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Recovery of Columbian Sharp-tailed Grouse in Washington: Progress Report

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WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

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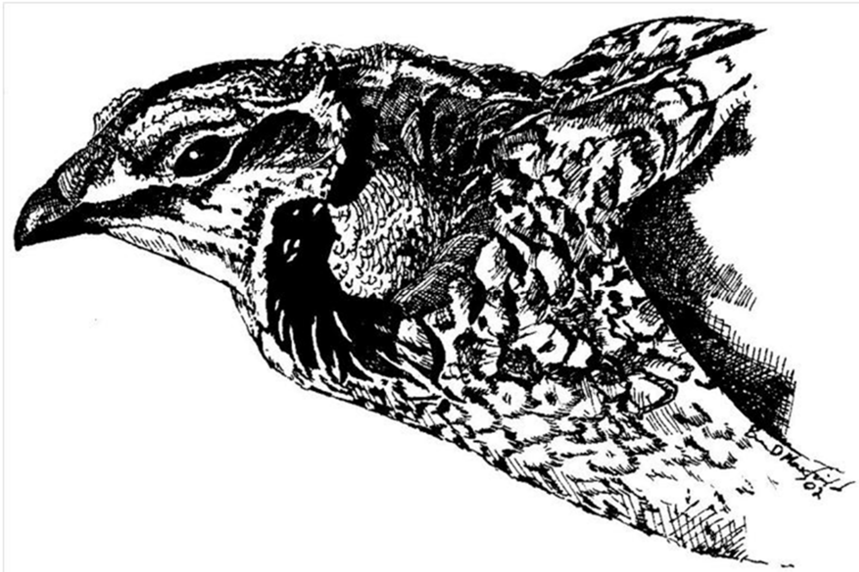
ABSTRACT

Declining populations and distribution of Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) in Washington have resulted in serious concerns for their long-term conservation status and their up-listing to state endangered in 2018. The overall population was estimated to be 410 associated with 31 active leks in 8 isolated populations in 2023. This was a decline in the population of 24% from the previous year and 51% since 2020. Grouse habitat has been dramatically impacted by a succession of wildfires in 2012, 2015, 2020, and 2021 with 7 of the 8 populations impacted. We examined the impact of wildfires by comparing lek attendance before wildfires (spring in year of fire) with lek attendance after the wildfires (spring of following year). Attendance declined 4.1% outside fire perimeters and 80.9% inside fire perimeters in the first year following wildfire. Multiple sharp-tailed grouse translocations have been conducted by WDFW and partners between 1998 and 2023. A total of 600 Columbian sharp-tailed grouse have been translocated to 6 of 8 populations in Washington State to improve their genetic and demographic health. In all release sites, translocations appear to have reversed the population declines and averted extirpation in the short term, though it is hard to assess long term success due to the impact of wildfires and other habitat degradations. Habitat conservation efforts such as grassland and riparian restoration, FSA general CRP and SAFE, habitat acquisition, etc. are ongoing in all populations.

On the front cover: Background photo by Michael Schroeder of Nespelem area and foreground photo by Justin Haug in Siwash Valley area, Okanogan County, Washington. On page 1: illustration by Brian Maxfield. On the back page: illustration by Darrell Pruett.

RECOVERY OF SHARP-TAILED GROUSE IN WASHINGTON: PROGRESS REPORT



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INTRODUCTION

Columbian sharp-tailed grouse were historically found in many of the shrubsteppe habitats of central and southeastern Washington (Yocom 1952, Aldrich 1963). Currently, surveys indicate that sharp-tailed grouse are virtually extinct everywhere except Okanogan, Douglas, and Lincoln counties (Fig. 1). The current range is approximately 3% of the historical distribution (Hays et al. 1998, Schroeder et al. 2000, Stinson and Schroeder 2012). Remaining populations are small and localized within isolated areas of relatively intact shrubsteppe, as well as Conservation Reserve Program (CRP) fields.

The Washington Department of Fish and Wildlife (WDFW) has a goal to recover and connect the endangered population of sharp-tailed grouse in Washington. The state listed the species as threatened in 1998, up-listed it as endangered in 2018, published a recovery plan (Stinson and Schroeder 2012, Fig. 2), acquired over 15,000 hectares of sharp-tailed grouse habitat, developed management strategies to improve their habitat (Hallet 2006, Olson 2006, Peterson 2006, Hoffman et al. 2015, WDFW 2015), conducted research on their life history requirements (McDonald 1998), contributed to detailed analyses of population genetics throughout the sharp-tailed grouse range (Spaulding et al. 2006), and initiated translocations to increase and expand populations (Stonehouse et al. 2015). The Confederated Tribes of the Colville Reservation (CTCR) have pursued a similar strategy of acquisition and restoration (Berger et al. 2005, Gerlinger 2005, Whitney 2014). The BLM includes the sharp-tailed grouse on their sensitive species list with a goal of minimizing or eliminating threats and improving the condition of habitat. The primary management strategy for the WDFW, BLM, and CTCR has been to improve habitat on publicly owned or leased lands that are currently, or were historically, occupied by sharp-tailed grouse and facilitate enrollment of private lands in Farm Bill conservation programs. Habitat improvements include the reduction of grazing pressure, transition of cropland (mostly wheat) to grass-dominated habitats (such as in the federally funded

CRP), restoration of native habitat, and planting of key habitat components such as riparian trees and shrubs.

