HABITAT NEEDS AND PROTECTION FOR COLUMBIAN SHARP-TAILED GROUSE IN WASHINGTON WITH EMPHASIS ON OKANOGAN COUNTY

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INTRODUCTION

The sharp-tailed grouse (*Tympanuchus phasianellus*) is one of five species of North American grouse that are broadly grouped as "prairie grouse". Besides sharp-tailed grouse, prairie grouse include greater sage-grouse (*Centrocercus urophasianus*), Gunnison sage-grouse (*Centrocercus minimus*), greater prairie chicken (*Tympanuchus cupido*), and lesser prairie chicken (*Tympanuchus pallidicinctus*). Collectively, these grouse inhabit a wide range of plant communities dominated by grasses and shrubs. Males of all of these species engage in ritualistic, communal breeding displays on relatively open areas within breeding habitat. These display areas are known as leks, or in the case of sharp-tailed grouse, dancing grounds (Connelly et al. 1998).

Sharp-tailed grouse have a relatively large distribution throughout the United States and Canada. This species ranges from central Alaska east to the Great Lakes and the province of Quebec and south through Montana, and the Dakotas to Colorado. The sharp-tailed grouse originally occurred in 21 states and eight provinces but numbers have declined considerably in the southern and eastern portion of this species' range. Currently there are six recognized subspecies of sharp-tailed grouse.

Sharp-tailed Grouse in Washington

The subspecies of sharp-tailed grouse that occurs in Washington is the Columbian sharp-tailed grouse (*T. p. columbianus*). This subspecies also occurs in adjacent British Columbia and Idaho and has been recently translocated into historic range in Oregon (Snyder 2001). The historic range of Columbian sharp-tailed grouse also included parts of California, Nevada, Utah,

Wyoming, Montana and Colorado. This subspecies now occupies only a relatively small portion of its historic range (Giesen and Connelly 1993, Tirhi 1995). Within Washington, Columbian sharp-tailed grouse historically occurred in about 20 counties and ranged from the Canadian border, south to the Oregon border, and from the foothills of the Cascades east to the Idaho border in Whitman County (McDonald 1998, Appendix 1). This species was considered relatively abundant in eastern Washington, inhabiting most of the prairies of the Columbia Plateau and the river and stream valleys emptying into the Columbia River (Yocom 1952, Hays et al. 1998). By the 1950's, Columbian sharp-tailed grouse had been extirpated from six counties that had supported breeding populations (Yocom 1952, Buss and Dziedzic 1955), and the species is now confined to a few remnant populations in Okanogan, Douglas, and Lincoln Counties (Tirhi 1995, Hays et al. 1998; Appendix 1). The Washington Department of Fish and Wildlife classifies Columbian sharp-tailed grouse as threatened within the state. This designation is defined as "any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats." (http://wdfw.wa.gov/wlm/diversty/soc/definitn.htm, accessed 30 January 2010).

In Washington, as well as throughout the species' range, Columbian sharp-tailed grouse occupy steppe, shrub-steppe, riparian zones, and mountain shrub communities (McDonald 1998). These areas are characterized by mixtures of grasses, forbs (flowering herbaceous plants [e.g., dandelion, *Taraxacum officinale*; clover, *Melilotus* spp.]), and shrubs. The species vary somewhat by area but shrubs normally include sagebrush (*Artemisia* spp.), cherry (*Prunus* spp.), bitterbrush (*Purshia tridentata*), serviceberry (*Amelanchier alnifolia*), and hawthorne (*Creatagus* spp.) Riparian areas are also important, especially for winter habitat. In Washington, these areas

are normally characterized by alder (*Alnus* spp.), aspen (*Populus tremuloides*), cottonwood (*Populus deltoides*), water birch (*Betula occidentalis*), rose (*Rosa* spp.), willow (*Salix* spp.), serviceberry, and hawthorne (McDonald 1998).

Columbian sharp-tailed grouse historically occupied roughly 50% or more of Okanogan County (Jewett et al. 1953, Yocom 1952). Presently, this species occurs in scattered populations in and near Tunk Valley, Scotch Creek, Chesaw, and the Colville Indian Reservation within this county (Tirhi 1995, Hays et al. 1998). Although some of the sharp-tailed grouse habitat is owned by the state, the fact that most of it occurs on private land within the county strongly indicates that private landowners are critical to conservation efforts for this species. By the late 1970s Washington Department of Fish and Wildlife was suggesting that urban expansion in Okanogan County will likely negatively affect Columbian sharp-tailed grouse (Zeigler 1979).

