Land Management Practices and their effects on Grouse Populations of the American Pacific Northwest

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Abstract

The range of birds within the Tetraoninae subfamily (known as grouse) of the North American Pacific Northwest extends from Alaska south to the central interior of California. During the 19th and 20th centuries, they were known to occur in abundant and stable populations. Although recently, multiple studies have found a marked decrease in the number of grouse within their historical distribution. Though they have been deemed not threatened in the central regions of their distributions, their northern and southern range populations are shrinking at an alarming level. Forest grouse have already been designated as a low-density species in Alaska and are nearly extirpated from a majority of California, noted as only inhabiting small islands of livable habitat. Various disturbances are considered detrimental to grouse populations and are hypothesized to explain the group's decline, including land development, habitat fragmentation, timber harvest/management, and a reduction in wildfire frequency. Habitat fragmentation, fire suppression, and a lack of forest management practices have been identified as the disturbances having the greatest impact on forest grouse populations throughout the Pacific Northwest. The application of new and existing land management strategies within current forest grouse habitats may be the key to protecting current populations. Implementation of practices that re-introduce historical fire regimes and increase forest management activities are two suggestions that may be able to accomplish the stabilization of forest grouse populations throughout the Pacific Northwest.

1.1. Introduction

Many North American game-bird species have experienced periods of rapid decline since the time of European settlement. The realization of these dwindling populations by the public and governmental agencies has saved some species from the brink of extinction (MoBCI 2013). An example of a successful conservation effort is the preservation of the American wild-turkey [*Meleagris gallopavo ssp.*] (Kennamer/NWTF 1992). Intense game management and conservation plans saved this symbol of American wildlife from habitat loss and over-hunting. Wild turkey populations in North American are estimated to be approximately 5.6 million individuals (Bromley 2001). But for many game bird species this has not been the case, and population losses have been largely ignored. The American grassland bird group, which includes forest grouse of the Pacific Northwest, is an example of a native bird species that has not received such protection. Collectively, 48% of American grassland bird species are of conservation concern, while 55% have shown significant declines in population numbers (PWRC: USGS 2009). This is epitomized by the near disappearance of the Mount Pinos blue grouse [*Dedragapus fuliginosus howardi*] of the Tehachapi Mountains (Bland 1992; Weiss 1979, Shuford et al. 2008). There are many factors driving the population decline of the forest grouse, including: (1) habitat fragmentation and loss from urban/agricultural development (Schroeder 2001), (2) lack of forest management activities (Zwickel 1992), and a (3) loss of historical fire regimes eliminating clearing of vegetation debris

and affecting forb availability (Bates 2011; Rhodes 2010). Many of these elements frequently occur within the same areas. This can culminate in some populations being exposed to multiple, interacting threats that lead to an even greater degree of decline.

The overall goal of this senior project is to outline the most pertinent and substantial impacts faced by forest grouse of the Pacific Northwest, and to suggest management practices that could provide effective conservation. Three major threats will be discussed, and two management strategies will be proposed that could possibly alleviate negative pressures currently faced in grouse habitats.

1.2. Description, habitat, and habitat extent

Forest grouse of the Pacific Northwest include seven distinct species, all being classified under the Phasiniadae (Pheasant) family of birds of the Galliformes order. These seven species are the ruffed grouse (*Bonasa umbellus)*, spruce grouse (*Falcipennis canadensis)*, greater sage-grouse (*Centrocercus urophasianus)*, dusky grouse (*Dendragapus obscurus)*, sooty grouse (*Dendragapus fuliginosus)*, sharp-tailed grouse (*Tympanuchus phasianellus)*, and the willow grouse (*Lagopus leucura)*. Grouse are upland game birds[1] that are short in height and have squatty forms, resembling domestic chickens in size and structure. They vary in length from 12-37 inches and 1-15 lbs. in weight. Species-specific descriptions are detailed in Appendix (A). Their distributions range along the Pacific Coast, stretching from a southern reach of Humboldt County, Cali-

[1] *Upland game bird : a term referring to non-water fowl birds that are hunted for sport (WGFC 2013).*

fornia, north to the Interior region of Alaska (Cornell University 2013; Bendire 1889; del Hoyo 1994). One exception to this range exists, as a few species are found in a narrow strip of habitat encompassing California's Sierra Nevada Mountain range (WDFW 2008). Within this range, they extend from the Pacific Coast to approximately 500 miles inland (Cornell University 2013). Among these areas, grouse establish themselves in the Pacific Temperate rainforest, Klamath-Siskiyou Coniferous forest, and the Sierra Nevada Coniferous forest ecological regions (WWF 2014). These ecological regions are further delineated by the dominat forest cover types, which include Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), hemlock-Sitka spruce (*Tsuga mertsiana*; *Picea sitchensis*), coast redwood (*Sequoia sempervirens*), and fir-spruce (*Abies sp.*; *Picea sp.*) forests. Grouse utilize these different forest types throughout the year depending on seasonal changes, having a distinct summer range in lower elevations (0-2,000 Ft.), and a winter range in higher elevations (3,700-11,000 Ft.) (Cornell University 2013; Johnson 1929; Siegel et al., 2012; Bland 1992). During migrations between these contrasting ranges, they prefer forested areas with intermediate age structures intermixed with canopy openings (Zwickel 1992; Bendell 1996). This type of forest structure provides them with adequate cover from predation, and an abundance of vegetative mast that comprises over 98% of their diet (Schroeder 1985). The high variation in these uneven-aged forests typically maintains a distribution of patchy and discontinuous canopy openings, which supports the highest amount of breeding success in grouse populations (Schroeder 1984).