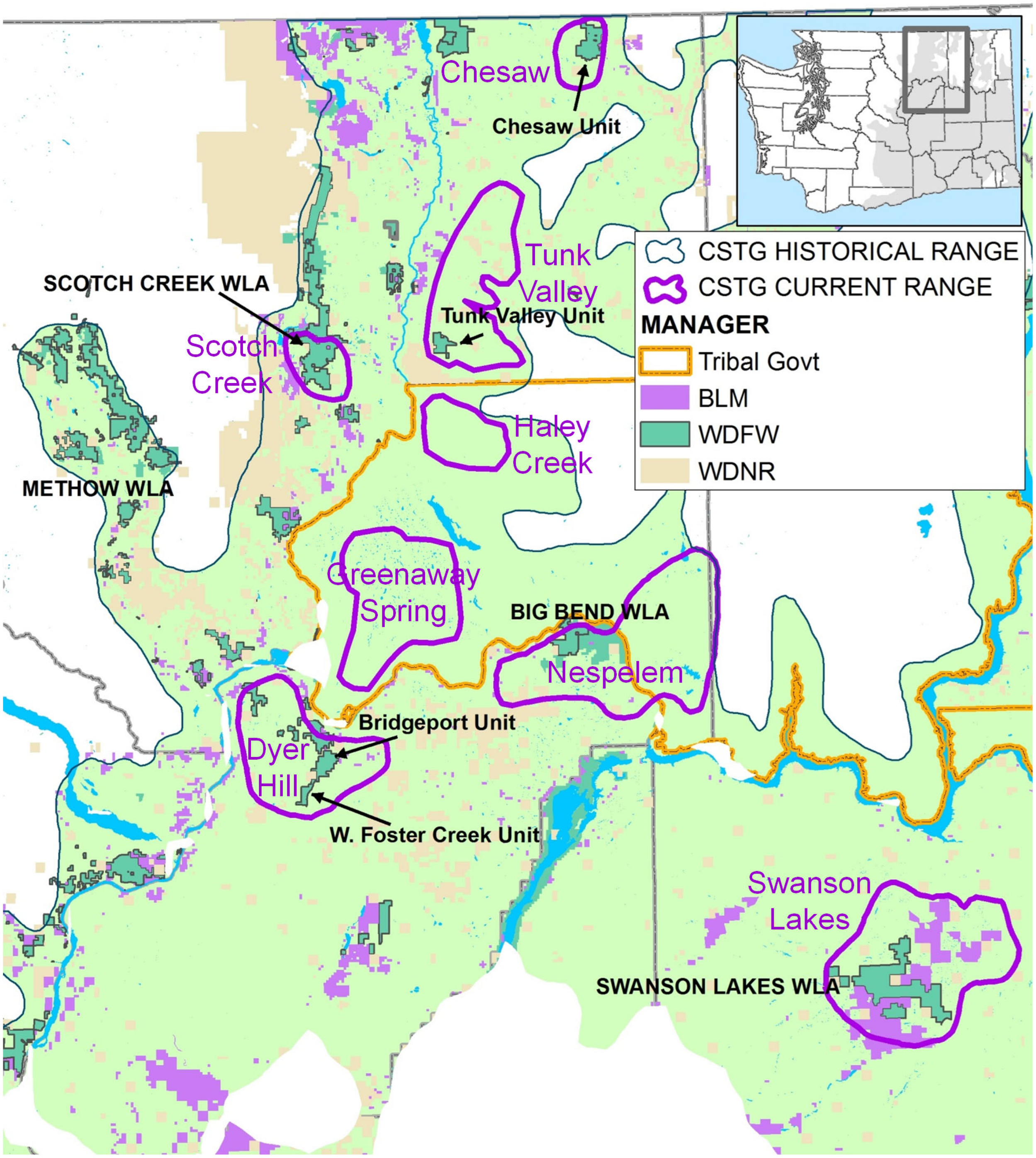

Fig. 1. Estimated historic and current range of sharp-tailed grouse in north-central Washington (modified from Schroeder et al. 2000). The Nespelem area is usually divided into the Nespelem area in Okanogan County and the Big Bend area in Douglas County. The Haley Creek and Greenaway Spring areas are usually combined into the Greenaway Spring area.

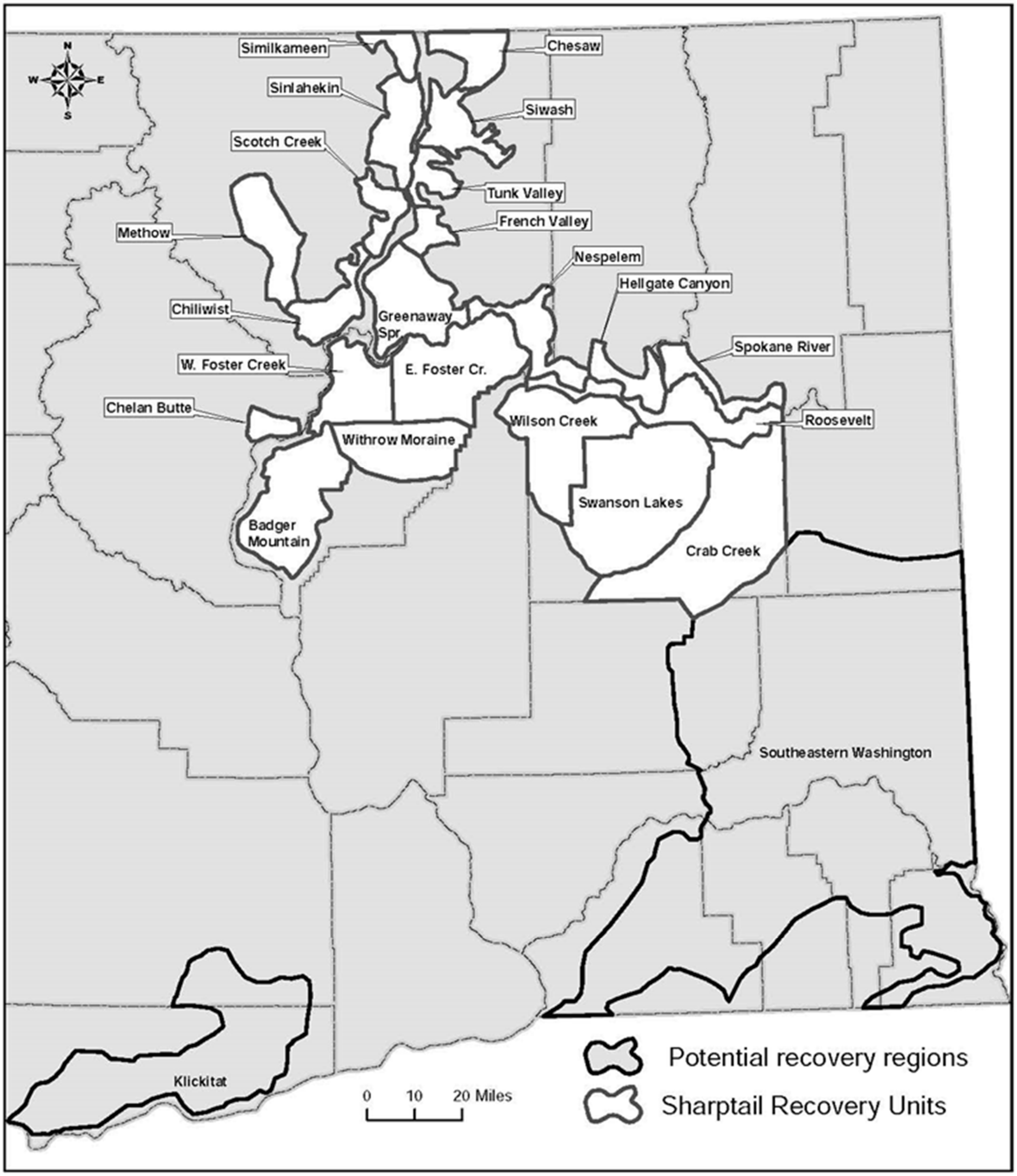

Fig. 2. Twenty-two Columbian sharp-tailed grouse recovery units and two potential recovery regions have been defined for Washington (Stinson and Schroeder 2012). The Big Bend population is in the East Foster Creek Unit, the Dyer Hill population is in the West Foster Creek Unit, and the Tunk Valley population is in the Tunk Valley and Siwash units.