General Biology

Population Ecology

Nesting. Sharp-tailed grouse are prolific in terms of clutch size and, with optimal conditions, can significantly increase in numbers in a single nesting season (Flake et al. 2010). In the northern plains, the average clutch size for 399 sharp-tailed grouse nests, including initial nests and renests, was 13.5 (Kantrud and Higgins 1992). The average clutch size in Nebraska for sharp-tailed grouse nests (including first nests and renests) was 11.6 eggs (Sisson 1976). In South Dakota, sharp-tailed grouse averaged 13.5 eggs/clutch (range 8-17) for initial nests and 11.4 on renests (Norton 2005). Similarly, researchers in an earlier South Dakota study reported that sharp-tailed grouse clutches averaged 12 eggs (including initial nests and renests) and these clutches ranged in size from 5-17 eggs (Hillman and Jackson 1973). Sharp-tailed grouse have an incubation period that normally lasts 23-24 days (Johnsgard 1983).

Nesting success (a successful nest is defined as a nest where at least one egg hatches) on the Fort Pierre National Grasslands of South Dakota averaged 72% for sharp-tailed grouse over a three year period (Norton 2005. In comparison, nest success rates for prairie grouse (sharp-tailed grouse and prairie chickens) of 75% in 1986, 53% in 1987, and 35% in 1988 in central South Dakota decreased apparently in relation to increasingly dry years (Fredrickson 1996).

Clutch size for Columbian sharp-tailed grouse in Washington appears similar (11-14 eggs) to that of sharp-tailed grouse in other parts of the species range. However, McDonald (1998) reported that the nest success rate for the Colville Reservation in Okanogan County was 42% and in adjacent Lincoln County it was 38%. These rates are lower than many rates reported in other portions of the range of sharp-tailed grouse. Moreover, they are lower than the 72% success rate reported by Meints (1991) and the 51% success rate reported by Apa (1998) for Columbian sharp-tailed grouse in Idaho.

Survival. Research results from different parts of a species' geographic range can provide a general picture of expected survival rates. Annual survival of adult Columbian sharp-tailed grouse in eastern Washington and Colorado ranged from 33 to 66% (McDonald 1998, Collins 2004). Researchers in Colorado also indicated that annual mortality may differ considerably between years.

Sharp-tailed grouse hen survival in Alberta was 53% during the reproductive period (March through mid-August), and this comprised approximately 80% of the annual mortality (Manzer and Hannon 2008). In recent studies in South Dakota, adult hens on the Fort Pierre National Grassland had an average survival rate of 80% (Norton 2005).

Survival of juvenile (young of the year) sharp-tailed grouse is not well understood throughout the species' range. In Alberta, chick survival was 47% and 81% of mortalities

occurred within the first 15 days after hatch (Manzer and Hannon 2008). Survival of sharp-tailed grouse chicks to approximately 12 weeks of age ranged from 30-40% over a 3 year period in the Fort Pierre National Grassland while brood survival ranged from 80-100% over this same period. These high survival rates were likely due to the vast grassland ecosystem encompassing the study area and rotational livestock grazing in conjunction with annually resting 10% or more of the area from grazing for two year periods (Norton 2005). Chick survival, particularly in the first two weeks after hatch, is much lower than yearling and adult survival in sharp-tailed grouse (Amman 1957, Connelly et al. 1998) as well as other prairie grouse species.

In Washington, research indicated that rearing young could be hazardous for female sharp-tailed grouse; brood-rearing hens had higher mortality rates than hens not engaged in brood-rearing (McDonald 1998). McDonald (1998) indicated that annual survival of adult Columbian sharp-tailed grouse was similar in Okanogan and Lincoln counties and in both counties combined averaged 55%. These survival rates are somewhat higher than rates reported for sharp-tailed grouse in Michigan, Nebraska and Colorado (McDonald 1998).

Causes of mortality. Predation appears to be a significant cause of mortality for adult sharp-tailed grouse during the breeding season (Manzer and Hannon 2008) and may also be substantial for some populations during severe winters (Ulliman 1995, Connelly et al. 1998). However, predation on sharp-tailed grouse hens in South Dakota during the reproductive period was rare and about equally split between raptors and canids (red fox [*Vulpes vulpes*] and coyotes [*Canis latrans*]) (Norton 2005). Raptors (hawks, falcons, and owls) accounted for most of the documented mortalities of chicks on the Fort Pierre National Grasslands, followed by mammalian predators. Much of the loss to raptors may have been due to northern harriers and short-eared owls (Norton 2005).

The act of predation is often highly visible to professional biologists as well as non-professionals. Predation events are frequently witnessed by farmers, ranchers, and hunters and vividly remembered, sometimes leading individuals to believe that predation is responsible for all game bird population declines (Flake et al. 2010). In spite of these observations, most available information indicates predation normally does not have a significant impact on grouse populations (Schroeder and Baydack 2001, Flake et al. 2010). Sharp-tailed grouse have evolved with a variety of predators and have developed many different ways to cope with predation (Flake et al. 2010). Long-term grouse population trends are normally much more influenced by the availability of key habitats such as good condition grasslands, shrub steppe, and riparian zones then predators, disease, or other decimating factors that directly kill individual grouse (Flake et al. 2010). Thus, the fact of predation can be far different than the effect of predation.

