar populations is difficult to determine, because the exact size of the illegal harvest is unknown.

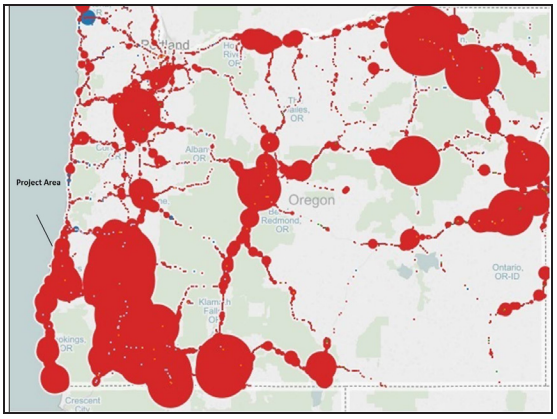


Figure 14. Heat map of Oregon Department of Transportation reported deer death (2007-2013) showing deer collision "hot spots" in Oregon. The size of the red dot indicates the number of reported deer fatalities, with large dots corresponding to more deer deaths. The most reported collisions in proximity to the project area during these years have occurred on highway OR-42. These data include only Oregon state highways and U.S. interstates. They are likely to underestimate the total number of deer mortalities from collisions, because many collisions with deer go unreported. Similarly, deer may not die immediately after collision in many cases. Data: ODOT 2014

Human Dimensions: Non-hunting

Although the exact amount of deer mortality from vehicle collisions in Oregon is unknown, it appears to be substantial in areas of western Oregon (Figure 14). For example, ODFW (2006) explains that 1,036 deer were removed from state highways and country roads in Jackson and Josephine Counties in 2005 alone. By comparison, they report that approximately 3,400 deer were harvested by hunters in these counties in the same year.

Most non-hunting conflicts between humans and bears in Oregon occur in rural and urban residential areas as well as recreational areas such as campgrounds. These encounters commonly occur in western Oregon and frequently involve food (ODFW 2012). To avoid these conflicts, Oregon law (ORS 469.731) prohibits knowingly placing food, garbage, or other attractants for bears. Human safety conflicts with bears are rare, and are typically related to bears that have been conditioned to human presence or human food sources (Herrero and Fleck 1990). ODFW (2012) began recording human safety conflicts involving bears in the 1980s. Since that time, they have recorded only 4 such conflicts statewide (none of which have resulted in human fatalities). However, the most recent of these conflicts occurred near Coos Bay in 2009, when a hunter approached a bear that was believed to be dead. The hunter survived with only a bite on the leg (ODFW 2012). Most conflicts are resolved by wildlife managers without the use of lethal force. Nevertheless, in rare circumstances, ODFW will euthanize bears that are in poor physical condition, have been

Figure 15. Number of cougars bountied annually in Oregon (1928-1961) Data and Caption: ODFW 2006

Figure 16. Cougar bounty hunters in British Columbia in the early 20th century. Cecil Smith (left) enjoyed some notoriety for his effectiveness as a cougar bounty hunter. Figure: KnowBC n.d.

habituated to human food, or cannot be captured safely (ODFW 2012). Increases in the frequency of bear conflicts may be related to management decisions (e.g., the prohibition of dogs as a bear hunting aid) or other factors (e.g., unseasonably cool and wet weather that can limit food availability)(ODFW 2012).

Historically, cougars were viewed as a direct predatory threat to the livestock industry and were harvested through bounty programs without regulation until the 1960s (Figures 15 and 16)(ODFW 2006). This practice resulted in dangerously low cougar numbers, which warranted legal protection by 1967 Oregon Legislature (Keister and Van Dyke 2002).