Isolation poses a significant threat to the viability of remaining populations. Westemeier et al. (1998) described the reduction in genetic diversity and in population fitness over a 35-year period in a small, declining greater prairie-chicken (*Tympanuchus cupido*) population in Illinois. They reported that declines in fertility and egg hatchability correlated with a population decline from 2000 individuals in 1962 to less than 50 by 1994. Bouzat et al. (1998) genetically compared the Illinois population with larger populations in Kansas, Nebraska, and Minnesota and found that it had approximately 2/3 the allelic diversity of the other populations. Bellinger et al. (2003) found a similar reduction in genetic variation, though not in reproductive success, in greater prairie-chickens in Wisconsin. Their comparison of greater prairie-chicken samples collected in Wisconsin in 1951 with those collected from 1996 through 1999 revealed a 29% allelic loss.

Population augmentation efforts are one approach to address genetic issues associated with small populations (e.g., lack of genetic heterogeneity and fitness). In addition, by translocating birds from genetically heterogenous populations, a basic hypothesis can be tested. Specifically, is habitat post conservation and restoration still limiting the growth and/or expansion of existing populations or is the problem related to the intrinsic genetic 'health' of the birds? Assuming monitoring indicates that the translocated birds remained in the area and survived to attempt reproduction, an increasing population trend following augmentation would support the hypothesis that a population 'health' problem existed. If the population size remains the same or continues to decline this would support the conclusion that habitat quality and/or quantity are still limiting population growth.

METHODS

Inventory and monitoring

Leks can be defined as traditional locations where males perform their breeding displays. Because males sometimes display at satellite or temporary locations or lek sites may be altered slightly from one year to the next, lek locations ≤ 1 km from one another were grouped into lek complexes. In contrast, lek complexes were typically separated from the nearest lek complex by ≥ 2 km. Lek complexes were surveyed annually to obtain information on sharp-tailed grouse populations and annual rates of change (Schroeder et al. 2000). The survey protocol included multiple (≥ 2) visits to all known active complexes, searches for new complexes, and occasional visits to historic complexes believed to be inactive. Some original data from the 1970s were lost so that only the summarized data (highest count) from that period remain, despite some complexes having been observed on more than one occasion.

Numbers of grouse attending lek complexes were analyzed using the greatest number of grouse observed on a single day for each complex for each year. This technique is well established for greater sage-grouse (*Centrocercus urophasianus*) but may have biases. Despite potential biases, lek counts provide an assessment of a population's long-term trend (Connelly et al. 2004). The population size was estimated by doubling the counts of grouse on lek complexes to account for undetected females, which typically visit leks only once so are rarely counted. We estimated annual rates of population change by comparing total number of grouse counted at lek complexes in consecutive years [$(CNT_t - CNT_{t-1})/CNT_{t-1}$]. Annual instantaneous rates of change for each population were estimated as the natural logs of the number of grouse counted on leks in one year divided by the number of grouse counted on the same leks the previous year. Sampling was occasionally affected by effort and/or size and accessibility of leks. If a lek complex was not counted in a given year the count was estimated as the rate of change between counts evenly distributed across the intervening year/s. For example, if a lek complex was not counted in year t then counted the following year (t+1) then we'd estimate the count for the missing year as $CNT_t = CNT_{t-1}*(CNT_{t+1}/CNT_{t-1})^{1/2}$.

Translocations and research

Translocations were conducted following a four-stage process: 1) consideration of release sites; 2) consideration of source populations; 3) conducting the actual capture and translocation; and 4) monitoring and evaluation of results (Griffith et al. 1989, Reese and Connelly 1997). Release sites (stage 1) were selected based on their historical or current occupancy. The historical presence of sharp-tailed grouse throughout most of eastern Washington has been well established (Yocom 1952, Aldrich 1963). The current distribution of sharp-tailed grouse has also been documented with the aid of extensive statewide surveys (Hays et al. 1998, Schroeder et al. 2000). The grouse population has declined substantially from 50 years ago, but appears to have become somewhat stable in the last 25 years. Genetic diversity and allelic richness are significantly lower in Washington than in populations in Utah, Idaho, and British Columbia (Warheit and Schroeder 2003). Some of this lack of genetic diversity appears to be due to the small size and isolation of populations in Washington relative to other occupied areas.

Because of the declines in sharp-tailed grouse populations throughout Washington and the isolation and small size of the remaining populations, several locations were considered for translocation efforts. Six sites were identified based upon assessments of their size, habitat quality, and management potential (Fig. 1): Scotch Creek (northwest of Omak in Okanogan County), Dyer Hill (south of Brewster in Douglas County); Swanson Lakes (southeast of Wilbur in Lincoln County); Nespelem (east of Nespelem in Okanogan County); Greenaway Spring (southeast of Okanogan in Okanogan County), and Tunk Valley (northeast of Omak in Okanogan County). Four of the release sites are on or adjacent to state and federally-owned public land and the other sites are CTCR land; all are being managed for the benefit of wildlife. The Dyer Hill site also was recommended by McDonald and Reese (1998) as the primary target for improvements in the statewide sharp-tailed grouse population. All of the release sites are recommended in the statewide recovery plan for sharp-tailed grouse (Fig. 2, Stinson and Schroeder 2012).

Why have populations of sharp-tailed grouse been reduced or eliminated on the prospective release sites and has subsequent management adequately addressed the explanations for previous declines? The cause of observed declines in sharp-tailed grouse populations can be split into three major categories: degradation of quantity and quality of habitat (e.g. conversion for ag, wildfires, invasive annual grass, etc), increases in densities of generalist predators such as common ravens (*Corvus corax*), great-horned owls (*Bubo virginianus*), and coyotes (*Canis latrans*), and isolation of remnant populations due to the lack of dispersal corridors between adjacent populations. The three causes of declines are relevant in all of Washington's populations to various degerees and they also interact with each other. Some of the causes for the declines have been directly addressed with management activities. The primary emphasis of WDFW and partners has been habitat protection and restoration, which has been conducted at all the potential release sites. These sharp-tailed grouse-focused activities include replacement of poor-quality non-native grass/forb habitats with native shrubsteppe vegetation for spring and summer habitat and establishment of shrubs and trees necessary for improvement of wintering habitat. CRP also has resulted in the conversion of large areas of cropland to potential sharp-tailed grouse habitat since the late 1980's. Although a significant amount of habitat work has been done, there is still more to do and all partners are actively restoring or improving habitat (e.g. habitat restoration post wildfire). However, because some of the remaining populations have endured severe 'bottlenecks' in abundance, we believe some of these populations have lost some of their intrinsic ability to respond positively to habitat improvements due to their reduced genetic diversity (Westemeier et al. 1998, Bellinger et al. 2003, Johnson et al. 2003). Augmentations have potential to address this issue (IUCN/SSC 2013).

Source populations (stage 2) were considered for translocations. The sharp-tailed grouse is currently divided into six extant subspecies (modified from Aldrich 1963, Fig. 3). Sharp-tailed grouse in Washington are within the Columbian subspecies range; this subspecies is distinguishable by its grayer color, smaller size, and shrubsteppe and mountain shrub habitat. Taxonomic differentiation of subspecies has been somewhat arbitrary and ambiguous. Recent genetic analyses indicate that sharp-tailed grouse in Utah, British Columbia, Idaho, and Washington are more similar to each other than to any other region (Warheit and Schroeder 2003, Spaulding et al. 2006). Any population within these areas appears to be a genetically appropriate source population for translocation into Washington.