Besides predation, other causes of mortality for sharp-tailed grouse can include vehicle collisions and flying into fences, power lines, and other obstacles. In South Dakota, high winter mortality during unusually severe winters, unlike the case for ring-necked pheasants, does not seem to be a major source of loss for sharp-tailed grouse populations (Hillman and Jackson 1973) and this is likely true throughout much of the species range but there are exceptions (Ulliman 1995). If depth of snow is adequate, sharp-tailed grouse will try to find roost sites and even daytime protection during severe winter storms by diving into snow banks and remaining in this wind protected and much warmer environment until conditions improve (Flake et al. 2010).

Infectious disease has not commonly been reported for sharp-tailed grouse although, in part, this could be due to the fact that birds weakened by disease are quickly eaten by a variety of predators and scavengers (Connelly et al. 1998). However, tularemia, a disease often associated with rabbits, has been recorded in sharp-tailed grouse (Connelly et al. 1998). Current

information suggests that neither parasites nor disease appear to pose threats to sharp-tailed grouse populations (Connelly et al. 1998, Flake et al. 2010).

Early researchers concluded that hunting had little effect on sharp-tailed grouse populations (Amman 1963, Hillman and Jackson 1973). More recently, scientists have been cautious in their conclusions regarding effects of hunting (Connelly et al. 2005). In Wisconsin and the Yukon Territory harvest rates can, at times, be relatively high (up to 56% of the fall population) and in some years harvest may negatively impact populations (Gregg 1990, Mossop 1994). A more thorough treatment on hunting and upland game is presented in Connelly et al. (2005).

HABITAT NEEDS

Breeding Habitat

The breeding complex includes the lek and adjacent nesting habitat (Connelly et al.1998). This complex includes all suitable habitats within at least a 2 km (1.2 miles) radius of lek sites. Nest sites are dispersed in appropriate habitats adjacent to leks but do not appear to be concentrated in relation to distance from the lek, that is, females neither avoid nor attempt to nest close to leks (Connelly et al. 1998). In South Dakota, the distance from lek of capture to the nest for radio-marked female sharp-tailed grouse averaged a little over 1.6 km (1 mile) during three nesting seasons (Flake et al. 2010). The distance appears to be similar for Columbian sharp-tailed grouse and, for first nests, averaged 1.2 km in Okanogan and Lincoln counties (McDonald 1998). Sharp-tailed grouse are well adapted to nesting in grassland areas with mixed shrubs and shrubby draws (Kantrud and Higgins 1992, Meints et al. 1992). Shrubs such as sagebrush mixed with herbaceous growth provide visual screening to help reduce predation on sharp-tailed grouse nests; these shrubs also provide shade from the heat (Flake et al. 2010). Shrubs are sometimes

the only usable nesting cover remaining when herbaceous cover is significantly reduced due to drought or inappropriate management activities.

In central South Dakota, sharp-tailed grouse nests were generally found under some type of overhead grass and forb cover or near the base of a shrub (Hillman and Jackson 1973). Sharp-tailed grouse nesting habitat in North Dakota was described as areas with a uniform vegetation height of 30.5 cm (12 inches) and patchy vegetation of 35.5 cm (14 inches) (Christenson 1971.

In Okanogan County, most sharp-tailed grouse nests were found in grass/forb dominated habitats although grass/shrub and Conservation Reserve Program (CRP) habitats (non-irrigated agricultural fields that have been removed from crop production and planted to permanent cover) were occasionally used (McDonald 1998). Moreover, nest success was considerably higher in grass/forb habitats used by nesting grouse compared to the other habitats used. McDonald (1998) also reported that in Okanogan and Lincoln Counties sharp-tailed grouse used grassland, grass/forb, and Conservation Reserve Program (CRP) habitats extensively throughout spring and summer. Most Columbian sharp-tailed grouse leks occur on private land in Washington where 80% of Columbian sharp-tailed grouse habitat is privately owned, 12% is managed by the Colville Tribe, 4% is managed by the Washington Department of Natural Resources and 3% is managed by the Washington Department of Fish and Wildlife (Tirhi 1995).

Residual cover from the previous fall is of particular importance for nesting sharp-tailed grouse because these grouse, like other prairie grouse, begin nesting before new grasses and forbs have had time for much growth. Research in North Dakota indicated that sharp-tailed grouse nests were often located in cover tall and dense enough to obscure (visual obstruction) a Robel Pole to a height of about 15 cm (6 inches) at most grouse nests (Flake et al. 2010).

Brood-rearing Habitat

Sharp-tailed grouse hens generally select brood rearing habitat within 1.6 km (1 mile) or less of the nesting site and longer movements are unusual. In Idaho, Columbian sharp-tailed grouse broods generally remained within about 1 km (0.8 miles) of nest sites (Meints 1991). Recently hatched sharp-tailed grouse broods in South Dakota tend to occupy small areas with adequate concealment for the secretive young and an abundance of food in the form of insects and forbs (Hillman and Jackson 1973). Brushy draws and roadside ditches can provide shade and cover on hot days. As broods reached 8 or 9 weeks they may use much larger areas and often may feed in alfalfa fields and areas with abundant sweet clover (*Melilotus officinalis*) or other forbs (Hillman and Jackson 1973).