A 2002 public opinion poll of Oregonians in six southwest counties, including Coos County, shows that the traditional perception of cougars as a prominent predatory threat in Oregon has not changed. Although 64% of respondents agreed that "occasional contact with cougars should be accepted as part of living in the Pacific Northwest," most Oregonians (75%) feel that they should have the right to kill a cougar they perceive as a threat "no matter what the government says" (Chinitz 2002). In recent years, non-hunting cougar mortalities have shown an increasing trend in Oregon (Figure 17). ODFW (2006) estimates that from 1987-1994 there were 186 cougar mortalities (23 mortalities/year) from livestock damage and human/pet safety alone. From 1995-2003, this number increased to 1,046 cougar mortalities (116 mortalities/year). In 2003, non-hunting mortality represented a substantial share (approximately 30-65%) of total annual cougar mortality statewide.

Habitat

Deer and elk rely on young forest habitats and commercial tree plantations as an important foraging resource (Figure 18)(Oregon Forest Resources Institute 2013, USDA n.d., ODFW 2006). The Oregon Forest Resources Institute (2013) explains that the passage of the Northwest Forest Plan (see sidebar) resulted in social, political, and legal mandates that limited harvest of late successional forests, but have also resulted in less early successional habitat on public lands. To reduce competition between conifer seedlings and other plants (e.g., grasses, forbs, and shrubs), managers

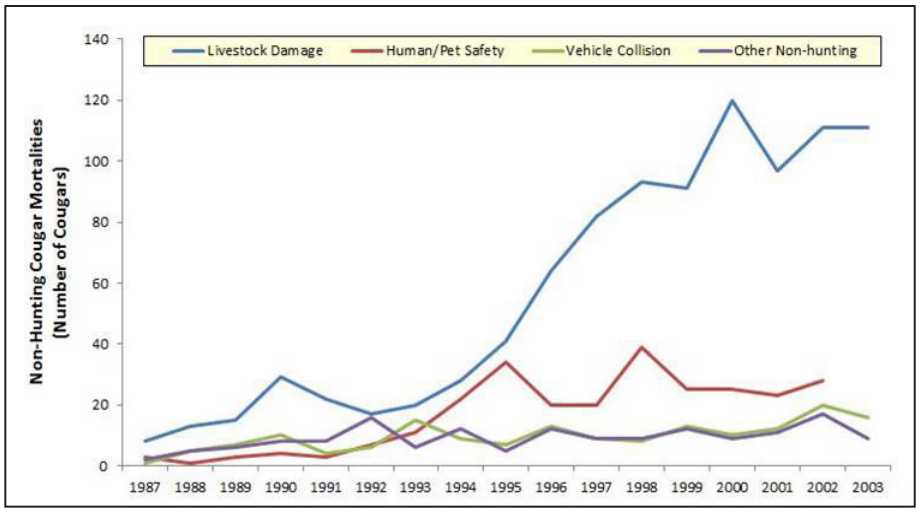


Figure 17. Non-hunting cougar mortality has been increasing statewide since the late 1980s, with the large majority of non-hunting mortality resulting from livestock damage. Data: ODFW 2006.

Figure 18. Deer and elk commonly browse planted seedlings in recently-reforested commercial tree plantations. Photo: Oregon Forest Research Institute 2013.

commonly apply herbicides to reforested areas for the first two years after timber harvest (Oregon Forest Resources Institute 2013). These practices may limit the suitability of deer, elk and bear foraging habitat in SW Oregon (S. Love, pers. comm., April 29, 2015; M. Vander Heyden, pers. comm., June 1, 2015), but the exact effects of these policies is under debate (OFRI 2013).

Forest management activities that adversely affect deer and elk may also affect cougar populations. Management practices that increase forage for prey species will also likely benefit cougars (ODFW 2006). Human development can affect cougars by increasing the potential for non-hunting conflicts and introducing high density roads in the winter range of deer and elk that may reduce prey availability (ODFW 2006). However, cougars are highly resilient to human disturbance (Anderson and Lindzey 2005, ODFW 2006).

Background

Only the Columbian black-tailed deer and Roosevelt elk occur within the project area (Figure 19). Oregon supports two additional deer species and one additional elk species. These are the mule deer (*Odocoileus hemionus*), white-tailed deer(*Odocoileus virginianus*), and Rocky Mountain elk (*Cervus canadensis nelsoni*). In addition, two subspecies of mule deer also occur in Oregon, including the Rocky Mountain mule deer (*Odocoileus hemionus hemious*) and the Columbian black-tailed deer (*Odocileus hemionus columbianus*).