Sharp-tailed grouse are generally captured for translocation (stage 3) during the spring breeding period (first three weeks of April) with the aid of walk-in traps on leks (Schroeder and Braun 1991). All birds are weighed, measured, and banded with unique numbered bands. All birds destined for translocation received a health certificate from a veterinarian accredited within the donor state or province. The U.S. Department of Agriculture maintains a disease list for which all translocated birds are screened. Majority of birds are fitted with necklace-mounted, battery-powered radio or GPS transmitters to allow monitoring post release. In addition, sex and age are determined (Henderson et al. 1967, Caldwell 1980) and feather samples are collected for subsequent genetic testing. Birds are transported by car in an individual box or a portion of a box that is small enough to contain the bird's movement. The bottom of each box is lined with absorbent material to reduce contact between feces and the birds' feet.

Prior to 2008, birds were released directly from boxes. Starting in 2008, birds have been held in settling boxes for a minimum of about 15 minutes prior to release, using a box design modified from those described by Musil (1989). This allows small groups of birds to be held and released together when the box was opened with a cord from a blind to minimize stress during release. All birds are released on an active lek in the target location prior to darkness the same day they were captured, or the following morning.

Monitoring and evaluation (stage 4) are conducted with the aid of lek surveys, genetics from feather samples taken on leks and translocated individuals, and monitoring of GPS and VHF marked individuals. Sharp-tailed grouse are located visually or by triangulation with the aid of portable receivers and 3-element Yagi antennas. Disturbance of birds, particularly at nest sites, is avoided. Fixed-wing aircraft are used to locate lost birds on an as needed basis. GPS data are transmitted via satellite or cellular networks. The specific objectives for monitoring individuals include examinations of movement, habitat and landscape use, productivity, and survival. These evaluations provide essential information to determine whether additional translocations, habitat improvements, release locations, and/or translocation methodologies are necessary (Toepfer et al. 1990, IUCN/SSC 2013).

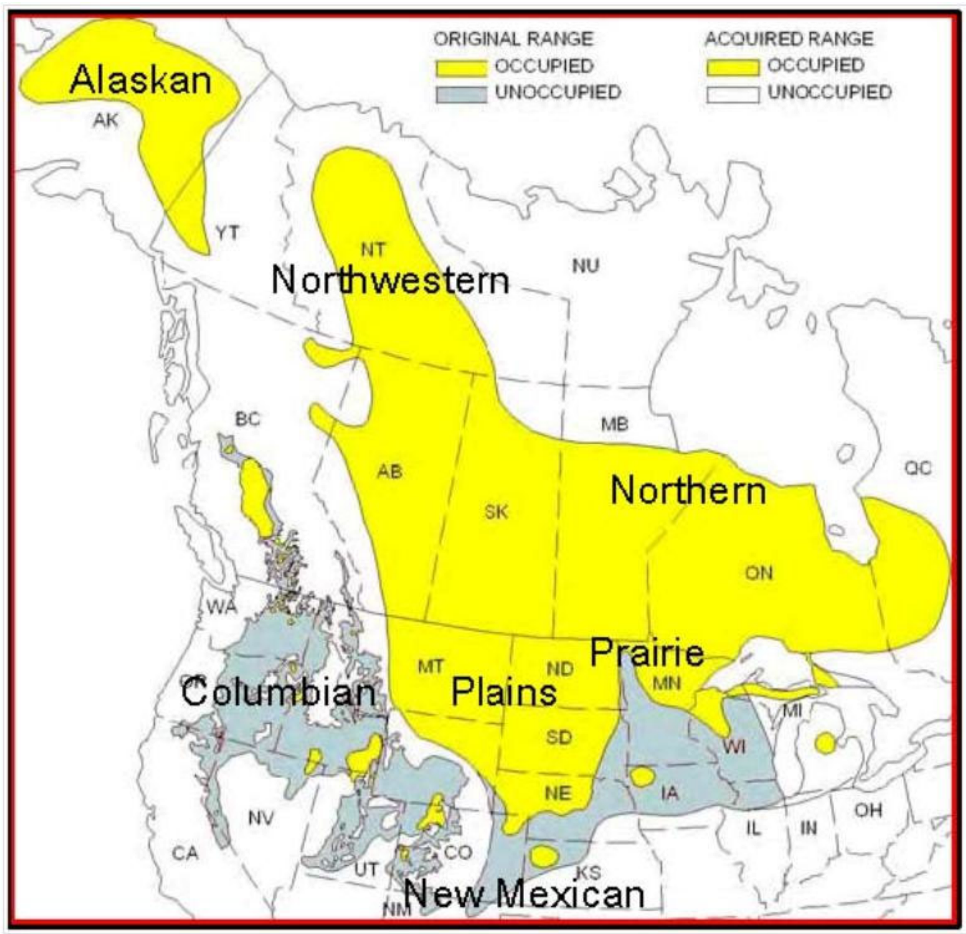

Fig. 3. Distribution of sharp-tailed grouse subspecies in North America (modified from Aldrich 1963).

RESULTS AND DISCUSSION

Inventory and monitoring

The total population estimate for sharp-tailed grouse in Washington was 410 in 2023 (Table 1, Fig. 4). This represents a 24% decline from last year and a 51% decline from 2020. During the last 50 years a total of 138 lek complexes have been documented; currently only 31 are active (22%). The average annual rate of population change (instantaneous) since grouse were first monitored in 1954 was -5.3%. Most of the subpopulations studied (Table 1), except for the Methow declined 2% to 10% annually during the same period. One population (Methow) was extirpated in 1982. The size of the remaining subpopulations varies from 12 at Chesaw to 104 at Big Bend and Nespelem.

Table 1. Population characteristics for sharp-tailed grouse in Washington State (see Figs. 1 and 2 for locations).

Population	Active leks (% of total)	Total leks	2023 population estimate (% change)	Average annual rate of change (1st year monitored)
Tunk Valley	6 (46.2%)	13	64 (-11.1%)	-3.5% (1954)
Greenaway Spring[a]	1 (8.3%)	12	18 (-43.8%)	-10.2% (1970)
Chesaw	1 (16.7%)	6	12 (-45.5%)	-8.8% (1989)
Scotch Creek	2 (14.3%)	14	28 (-48.1%)	-5.8% (1954)
Dyer Hill	3 (17.6%)	17	42 (-40%)	-3.9% (1970)
Big Bend[b]	7 (35.0%)	20	104 (2.0%)	-5.1% (1970)
Nespelem	7 (33.3%)	21	96 (-25.7%)	-2.8% (1979)
Swanson Lakes[c]	4 (12.9%)	31	46 (15.0%)	-7.2% (1959)
Methow[d]	0 (0.0%)	4	0 (0.0%)	-31.4 (1974)
All populations combined	31 (22.5%)	138	410 (-24.0%)	-5.2% (1954)

[a]Greenaway Spring includes the Haley Creek area (Fig. 1).

[b]The Big Bend population is listed as a separate population here, even though it is shown as the Douglas County portion of the Nespelem population in Fig. 1.