In western North Dakota, broods were usually found in grasslands with excellent height and density of grasses. Vegetation at brood flush sites obscured a Robel Pole to a minimum of 23 cm (9 inches) at over 75% of brood site readings (Flake et al. 2010). Pastures that provided grassland in good enough condition for nesting females also had isolated areas of taller grass used for brood rearing. Grouse nesting in brushy uplands or in woody draws in very heavily grazed pastures left those areas to find better condition pastures to rear the young. However, broods used shorter vegetation with abundant forbs during early morning and evening feeding times (Flake et al. 2010). Concealing overhead cover, primarily from an abundance of forbs and shrubs, characterized sharp-tailed grouse brood habitat in Nebraska (Sisson 1976).

Sharp-tailed grouse brood hens on the Fort Pierre National Grassland used sites with an abundance of forbs, particularly sweet clover, and grasses (Norton 2005). These areas had an open understory where chicks could move about freely to feed and likely produced more invertebrates (an important source of protein for young chicks) than generally drier grass and

shrub dominated sites (Flake et al. 2010). The affinity for a diversity of forbs in brood habitat is also shown by the Columbian subspecies of sharp-tailed grouse in shrub steppe habitats throughout the intermountain west (Giesen and Connelly 1993).

Winter Habitat

Prior to tillage and development of cropland, sharp-tailed grouse in South Dakota were dependent on hard and soft mast from trees, shrubs, tree buds, and seeds of native grasses and forbs (Giesen and Connelly 1993, Flake et al. 2010). Sharp-tailed grouse can commonly be found in a variety of trees and shrubs, including the introduced Russian olive (*Elaeangnus angustifolia*), feeding on the fruits (soft mast) of these species in fall and winter. Some sharp-tailed grouse in Nebraska fed almost entirely on fruits of red cedar; rose hips can also be an important native food (Sisson 1976). Cultivated crops can also comprise an appreciable portion of the winter diet (Meints et al. 1992, Flake et al. 2010) Meints et al. (1992) reported that Columbian sharp-tailed grouse do not require cultivated grain but grain can be a preferred winter food when available. Corn, oats, wheat, barley, and sorghum made up 64% of the diet volume during winter in sharp-tailed grouse in western South Dakota (Renhowe 1968).

In Washington, sharp-tailed grouse tend to rely on sagebrush, mountain shrub, and riparian cover types during winter (Zeigler 1979, McDonald 1998). Water birch appears to be an especially important riparian shrub for wintering Columbian sharp-tailed grouse in Washington Zeigler 1979, Weddell 1992, Tirhi 1995).

Habitat Management and Protection

Overall

Sharp-tailed grouse, like other prairie grouse species, are well-adapted to use reasonably large areas of shrub and grass-dominated habitats. However, unlike sage-grouse, sharp-tailed grouse are not specifically dependent on a single plant species. Instead, sharp-tailed grouse are

relatively adaptable and will use farmland and introduced species such as Russian olive to meet some of their food and cover requirements. Although some species of upland game (e.g., valley quail [*Lophortyx californicus*], pheasant [*Phasianus colchicus*]) can thrive in fairly close association to humans, sharp-tailed grouse are normally not found in close proximity to residential areas (Deeble 1996, Connelly et al. 1998). Thus, a general approach to conserving Columbian sharp-tailed grouse populations is to manage landscapes in a manner that protects relatively large expanses of grass and shrub dominated areas. Deeble (1996) underscored this point when he argued that many land use practices of ranching and farming communities are preferable to other land use options such as subdivision and development. Additionally, Flake et al. (2010) pointed out that although grazing too intensively and over too long of period can have negative effects on grouse, maintenance of ranching economies where private grasslands are appropriately managed to maintain good range condition is "one of the greatest hopes for the future of prairie-chickens, as well as sharptails and sage-grouse…" Flake et al. (2010) also argued that compared to conversion to cropland, ranching operations are of great value to long-term efforts to maintain grasslands and prairie grouse populations. This observation also likely applies to other land uses including suburban development and intensive energy development.

Okanogan County clearly contains important habitat for Columbian sharp-tailed grouse. Washington State's management plan for sharp-tailed grouse identified the area northwest of Chesaw (now the Chesaw Wildlife Area) and the Tunk Valley as the top two areas for protection of sharp-tailed grouse habitat (Tirhi 1995). The Siwash Valley is to north, the Scotch Creek Wildlife Area is to the west, and Haley Creek is to the south of Tunk Valley. All of these areas are occupied by Columbian sharp-tailed grouse. The Tunk Valley serves as a hub to these adjacent occupied areas and therefore plays a critical role; without the Tunk Valley, Okanogan

County's overall ability to support sharp-tailed grouse would be greatly diminished (M. A. Schroeder, Washington Department of Fish and Wildlife, personal communication).