Northwest Forest Plan

In the late 1980s and early 1990s, a series of lawsuits effectively halted timber harvest in the Pacific Northwest. In response to this environmental crisis, President Clinton enacted the Forest Plan for a Sustainable Economy and Sustainable Environment, which mandated federal land managers and regulatory agencies to work together in developing a plan to resolve this conflict. This legislation brought sweeping changes to the management of forest in Oregon, Washington, and California and has since become known as the "Northwest Forest Plan" (NWFP).

Initially, the NWFP was intended to protect critical habitat within the range of the northern spotted owl (Strix occidentalis caurina). However, since its passage, the framework has been adapted to accommodate regional interagency monitoring of several additional resources, including federal-tribal relationships and the status and trends of watershed conditions, old-growth forests, socioeconomic conditions, and population and habitat for marbled murrelet.

Sources: USFWS 1997, Charnley et al. 2008, REO n.d., Raphael et al. 2011

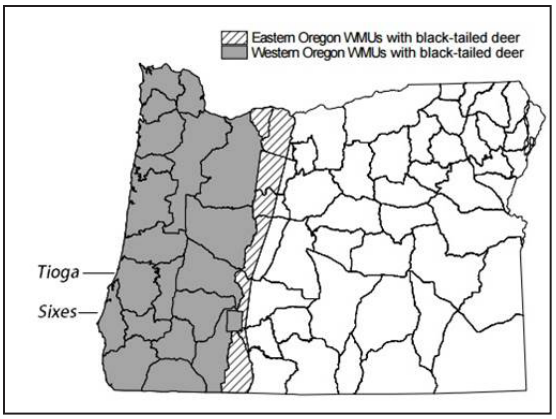


Figure 19. Range map showing the extent of black-tailed deer in Oregon. Although the range of Roosevelt elk in Oregon is not mapped, it corresponds to roughly the same area. Figure: ODFW 2008.

Deer and elk are herbivores, and rely on young forests for foraging habitat (Oregon Forest Resources Institute 2013, USDA n.d., ODFW 2006). However, unlike elk, which are able to process large volumes of poor quality forage, deer require high quality forage provided by plants that are actively growing (ODFW 2008). Although adult female and juvenile elk form herds, males (or "bulls") tend of be solitary most of the year (ODFW n.d.b.). Adult male deer (or "bucks") are also solitary, but, unlike elk, deer bucks do not herd groups of females during breeding (Link 2004).

The black bear is the only bear species in Oregon. Black bears occur in a wide range of habitats throughout Oregon, and are abundant in western Oregon, particularly in forests that combine understory vegetation food resources with concealment and escape cover (Figure 20)(Vander Heyden and Meslow 1999, ODFW 2012). Bears are omnivores that eat a variety of plants and animals, including berries, acorns, skunk cabbage, and other herbaceous plants as well as deer fawns, elk

Figure 20. Bear Distribution in Oregon Figure: ODFW 2012.

calves, carrion and insects (ODFW 2012; M. Vander Heyden, pers. comm., June 1, 2015). Although black bears hibernate from late fall to early spring, hibernation may not occur in the southern portion of their range, especially in coastal areas that have mild winter conditions (Hellgren and Vaughan 1989, Graber 1990, Hellgren et al. 1997).

Cougars occur throughout western Oregon and into parts of eastern Oregon, where their range is largely limited to the Ochoco, Blue, and Wallowa mountains (ODFW n.d.b.). The greatest cougar densities appear to be in the southwest and northeast portions of the state where deer and elk are also abundant (Figure 21)(ODFW 2006). Cougars are obligate carnivores that eat a variety of prey species but show clear preference for deer and elk (ODFW 2006). They are generally solitary animals active at all times of day and night and use caves as retreats (ODFW n.d.b.).