[c]The current Swanson Lakes population is entirely found in the Swanson Lakes Recovery Unit (Fig. 2), but the historical area referenced here includes Lincoln and Spokane counties.

[d]The Methow population was last known to be active in 1981.

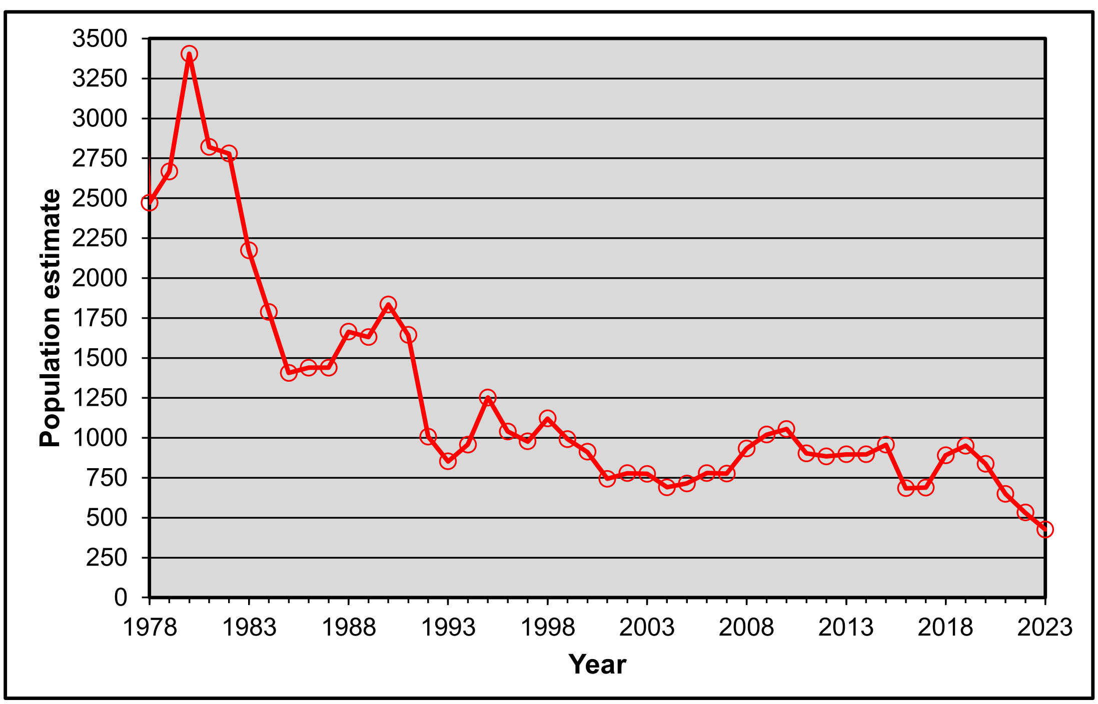

Fig. 4. Population estimates for sharp-tailed grouse in Washington State.

Wildfire was the most significant issue for sharp-tailed grouse in Washington in the last decade. The wildfires of 2020 had a greater impact on sharp-tailed grouse habitat in Washington State than any other wildfires in recorded history. The 164,000 ha Cold Springs Canyon/Pearl Hill wildfire was the largest wildfire in Washington State history. This wildfire impacted 8 of 9 known leks in the Dyer Hill population and 1 of 2 leks in the Greenaway Spring population. The Whitney fire, about 50,000 ha, impacted all recently active leks in the Swanson Lakes population. The smaller 600 ha Green wildfire impacted 1 lek in the Tunk Valley, reburning habitat that was burned in the 2015 Okanogan complex fire. The 806 ha Anglin Fire plus another small unnamed wildfire in the Siwash Creek area burned habitat and a historic lek complex last active in 2014. In 2021 the Chuweah Creek wildfire burned habitat supporting 3 leks in the Nespelem population. Previous wildfires in 2012 and 2015 also had an impact but were smaller in size and number of leks impacted.

Twenty-seven leks that were directly impacted by wildfires declined from an average lek attendance of 11.1 (SD = 1.5) birds prior to the fire to 2.1 (SD = 0.7) birds the year after the fire (80.9% decline). In contrast, attendance at 46 leks that were unaffected by fires was 9.4 birds (SD = 1.0) prior to the fire and 9.0 birds (SD = 1.0) after the fire (4.1% decline).

Translocations and research

A total of 600 sharp-tailed grouse have been translocated to key populations in Washington State since 1998, including 40 grouse in 2023 (Appendix A). Most of the grouse came from Idaho, but smaller numbers were translocated from Utah, British Columbia, and within Washington. When the results for translocations to Dyer Hill, Swanson Lakes, and Scotch Creek were combined into a single analysis they showed that translocations had a positive effect on estimates of population size, even after translocations ended (Fig. 5). One issue that has not been addressed in this analysis is the interaction between past translocations and the more recent wildfire.

Experimental translocations in 1998, 1999, and 2000 were successful in augmenting the Scotch Creek population of sharp-tailed grouse, located on the 9,700 ha Scotch Creek Wildlife Area, northwest of Omak. Birds for this translocation were obtained from the Rockland area in southeastern Idaho (26 males and 25 females) and the Colville Confederated Tribal Reservation in Washington (6 males and 6 females, Appendix A). Prior to the translocation, surveys indicated that the Scotch Creek population had declined to 1 lek with 2 displaying males. This population increased after the translocation. The population was set back in 2016 as a result of the Okanogan complex wildfire in summer 2015, but it appears to have recovered somewhat, helped by habitat restoration and translocations of 39 grouse (32 males and 27 females) from British Columbia in 2019, 2022, and 2023 (Appendix A, B).

During 1999–2008, 64 sharp-tailed grouse (35 males and 29 females) were translocated from Nespelem, Washington, south-central British Columbia, southeastern Idaho, and north-central Utah to the Dyer Hill area (Appendix A). The population fluctuated in the years following translocation, but dramatically peaked in 2019 at a level higher than ever recorded (126 birds observed on 7 leks). The population increase was not entirely surprising following the observation of a single flock of 54 grouse the winter prior (2017/2018). This was the largest flock observed in Douglas County in the last 50 years. It isn't clear if these observations were a result of the translocations, at least in part, or if they were due to other management activities such as CRP/SAFE and restoration of riparian areas. Direct observations and remote cameras have confirmed that grouse are feeding in planted water birch in winter. Dyer Hill encompasses the Central Ferry Canyon, West Foster Creek, and Bridgeport Wildlife Areas in Douglas County. These state-owned areas include approximately 3,800 ha of potential sharp-tailed grouse habitat within a matrix of tens of thousands of additional hectares of private land, also with potential to support sharp-tailed grouse. Despite these gains, the wildfires of 2020 impacted most of the known leks in the area resulting in dramatic declines (16 birds observed on same 7 leks in 2021 where 126 birds were observed in 2019). Previously restored habitat, typically in old ag fields with deeper soils, is recovering well, but the 2021 drought has slowed this recovery. Work is also currently underway to restore those areas in need.