Predation, hunting, and disease have not been identified as important constraints on sharp-tailed grouse populations (Columbian sharp-tailed grouse are not hunted in Washington) but habitat loss and degradation, in general, have been implicated in population declines. Thus, these recommendations emphasize actions that are generally necessary to avoid habitat loss or degradation and are organized by likely threats within breeding and winter habitat.

Breeding Habitat

There are no empirical estimates of how large (or small) an area is necessary to maintain a breeding population of Columbian sharp-tailed grouse. In all likelihood, the size of area will depend, at least in part, on productivity of the soil, vegetation communities involved, and topography. Meints et al. (1992) suggested that the minimum area necessary for successful reintroductions was 30 km^2 (11.5 $miles^2$) and that about 33% of this should be undisturbed grass/shrub habitat while the remainder can be composed of pasture, cropland and grazed uplands.

Vegetation manipulation of suitable habitat for sharp-tailed grouse should be avoided within 2 km of leks because of this area's importance for nesting and brood-rearing. However, some activities (e.g., fire, grazing) may be used to maintain appropriate long-term vegetative condition (Connelly et al. 1998).

Figure 1. Site of a sage-grouse collision with a barbed wire fence

Housing development. The development of ranchettes, vacation homes, and suburban

sprawl should be avoided in critical sharp-tailed grouse breeding habitat. These activities represent a permanent loss of habitat. Moreover, the footprint of a housing development is larger than the immediate structures because of disturbance, construction of fences and power lines, and attraction for generalist predators (Leu et al. 2008; Leu and Hanser, in press). Grouse can be injured or killed by flying into fences (Figure 1) and power lines (Figure 2). Fences have been documented to be the leading cause of mortality of lesser prairie chickens in Oklahoma (Wolfe et al. 2007).

Figure 2. Sage-grouse mortality from flying into a power line.

Energy development. Proposed energy developments should be carefully planned to avoid critical Columbian sharp-tailed grouse breeding habitat. The development of grass/forb and grass/shrub communities for energy production represents a very long-term, if not permanent loss of habitat. Energy development is similar to housing development in that the footprint of an energy development is larger than the immediate structures (e.g., wind turbine, oil well) because of disturbance, construction of fences and power lines (Figure 2), and attraction for generalist predators (Leu et al. 2008; Leu and Hanser, in press). Developments with hundreds of wind turbines with associated roads and other infrastructure would cause extensive habitat fragmentation and losses potentially damaging to grouse (Flake et al. 2010). Early research in Minnesota and Nebraska indicated that influences of smaller wind power developments on prairie-chickens and sharp-tailed could be minimized by proper placement of turbines (Toepfer and Vodehnal 2007). However, large wind

power developments with hundreds or even thousands of towers would likely become a serious problem because of the human activity, associated infrastructure, and fragmentation of habitat (Kuvlesky et al. 2007). Current studies in the Flint Hills of Kansas, the largest area of tall grass prairie remaining in North America, indicate concern about potential effects of extensive wind power development on greater prairie-chicken populations (McNew and Sandercock 2007) and these concerns also likely apply to Columbian sharp-tailed grouse (Appendix 2).

Loss of CRP. Maintenance of CRP lands should be supported to provide habitat for Columbian sharp-tailed grouse. Development of CRP has had a positive effect on Columbian sharp-tailed grouse populations (Meints et al. 1992, Connelly et al. 1998). While CRP within areas formerly characterized by sagebrush steppe have commonly been seeded in grass cover that lacks sagebrush and many of the native grasses and forbs associated with the sagebrush, there is an increasing effort to seed these areas with seed mixtures that include sagebrush (Flake et al. 2010).

. Recently, the CRP program has come to a cross-road and decisions must be made by congress on the future of this program (Flake et al. 2010). Landowners must also decide whether this program or other land retirement programs fit into their farm plan. Reauthorization of a meaningful CRP program may not be competitive with corn, or small grain prices. If CRP is not re-authorized or replaced by a similar land-retirement program, projections indicate major losses of quality grouse habitat (Flake et al. 2010). As of spring 2008, over 300,000 acres of CRP grasslands in South Dakota had been either tilled or chemically treated prior to planting of row crops; hundreds of thousands of additional planted grassland acres in CRP will likely be destroyed in the next few years (Flake et al. 2010). The influence of this CRP loss is expected to

erase many recent gains in prairie grouse populations (Flake et al. 2010). However, conditions may change making federal land retirement programs more attractive in the future.