Section 2. Impacts faced by Pacific Northwest forest grouse

2.1 Habitat fragmentation, loss and degradation

Habitat loss and degradation has the most significant impact on forest grouse populations (Ribic 2009, Brennan 2005). Forest grouse habitat frequently occurs along the highly developed Pacific Coast of the United States and Canada, exposing the forest grouse to heightened levels of urban encroachment and development when compared to similar bird species. Their once widespread geographic distributions have been greatly reduced and partitioned in the past decades. Though loss of habitat is detrimental, habitat fragmentation can be even more severe. This fragmentation leads to a loss of population connectivity, which compromises the ability of grouse to reproduce (Knick 2011, 2013). Without a connection to multiple populations within the species range, small groups become spatially isolated, potentially leading to local area extinctions. These extinctions occur from a decrease in genetic variability, which leaves species susceptible to novel conditions such as viral outbreaks or a reduction in available sustenance to cause increased levels of mortality. Also, when these groups are limited to a specific land area, the ability of the local environment to host a multitude of individuals is severely limited.

Though urban development causes a great deal of negative pressure, agricultural development places further threats on grouse populations (Freemark 1995). Grouse in the Pacific Northwest often gravitate toward forested areas that feature timber clear-cuts and land clearings. These clearings are also commonly sought as tracts for agricultural operations (Timossi et al., 1995). Once developed, these agricultural lands may produce annual negative effects, frequently stem-

ming from the use of pesticides and fertilizers (Freemark 1995). The use of these inorganic compounds, synonymous with modern agriculture, may impart biological consequences for local grouse species (Freemark 1995; Askins 2007). These synthetic chemicals can contaminate water sources, taint vegetative mast, or be accidentally consumed by feeding grouse populations. Though many of these chemicals have known poisonous properties, there are many effects that may still be unidentified. Without conclusive knowledge on these agricultural chemicals and the related effects to bird species, we do not yet know the potential effects of agriculture on grouse populations.

2.2. Disruption and/or lack of historical fire return intervals (FRI)

Urban encroachment has also affected the size, intensity and frequency of fire events in grouse habitat. With so many homes, businesses, and communities in close proximity to these areas, fire suppression has been a major forest management objective in the 19th and 20th century. The common practice of fire suppression has been in place from the early 20th century to present, to protect both life and property (Forest History Society, 2013). Before this practice was instuted, fire was historically allowed to burn freely throughout America's forests. This allowed natural disturbance to occur, which modified vegetative structures and influenced stand development. Elimination of an area's natural fire regime leads to a change in local environmental conditions, by reducing or even eliminating the effects fire has on landscapes adapted to this disturbance (Baker 1992). This alters species composition, density, forb availability and overall plant vigor,

which can all introduce several impacts to grouse populations (Bates 2011; Rhodes 2010). These include a change in habitat structure, food availability and increased predation pressures. Landscapes have adapted over long periods of time to withstand and thrive in these areas with regular fire disturbance, and the suppression of fire ultimately leads to a change in the local ecological dynamic (Baker 2012).

2.3. Timber harvest and silvicultural practice influences and effects

Timber harvest and silvicultural management in forested environments is a major factor influencing grouse populations (McCaffery 1996). Grouse have been shown to respond favorably in post timber harvest conditions (Bendell 1966). The opening of the forest canopy and the clearing of vegetation produces a large amount of understory species regeneration, increasing vegetative mast that supplement grouse diets (Dessecker 2001). Furthermore, timber harvest and thinning activities provide a reduction in canopy cover and an increase of forest canopy openings (Woodward et al., 2011). This benefits forest grouse in two different aspects. It first provides a patchy and discontinuous canopy layer, which has been found to support the highest densities of grouse (Sharp 1963). Secondly, this irregular pattern of timber combined with canopy openings provides optimal breeding habitat for grouse populations during the spring breeding season (Sharp 1963).