Surveying Large Mammals

Estimating the population of deer, elk, bears, and cougars is difficult due to the secretive life histories of these animals and the dense cover they inhabit (ODFW 2006, 2008). Consequently, wildlife managers commonly rely on alternatives to actual population counts (e.g., buck or bull ratios, damage reports, mark-recapture, etc.) to assess large mammal populations (ODFW 2008). These alternative metrics are used to inform management decisions, because, in many cases, they are more reliable than total population counts (S. Love, pers. comm., April 29, 2015).

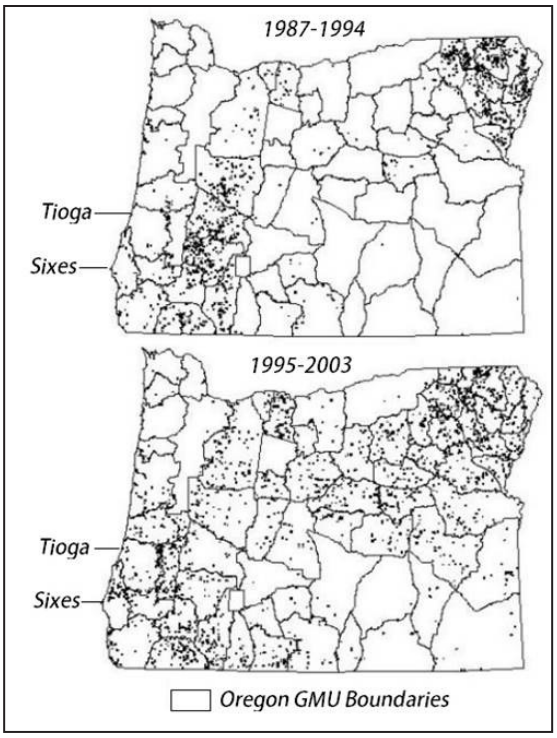


Figure 21. Approximate density of cougar populations in Oregon as shown by cougar mortalities (hunting and non-hunting) between 1987-1994 (top) and 1995-2003 (bottom). Figure: ODFW 2006

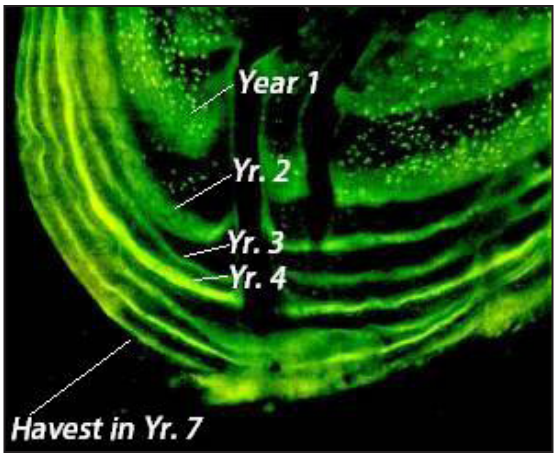


Figure 22. Biomarkers leave a stain on bears' tooth, which fluoresces under a special light. Using a microscope, biologists are able to determine the age of a bear at the time it consumes the biomarker and calculate the year the bait was ingested. The bright florescent annular ring in the example above indicates that a biomarker was consumed 3 years prior to harvest. A second florescent ring (unmarked in yr. 6) shows the consumption of an additional marker the year before harvest. Although bears may consume multiple biomarkers throughout their lifetime, it is unlikely that they will consume more than one annually due to the large distance between baits.

For deer and elk, population data are gathered using a variety of methods, including spotlighting or ground surveying, pellet group survey (i.e., collection of droppings along a transect), or aerial surveys (Bender n.d.). ODFW surveys for bears using a mark-recapture method in which bears ingest bacon baits that contain a benign "biomarker" that stains bear teeth. Since bear teeth grow continuously, putting on a new annular ring each year much like a tree does, biologists are able to "back-calculate" the date of biomarker consumption from teeth collected from harvested bears (Figure 22)(S. Love, pers. comm., April 29, 2015). However, due to the time it takes to harvest bears and process these data, bear population estimates lag by 2 years (S. Love, pers. comm., April 29, 2015). Similar to deer and elk, cougars surveys make use of scat collection data (ODFW 2015a)

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