Fire. Prescribed fire should generally not be used in areas that provide critical breeding habitat for Columbian sharp-tailed grouse, but may be acceptable for creating habitat where conifers have invaded traditional shrub/meadow steppe areas. In addition, small fires are sometimes a useful management tool for maintaining habitat condition. In many cases fire can be a threat to sharp-tailed grouse populations but fire does not normally represent a permanent loss of habitat. In Lincoln County, three large prescribed fires and one chemical control of sagebrush in the 1980's were believed to be directly responsible for the decline of both sharp-tailed grouse and sage-grouse populations (Hays et al. 1998). In Idaho, McArdle (1977) reported less use by Columbian sharp-tailed grouse of burned areas compared to other vegetation manipulations. Similarly, Hart et al. (1950) reported Columbian sharp-tailed grouse abandoned a lek site following a fire which also caused accelerated erosion, loss of nests, and loss of winter food and cover. In contrast, burning dense sagebrush and thickly wooded areas improved sharp-tailed grouse habitat in Utah (Hart et al. 1950), North Dakota (Kirsch et al. 1973), Colorado (Rogers 1969), and Wyoming (Oedekoven 1985). Fire suppression policies have allowed conifers to invade sagebrush and prairie habitats in some areas to the detriment of sharp-tailed grouse populations (Hays et al. 1998). Prescribed burning may be effective in these situations for maintaining suitable habitats (Giesen and Connelly 1993).

Livestock Management. Private land ownership that includes ranching and farming operations should be encouraged in areas providing habitat for Columbian sharp-tailed grouse. Inappropriate grazing practices do not normally represent permanent loss of sharp-tailed grouse habitat. Nevertheless, Hays et al. (1998) point out that increases in grazing pressure on currently

occupied sharp-tailed grouse habitat in Washington is a principal threat to the continued existence of populations if grazing by livestock reduces the grass and forb component. However, the effects of grazing on sharp-tailed grouse vary and appear to depend on intensity, duration of grazing, type of livestock, site characteristics, precipitation levels, and past and present land-use practices (Hays et all 1998). Hart et al. (1950) found light to moderate grazing benefitting landowners and Columbian sharp-tailed grouse in Utah. Moreover, Weddell (1992) concluded that rest rotation and deferred grazing were less detrimental to sharp-tailed grouse than season-long grazing, but suggested the disadvantages of increasing grazing under any of these systems outweigh the advantages for sharp-tailed grouse. Even light to moderate grazing can be detrimental in areas with a history of overgrazing, because it may prevent recovery of the native vegetation (Hays et al. 1998). Nevertheless, Flake et al. (2010) noted that ranching operations on private lands throughout South Dakota's grassland, shrub steppe, grassland-woody draw habitats (river-break topography), and other areas should be considered a primary hope for the long-term preservation of habitat for prairie grouse. If critical breeding habitats are being damaged by livestock grazing, landowners and professional biologists should work cooperatively to design grazing systems that have minimal impact on grouse while providing for the needs of the landowner. The Washington Department of Fish and Wildlife stated that a good working relationship between conservation agencies and private landowners needs to be developed and maintained and that the agency needs access to private lands, in some cases, to conduct lek surveys and other research (Hays et al. 1998).

Winter Habitat

Winter habitat can often be the key to survival of Columbian sharp-tailed grouse populations. Mountain shrub habitats used during winter should be within 6 km (3.7 miles) of breeding habitat. This seasonal habitat is normally characterized by healthy stands of shrubs and

trees that provide food and cover for sharp-tailed grouse. In Okanogan County, winter areas are often riparian zones.

Housing development. The development of ranchettes, vacation homes, and suburban sprawl should be avoided in and adjacent to critical sharp-tailed grouse winter habitat. These activities represent a permanent loss of habitat and the issues and concerns discussed under breeding habitat also apply to winter habitat.

Energy development. Proposed energy developments should be carefully planned to avoid critical Columbian sharp-tailed grouse winter habitat. The development of winter habitat (primarily shrub-dominated communities) for energy production represents a very long-term, if not permanent loss of habitat. Energy development is similar to housing development in that the footprint of an energy development is larger than the immediate structures (e.g., wind turbine, oil well) because of disturbance, construction of fences and power lines, and attraction for generalist predators (Leu et al. 2008; Leu and Hanser, in press). The issues and concerns described for breeding habitat also apply to winter habitat.

Protection of riparian zones. Riparian zones should be maintained and protected against loss of shrubs and trees that provide important food and cover for Columbian sharp-tailed grouse during winter. Loss of deciduous cover can be especially severe in and near riparian areas that attract livestock in summer because of water and shade; this cover provides critical foraging areas and escape cover for sharp-tailed grouse throughout the year (Zeigler 1979, Marks and Marks 1988). Inappropriate management of riparian areas results in erosion and a lowered water table causing declines in the quality of the riparian areas especially with regard to trees and shrubs supported by these areas (M. A. Schroeder, Washington Department of Fish and Wildlife, personal communication). Moreover, loss of deciduous trees and shrubs by chemical control was

associated with declining Columbian sharp-tailed grouse populations in Washington (Zeigler 1979) and Utah (Hart et al. 1950). Chemical treatment of vegetation in sharp-tailed grouse habitat is detrimental due to the direct loss of vegetation (McArdle 1977, Oedekoven 1985). In Washington, use of herbicides to control sagebrush and other vegetation may cause additional reductions in sharp-tailed grouse habitat.