In past decades, strong political movements have reduced the amount of actively managed forestlands in the Pacific Northwest (WJU 2004). Public pressure has reached to both lands held by the US Government and private industry. The US Forest Service, responsible for the management of

over 183 million acres of forest, has shifted their past goal of timber production to now centering around recreation and ensuring ecologically stable landscapes (Barnard 2013). With the absence of timber harvest and management in the majority of our forests, combined with heavy fire suppression activities, forested environments are not allowed to redevelop themselves into landscapes that promote positive wildlife habitat (Peterson 2005). This has resulted in heavily stocked forests with overcrowded canopies. These two conditions deteriorate grouse habitats, by reducing understory vegetation and canopy openings. With less food available to nourish grouse populations, populations of grouse have and will eventually suffer. Additionally, the lack of forest management produces excessive fuel and litter build-up, exposing areas to high intensity fire events (Stephens 1998). Such situations torch entire areas, deteriorating habitats and leads to outcomes with an extreme level of vegetation mortality. Forested environments exposed to fires of this degree take many years to regenerate themselves and sustain wildlife populations.

Section 3. Management suggestions

3.1 Returning fire to grouse habitats

The re-introduction of natural fire return intervals has been shown to increase the health of wild land habitats for grouse by reducing litter fuels and reducing tree competition (USFWS 2009). With adequate research and review of historical records, land managers can return fire events to

their past that habitats have been exposed to through dendrochronology. This has an overarching effect, as it increases the health of the local ecosystems in a multitude of ways. First, it benefits the area's vegetation by reverting tree species composition and structure back to the pre-suppression era. The application of fire events will also help thwart the occurrence of invasive species, but increasing the rate of regeneration of fire-adapted species (Askins 2007). It also removes dead debris and suppressed trees, increasing growing space for residual mature species (Fernandes, 2013). This increase in space allows understory species to thrive, expediting growth and mast production. This increase in forb and mast production will provide forest grouse with a larger and wider array of food materials to sustain and increase current populations. Secondly, the reduction of dead and weakened biomass by fire will result in forested environments with frequent canopy openings and land clearings (Ffolliott et al., 1977). This increases the frequency of available habitat used for grouse breeding and nesting, which is vital for the successful rearing of offspring (Connelly et al., 2000).

The return of fire regimes in grouse habitats will also provide opportunities for re-population of habitats that they are currently extirpated from (Davis 1970, Bendell 1974). Many Pacific Northwest forests that are fire suppressed can suffer from poor health and regeneration. When forest stands are allowed to grow without disturbances that promote discontinuous structures, the canopy reaches almost full closure, restricting regeneration and understory growth (Kolb et al., 1994). This results in crowded and unhealthy tree individuals, making the area susceptible to pests and pathogens that can cause increased mortality within forest stands (DellaSalla et al., 1995). As previously noted, areas with a high rate of canopy closure support the lowest densities

of forest grouse and also provide lower amounts of vegetative mass essential to grouse diets (Spanner et al.,1990).

3.2 The benefit of forest management

Research indicates that forest grouse respond favorably to ponderosa pine, red/white fir, and lodgepole pine forest types that are actively managed for the retention of mature tree species and the creation of canopies with frequent openings (Beese 1999, Pelren 1996, Perkins 1991, Rogers 1963). Multiple studies have substantiated this data, finding that grouse favor open areas that have been recently cleared by timber harvest and posses a high level of subsequent forb and seedling growth (USFS 2013; Bland 1992). Moreover, active management of forested areas provides a patchy and discontinuous forest structure, which has the potential to increase the rate of breeding success (Moore 2005). Active forest management leads to many of the same benefits experienced from the re-introduction of fire regimes. Although forest management is a more time-intensive process, it is often safer than prescribed fire and allows landowners to be compensated with investment returns from the harvest of timber. Utilizing modern silvicultural techniques, timber harvest cannot only benefit landowners economically but also increase the health of the surrounding forest (Fiedler et al., 1996). Applying uneven-aged management allows for forest regeneration, understory growth, and aids in increasing plant vigor (Beese 1999). Successful understory regeneration increases the amount of grouse food available, and canopy openings provide breeding and nesting areas for forest grouse species (Sallabanks et al., 2002).

Section 4. Conclusions

4.1 Summary and future research opportunities

Throughout Pacific Northwest landscapes, forest grouse are experiencing increasing and sustained threats resulting in the reduction of populations. Recent increases in land development have led to habitat loss and fragmentation at levels beyond the adaptability level of forest grouse. This immediate threat, paired with unmanaged and fire deprived forests, is negatively impacting population densities and growth. Although grouse are being pushed into a precarious situation, land management practices could be the answer to protecting the integrity of current habitats and thereby restoring the proliferation of these birds. The restoration of fire regimes, and the application of forest management are two concepts that may be the answer improving habitat and increasing population densities. These two management strategies also provide opportunities for further research into the topic. Future studies could provide definitive data on whether grouse respond favorably to forest management and prescribed fire and support decision-making to support the maintenance of healthy grouse populations. These avenues of research need to be further pursued to ensure the perpetuity of forest grouse in the Pacific Northwest for years to come.

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