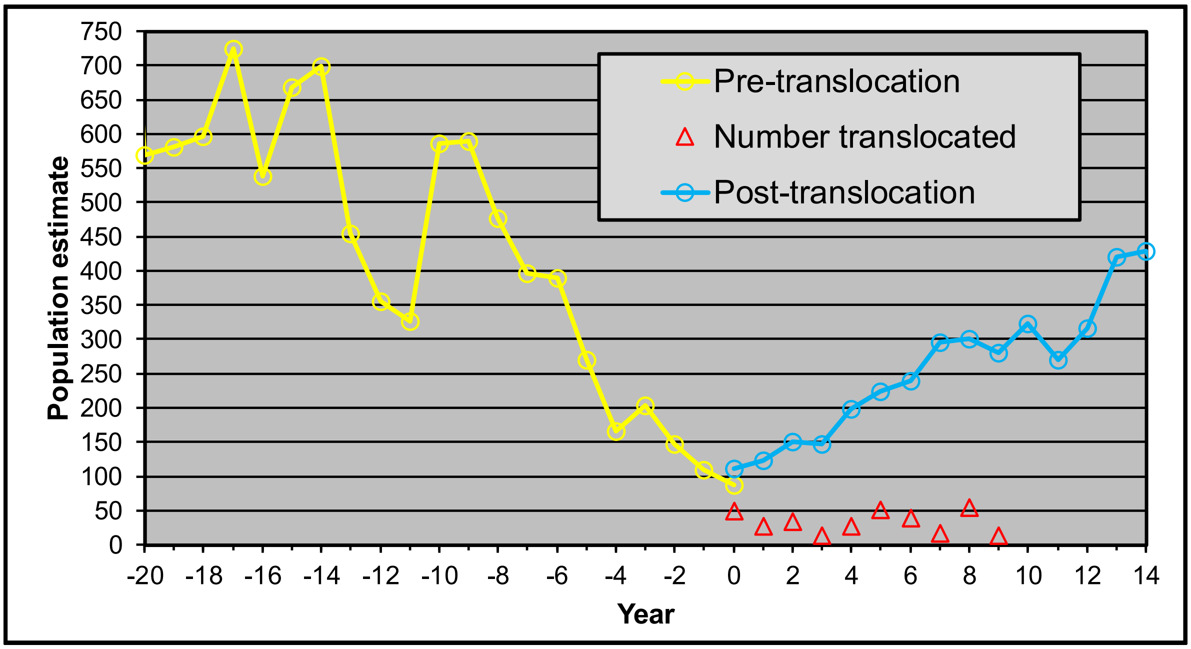

Fig. 5. Population estimate for combined populations (Dyer Hill, Swanson Lakes, and Scotch Creek) of sharp-tailed grouse prior to, and after initiation of translocations in Washington State. The annual rates of population change are centered at year zero (1st year of translocation) for each target population.

During 2005–2013, 203 sharp-tailed grouse (113 males and 92 females) were translocated from south-central British Columbia, southeastern Idaho, and north-central Utah (Appendix A) to the Swanson Lakes population. The population fluctuated in the years following translocation, but was consistently higher than it was prior to translocation, up until the 2020 Whitney fire. The translocated birds in the Swanson Lakes area have been the focus of sharp-tailed grouse research in Washington State (Stonehouse 2013, Stonehouse et al. 2015). This research included examinations of movement, habitat use, productivity, and survival. The basis for this research was approximately 5000 telemetry locations for 184 individual grouse. The Swanson Lakes Wildlife Area includes about 8100 ha, with an additional ~500 ha lease of Washington Department of Natural Resources land (Fig. 10). In addition, the BLM has purchased several properties adjacent to the wildlife area, providing an opportunity to secure connectivity of habitats among various agencies. BLM Twin Lakes Recreation Area is 6,200 ha located approximately 26 km southwest of Davenport in central Lincoln County and is immediately adjacent to Swanson Lakes Wildlife Area. BLM's Coffeepot Lake property is 400 ha located 19 km west of Harrington in Lincoln County. BLM's Lakeview Ranch is 5100 ha located approximately 9 km north of the town of Odessa in southwest Lincoln County. Management of all these areas has focused on supporting wildlife habitat, conservative seasonal livestock grazing, and wildlife-based recreational opportunities. Similar to the Dyer Hill population, all known leks were impacted by the wildfires of 2020, resulting in a dramatic impact in grouse numbers. As noted above restored habitat in old ag fields with deeper soils is recovering well, but was slowed due to the 2021 drought. Work is also underway planting water birch and other winter habitat and restoring those grassland areas that do not appear to be recovering on their own.

During 2018–2023, 72 grouse (34 males and 38 females) were translocated from an area near 70-Mile House, British Columbia (Appendix A, B) to the Tunk Valley population (Appendix A). Most were released on a private ranch in the Tunk Valley close to the 566 ha Tunk Valley Unit of the Scotch Creek Wildlife Area about 12 miles northeast of Omak. A declining population (Table 1, total estimate of 27 birds in 2017) and a desire to maintain/improve connectivity between the Tunk Valley and adjacent populations (Chesaw, Scotch Creek, and Greenaway Spring) led to a need to augment the population with grouse from a healthy population. In 2021 the CTCR acquired 9,243 acres of occupied sharp-tailed grouse habitat within the Tunk Valley Recovery Unit, thus affording more opportunities for future management.

Translocations have been conducted in other populations including Nespelem (73 males and 40 females during 2005–2012 and 2022) and Greenaway Spring (16 males and 1 female in 2005 and 2011, Appendix A). Both of these were on land managed by the CTCR, which also carries out post-translocation monitoring. Lek data shared by the tribe indicate results similar to other translocations. The Greenaway Spring area is particularly important for connectivity among sharp-tailed grouse leks throughout the state of Washington due to its centrality (Robb and Schroeder 2012). Movements of radio-marked birds have been detected between Greenaway Spring and Dyer Hill, Scotch Creek, and Nespelem.

PLANS FOR 2024

Routine monitoring of all known sharp-tailed grouse populations and searches for new leks will continue in 2024, with additional focus on searches in those areas impacted by the 2020 wildfires. In addition to increased population monitoring within the 2020 wildfires, there will be continued monitoring of the habitat, management of weeds, and where needed, full restoration of grasslands and riparian areas. There is an ongoing field trial of herbicide treatments at the Swanson Lakes Wildlife Area, with a particular focus on invasive annual grass control in rangelands where traditional restoration methods are not viable due to shallow rocky soil limiting the type of equipment that can be used. Additionally, there is ongoing work to incorporate wildlife needs in the rebuilding of infrastructure lost in the fire. For example, rebuilding lost fences with wildlife friendly versions or where able, with virtual fencing.

The Dyer Hill and Swanson Lakes populations were hit extremely hard by wildfires in 2020 and though we are seeing recovery of habitat, especially in the restored ag fields, we are still seeing a decline in the Dyer Hill population and only a small increase in the Swanson Lakes population.