Fire. Winter habitat for Columbian sharp-tailed grouse should not be burned and if wildfire occurs in these areas, the fire should be immediately suppressed. Hart et al. (1950) reported a negative response by Columbian sharp-tailed grouse following a fire which caused accelerated erosion, and loss of winter food and cover.

SUMMARY

The Columbian sharp-tailed grouse now occupies only a relatively small portion of its historic range (Giesen and Connelly 1993, Tirhi 1995). Within Washington, Columbian sharp-tailed grouse historically occurred in about 20 counties and ranged from the Canadian border, south to the Oregon border, and from the foothills of the Cascades east to the Idaho border in Whitman County (McDonald 1998). This species was considered relatively abundant in eastern Washington, inhabiting most of the prairies of the Columbia Plateau and the river and stream valleys emptying into the Columbia River (Yocom 1952, Hays et al. 1998). By the 1950's, Columbian sharp-tailed grouse had been extirpated from six counties that had supported breeding populations (Yocom 1952, Buss and Dziedzic 1955), and the species is now confined to a few remnant populations in Okanogan, Douglas and Lincoln Counties (Tirhi 1995, Hays et al. 1998). Columbian sharp-tailed grouse historically occupied roughly 50% or more of Okanogan County (Jewett et al. 1953, Yocom 1952). Presently, this species occurs in scattered populations in and near Tunk Valley, Scotch Creek, Chesaw, and the Colville Indian Reservation within this county (Tirhi 1995, Hays et al. 1998). Although some of the sharp-tailed grouse habitat is owned by the

state, the fact that most of it occurs on private land within the county strongly indicates that private landowners are critical to conservation efforts for this species. The Washington Department of Fish and Wildlife classifies Columbian sharp-tailed grouse as threatened within the state. This designation is defined as "any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats." In Washington, Columbian sharp-tailed grouse occupy steppe, shrub-steppe, riparian zones, and mountain shrub communities (McDonald 1998) characterized by mixtures of grasses, forbs, and shrubs.

In Okanogan County, most sharp-tailed grouse nests were found in grass/forb dominated habitats although grass/shrub and CRP habitats were occasionally used (McDonald 1998). Moreover, nest success was considerably higher in grass/forb habitats used by nesting grouse compared to the other habitats used. McDonald (1998) also reported that in Okanogan and Lincoln Counties sharp-tailed grouse used grassland, grass/forb, and Conservation Reserve Program (CRP) habitats extensively throughout spring and summer. Most Columbian sharp-tailed grouse leks occur on private land in Washington where 80% of Columbian sharp-tailed grouse habitat is privately owned, 12% is managed by the Colville Tribe, 4% is managed by the Washington Department of Natural Resources and 3% is managed by the Washington Department of Fish and Wildlife (Tirhi 1995).

In Washington, sharp-tailed grouse tend to rely on sagebrush, mountain shrub, and riparian cover types during winter (Zeigler 1979, McDonald 1998). Water birch appears to be an especially important riparian shrub for wintering Columbian sharp-tailed grouse in Washington Zeigler 1979, Weddell 1992, Tirhi 1995).

A general approach to conserving Columbian sharp-tailed grouse populations is to manage landscapes in a manner that protects relatively large expanses of grass and shrub dominated areas. Deeble (1996) argued that many land use practices of ranching and farming communities are preferable to other land use options such as subdivision and development. Additionally, Flake et al. (2010) pointed out that although grazing too intensively and over too long of period can have negative effects on grouse, maintenance of ranching economies where private grasslands are appropriately managed to maintain good range condition is "one of the greatest hopes for the future of prairie-chickens, as well as sharptails and sage-grouse…" Flake et al. (2010) also argued that compared to conversion to cropland, ranching operations are of great value to long-term efforts to maintain grasslands and prairie grouse populations. This observation also likely applies to other land uses including suburban development and intensive energy development.

Okanogan County clearly contains important habitat for Columbian sharp-tailed grouse. Washington State's management plan for sharp-tailed grouse identified the area northwest of Chesaw and the Tunk Valley as the top two areas for protection of sharp-tailed grouse habitat (Tirhi 1995). Predation, hunting, and disease have not been identified as important constraints on sharp-tailed grouse populations but habitat loss and degradation, in general, have been implicated in population declines. Thus, specific recommendations were presented emphasizing actions that may be taken to avoid habitat loss or degradation and these were organized by likely threats within breeding and winter habitat.

In simplest terms, these recommendations emphasize protecting remaining habitat on public lands and adopting strategies for private lands that encourage ranching operations with appropriate livestock grazing management and the protection and enhancement of riparian zones.

Moreover, development of ranchettes, vacation homes, and suburban sprawl should be avoided in important sharp-tailed grouse breeding habitat because these activities represent a permanent loss of habitat. Providing habitat for Columbian sharp-tailed grouse in critically important areas of Okanogan County such as the Tunk Valley will help ensure the perpetuation of this species in the County.