We believe the populations in both areas have declined to such a level that augmentation is likely needed to allow them to take advantage of the habitat as it recovers. Given the spatial extent of the fires there are no population sources within or nearby to provide this augmentation naturally. Therefore, we are proposing to apply to British Columbia for another round of translocations, to augment both of these populations. Some of these efforts have been incorporated into the Washington Shrub-Steppe Restoration and Resiliency Initiative (WSRRI), which is a collaborative effort dedicated to conserving the state's shrubsteppe wildlife and habitat in the face of increasing threats from wildfire, climate change and other stressors.

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Appendix A. Number of sharp tailed-grouse translocated to populations in Washington, 1998–2023.

Target populations	Translocation year (always in April)	Source populations										
		SE Idaho		Nespelem, Washington		South-central British Columbia		North-central Utah		Total		
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total
Scotch Creek	1998	13	12	0	0	0	0	0	0	13	12	25
	1999	3	3	6	6	0	0	0	0	9	9	18
	2000	10	10	0	0	0	0	0	0	10	10	20
	2019	0	0	0	0	12	7	0	0	12	7	19
	2022	0	0	0	0	10	10	0	0	10	10	20
	2023	0	0	0	0	10	10	0	0	10	10	20
Dyer Hill	1999	3	2	0	0	0	0	0	0	3	2	5
	2005	5	3	0	0	7	5	0	0	12	8	20
	2006	0	0	0	0	0	0	5	5	5	5	10
	2007	1	0	0	0	0	0	7	7	8	7	15
	2008	6	5	0	0	0	0	1	2	7	7	14
Greenaway Spring	2005	0	0	0	0	5	1	0	0	5	1	6
	2011	11	0	0	0	0	0	0	0	11	0	11
Nespelem	2005	0	0	0	0	9	4	0	0	9	4	13
	2006	0	0	0	0	0	0	5	4	5	4	9
	2007	6	1	0	0	0	0	2	3	8	4	12
	2008	0	0	0	0	0	0	7	7	7	7	14
	2009	5	5	0	0	0	0	0	0	5	5	10
	2011	9	0	0	0	0	0	0	0	9	0	9
	2012	20	6	0	0	0	0	0	0	20	6	26
	2022	0	0	0	0	10	10[a]	0	0	10	10	20
Swanson Lakes	2005	7	5	0	0	5	3	0	0	12	8	20
	2006	0	0	0	0	0	0	5	5	5	5	10
	2007	0	2	0	0	0	0	8	4	8	6	14
	2008	4	5	0	0	0	0	3	2	7	7	14
	2009	15	15[b]	0	0	0	0	0	0	15	15	30
	2010	31	20	0	0	0	0	0	0	31	20	51
	2011	10	10	0	0	0	0	0	0	10	10	20
	2012	5	2	0	0	0	0	0	0	5	2	7
	2013	20	19	0	0	0	0	0	0	20	19	39
Tunk Valley	2018	0	0	0	0	20[c]	20[c]	0	0	20	20	40
	2019	0	0	0	0	7	12	0	0	7	12	19
	2023	0	0	0	0	10	10	0	0	10	10	10
Total		184	125	6	6	105	92	43	39	338	262	600

[a]*Includes 2 birds that died the day after release, likely capture myopathy.*

[b]*Includes 2 birds escaped their transport box during transit and were later euthanized due to injuries.*

[c]*Includes 7 birds (3 males and 4 females) that died from hyperthermia and stress during transit.*

Appendix B. Detailed information on the 2018–2023 BC surveys and translocations.

The British Columbia source population was in an area dominated by large-scale clearcuts. When mature, the forest habitat is generally dominated by lodgepole pine (*Pinus contorta*). When cut, pinegrass (*Calamagrostis rubescens*) and numerous species of shrubs dominate for a limited number of years. Sharp-tailed grouse numbers appear to peak in the clearcuts about five years post-clearcut; this appears to be characterized by an optimal cover of grass, while replacement trees are still very small. Another factor appears to be the size of the clearcut. Preliminary observations suggest that attendance at leks is proportional to the size of the clearcut; clearcuts < 100 ha in size appear unlikely to support leks. Although surveys are not complete, it seems that the time from timber harvest leading to colonization by sharp-tailed grouse to the disappearance of sharp-tailed grouse from the regenerating unit may be about 20 years (Table B1). Another factor that appears to play a role in British Columbia is wildfire. Large fires in 2017 and 2021 appeared to have a negative impact on grouse populations in the short term, but a positive impact on populations by about 4–5 years post-fire. Virtually all the new leks discovered in 2022 and 2023 (Table B1) were in the perimeter of the 191,865 ha Elephant Hill fire east of 70 Mile House. In contrast, the 74,184 ha Flat Lake fire west of 70 Mile House in 2021 adversely impacted lek counts in 2022 within the burn perimeter (Table B1).

In 2018, six leks in British Columbia were used for trapping and translocation including Cunningham 4, Cunningham 6, East Twin Creek 1, Little White Lake 2, Loch Lomond Trail, and Raphael (Table B1). Thirty-three birds (17 males and 16 females) were captured and successfully translocated to the Tunk Valley during 23–27 April 2018. In 2019, seven leks in British Columbia were used for trapping and translocation including Cunningham 4, Cunninghamd 6, Little White Lake 2, McKinley Lake, Copper Johnny Creek, Hanging Tree 2, and Hanging Tree 3 (Table B1). Thirty-six birds (17 males and 19 females) were captured and successfully translocated to both the Tunk Valley and Scotch Creek during 16–25 April 2019. In 2022, seven leks in British Columbia were used for trapping and translocation including Cunningham 7, East Twin Creek 2, East Twin Creek 3, Dougherty Lake 1, Hutchinson Creek 1, Hutchinson Creek 2, and Hutchinson Creek 5 (Table B1). Thirty-eight birds (20 males and 18 females) were successfully translocated to Scotch Creek and Nespelem during 19–27 April 2022. In 2023, eight leks in British Columbia were used for trapping and translocation including Nine to Five, Badello Lake 1, Campeau, East Twin Creek 2, East Twin Creek 3, Goshawk, Hutchinson Creek 2, and Young Lake (Table B1). Forty birds (20 males and 20 females) were captured and successfully translocated to both the Tunk Valley and Scotch Creek during 17–25 April 2023.

The combined attendance at the trapping leks was 133, 113, 166, and 195 grouse in 2018, 2019, 2022, and 2023 respectively. Observations suggested that at least 80% of the observed birds were males. If the sex ratio is equal then the the estimated number of birds associated with the trapping leks was 971 for the 4 years combined. This means that the number of birds translocated (including those that died during the translocation process) was about 15% of the birds associated with the trapping leks. If we look at all leks counted it drops to only 8% of the known leks in the population.Issues with translocations in 2018 (7 birds died during translocation) were addressed in 2019, 2022, and 2023. Even so, two males died during transport in 2019, both appeared to be adversely impacted by being captured simultaneously in the same trap. Two females died in 2022 the day after being released; we assume this was associated with stress from capture. All surviving birds were translocated and released on the same day they were captured in 2018, 2019, and 2023 or the next morning in 2022. Birds were released the following morning in 2022 due to High Path Avian Influenza testing requirements and the closure of the Oroville APHIS Veterinarian Services office necessitating a Sumas boarder crossing which increased transport time.

Table B1. Sharp-tailed grouse lek counts for central British Columbia ("1+" refers to active leks with no count of birds. Leks highlighted in yellow were used for trapping in the respective years.

Region	Lek Name	Type	2002	2004	2005	2012	2013	2017	2018	2019	2022	2023
Alexis Creek	Chilko River 1	Clearcut		6								
Alexis Creek	Chilko River 2	Clearcut		10								
Alexis Creek	Chilko River 3	Clearcut		10								
Alexis Creek	Chilko River 4	Clearcut		20								
Alexis Creek	Chilko River 5	Clearcut		16								
Alexis Creek	Chilko River 6	Clearcut		6								
Alexis Creek	Chilko River 7	Clearcut		10								
Alexis Creek	Mount Alexis 1	Clearcut		3								
Alexis Creek	Mount Alexis 2	Clearcut		12								
Alexis Creek	Mount Alexis 3	Clearcut		6								
Riske Creek	Barnes Lake	Grassland	1+									
Riske Creek	Doc English	Grassland	1+									
Riske Creek	Ferguson Ridge 1	Grassland										
Riske Creek	Ferguson Ridge 2	Grassland										
Riske Creek	Junction Area 1	Grassland	1+									
Riske Creek	Junction Area 2	Grassland	1+									
Riske Creek	Junction WMA	Grassland	1+									
Riske Creek	Leeches Lake	Grassland	1+									
Riske Creek	Litaco Road	Grassland	1+									
Riske Creek	Loran Creek	Grassland	1+									
Riske Creek	Lye Lake	Grassland	1+									
Riske Creek	Raven Lake	Grassland	1+									
Riske Creek	Raven Lake Road	Clearcut	15									
Riske Creek	Sword Creek	Grassland	1+									
Riske Creek	Taharti Lake 1	Clearcut	40									
Riske Creek	Taharti Lake 2	Clearcut	40									
70 Mile House	Nine to Five	Clearcut										23
70 Mile House	Augustine Flat 1	Clearcut		53	30		17	4			0	
70 Mile House	Augustine Flat 2	Clearcut			3							
70 Mile House	Augustine Flat N	Clearcut		19	12			0				
70 Mile House	Bandello Lake 1	Clearcut									21	17
70 Mile House	Bandello Lake 2	Clearcut									23	

Region	Lek Name	Type	2002	2004	2005	2012	2013	2017	2018	2019	2022	2023
70 Mile House	Beaverdam Lake 1	Clearcut	1+									
70 Mile House	Beaverdam Lake 2	Clearcut							4			
70 Mile House	Campeau	Clearcut										28
70 Mile House	Clink Lake	Clearcut	1+		25			0				
70 Mile House	Copper Johnny Creek	Clearcut								21	2[a]	12
70 Mile House	Cunningham Lake 1	Clearcut	1+									
70 Mile House	Cunningham Lake 2	Clearcut		1+								
70 Mile House	Cunningham Lake 3	Clearcut					7	4			0	
70 Mile House	Cunningham Lake 4	Clearcut					28	36	20	16	1[a]	
70 Mile House	Cunningham Lake 5	Clearcut						15	11	5	0	
70 Mile House	Cunningham Lake 6	Clearcut							20	15	0	
70 Mile House	Cunningham Lake 7	Clearcut									17	
70 Mile House	Dougherty Lake 1	Clearcut									45	19
70 Mile House	Dougherty Lake 2	Clearcut									28	
70 Mile House	Dougherty Lake 3	Clearcut									6	
70 Mile House	Dougherty Lake 4	Clearcut										27
70 Mile House	East Twin Creek 1	Clearcut					8	21	22	6	0	0
70 Mile House	East Twin Creek 2	Clearcut									30	41
70 Mile House	East Twin Creek 3	Clearcut									21	30
70 Mile House	Foxtail Flat	Clearcut						6				2
70 Mile House	Goodenough Lake	Clearcut			20			0				
70 Mile House	Goshawk	Clearcut										19
70 Mile House	Hanging Tree 1	Clearcut			16			0				0
70 Mile House	Hanging Tree 2	Clearcut						17		15	0[a]	0
70 Mile House	Hanging Tree 3	Clearcut						11		15	0[a]	0
70 Mile House	Hanging Tree 4	Clearcut								5		
70 Mile House	Hanging Tree 5	Clearcut										1+
70 Mile House	Hanging Tree NW	Clearcut	1+								0	
70 Mile House	Hihium Lake	Grassland										33
70 Mile House	Holden 1	Clearcut		3								
70 Mile House	Holden 2	Clearcut					7					
70 Mile House	Holden 3	Clearcut		7								
70 Mile House	Holden 4	Clearcut		17								
70 Mile House	Hutchinson Creek 1	Clearcut									9	12

Region	Lek Name	Type	2002	2004	2005	2012	2013	2017	2018	2019	2022	2023
70 Mile House	Hutchinson Creek 2	Clearcut									23	18
70 Mile House	Hutchinson Creek 3	Clearcut									16	
70 Mile House	Hutchinson Creek 4	Clearcut									37	
70 Mile House	Hutchinson Creek 5	Clearcut									21	13
70 Mile House	Hutchinson Creek 6	Clearcut									5	2
70 Mile House	Hutchinson Creek 7	Clearcut									8	12
70 Mile House	Hutchinson Creek 8	Clearcut										3
70 Mile House	Jim Lake	Clearcut									27	28
70 Mile House	Knife Lakes 1	Clearcut									8	
70 Mile House	Knife Lakes 2	Clearcut									13	
70 Mile House	Knife Lakes 3	Clearcut									12	
70 Mile House	Knife Lakes 4	Clearcut									6	
70 Mile House	Little Big Bar Lake	Clearcut			12			0				
70 Mile House	Little Big Bar Lake W	Clearcut			7							
70 Mile House	Little White Lake 1	Clearcut			14			0				
70 Mile House	Little White Lake 2	Clearcut					5	22	20	17	7	5
70 Mile House	Little White Lake 3	Clearcut						3				
70 Mile House	Little White Lake 4	Clearcut								2		
70 Mile House	Loch Lomond Trail	Clearcut					25	12	18	9	12	
70 Mile House	McKinley Lake	Clearcut								14	0[a]	2
70 Mile House	Mute Lake	Clearcut			30			0				
70 Mile House	Raphael	Clearcut					17	11	33	7	6	4
70 Mile House	Rayfield 1	Clearcut						3				
70 Mile House	Rayfield 2	Clearcut									5+	
70 Mile House	Snag Lake	Clearcut		5								
70 Mile House	Valenzuela Lake	Clearcut			14			0				
70 Mile House	Valenzuela Lake N	Clearcut	1+									
70 Mile House	West White Lake	Clearcut	1+									
70 Mile House	White Lake	Grassland	1+		12			0				
70 Mile House	Young Lake	Clearcut										19

[a]*These leks used for trapping in 2019 were within the perimeter of the 74,184 ha Flat Lake wildfire that burned in the summer of 2021.*