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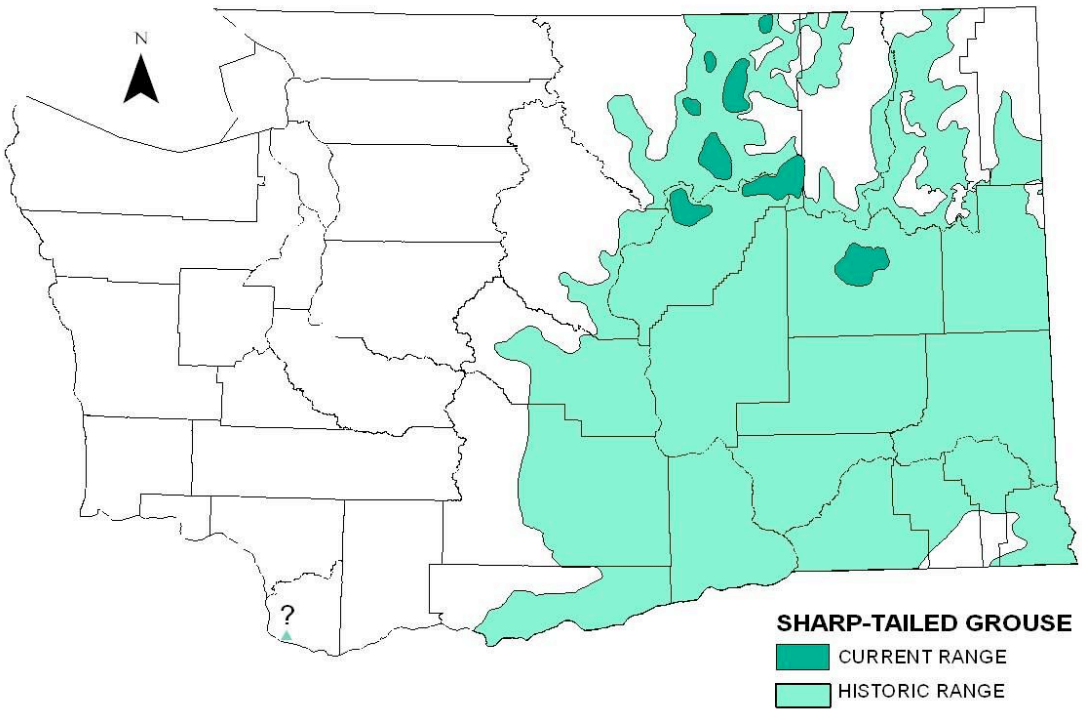
Appendix 1.

Distribution of Columbian sharp-tailed grouse in Washington from (Hays et al. 1998).



Appendix 2.

Prairie Grouse Technical Council

Position Statement on Wind Power Facilities

Since the mid-19th century, much of the prairie-grouse habitat originally present in North America has been lost. Across much of the currently-occupied ranges of the prairie grouse species, remaining suitable habitats have been severely degraded and fragmented. Much of this remaining habitat is now being considered for large-scale development of wind power facilities and associated transmission lines threatening to even further diminish both habitat quantity and quality. While the Prairie Grouse Technical Council recognizes the need to develop alternative energy sources, we also realize alternative energy development will have serious detrimental effects on prairie grouse populations if this development does not carefully take these species' needs into account. Thus, the Prairie Grouse Technical Council makes the following recommendations:

Recommendations:

1. First and foremost, wind farms should not be placed on large grassland tracts. Wind farms should be located in previously-degraded areas such as extensive croplands (>80% cropland) at least 2 miles from extensive grasslands.
2. Placement of wind farms should avoid active prairie-grouse leks by at least 3 miles.
3. Further fragmentation of native or restored grasslands within prairie grouse range by wind farms or transmission lines must be avoided, wherever possible.
4. Wind farms must not be placed in corridor areas considered critical to natural exchange between prairie grouse populations, even if such areas are presently unoccupied or rarely occupied by prairie grouse, or even if they consist primarily of cropland.
5. Transmission lines should be routed away from occupied prairie-grouse range or important corridor areas as much as possible.
6. Should proper siting prove untenable in preventing prairie grouse habitat loss, mitigation efforts should establish goals of restoring habitat at minimum ratios (restored:impacted) of 3:1 for intact habitats impacted and 2:1 for partially fragmented habitats or corridor areas impacted. This applies not only to wind farms but also to high-voltage transmission lines.
7. Turbines should be arranged in block rather than linear configurations to minimize the ecological footprint of the development.
8. Where transmission lines must cross occupied prairie grouse range or corridors, strong consideration should be given to laying these lines underground.
9. State or federal prairie-grouse biologists must be allowed to interact openly with wind power developers, transmission line developers, and utilities at the outset of project consideration to provide advice on siting and, if necessary, to arrange optimum mitigation.
10. Mitigation efforts should be designed to clearly benefit prairie grouse and should be targeted within the state where the expected impacts will occur. Examples might include,

but are not limited to, prairie habitat enhancement (e.g. tree removal, grazing and fire management) and grassland restoration.