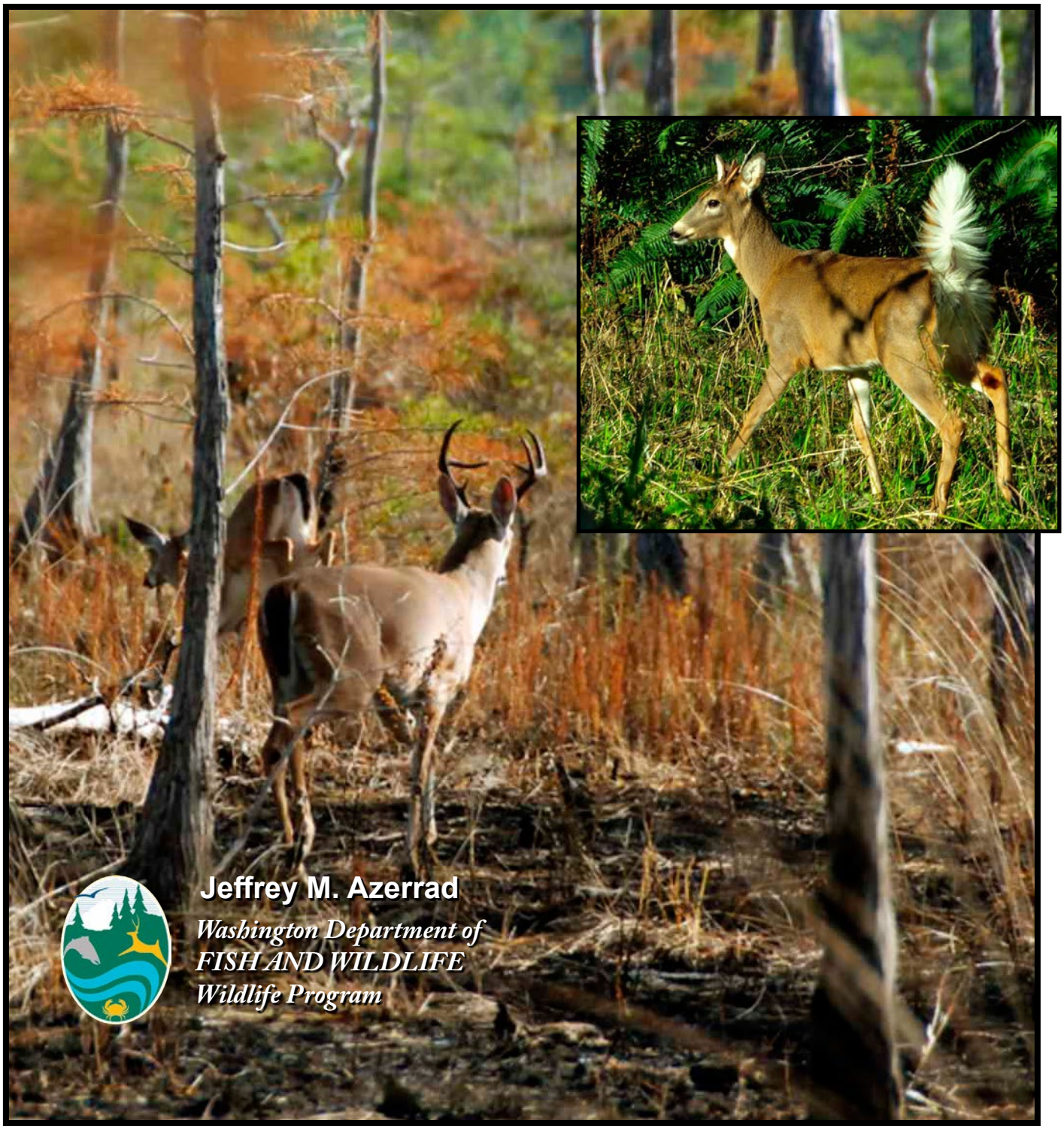
DRAFT

STATE OF WASHINGTON August 2022

Periodic Status Review for the Columbian White-tailed Deer



Jeffrey M. Azerrad

Washington Department of FISH AND WILDLIFE Wildlife Program

The Washington Department of Fish and Wildlife maintains a list of endangered, threatened, and sensitive species (Washington Administrative Codes 232-12-014 and 232-12-011). In 1990, the Washington Wildlife Commission adopted listing procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Code 232-12-297). The procedures include how species listings will be initiated, criteria for listing and delisting, a requirement for public review, the development of recovery or management plans, and the periodic review of listed species.

The Washington Department of Fish and Wildlife is directed to conduct reviews of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing by the Washington Fish and Wildlife Commission. The periodic status reviews are designed to include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification. The agency notifies the general public and specific parties who have expressed their interest to the Department of the periodic status review at least one year prior to the five-year period so that they may submit new scientific data to be included in the review. The agency notifies the public of its recommendation at least 30 days prior to presenting the findings to the Fish and Wildlife Commission. In addition, if the agency determines that new information suggests that the classification of a species should be changed from its present state, the agency prepares documents to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act.

This document is the Draft Periodic Status Review for the Columbian White-tailed Deer. It contains a review of information pertaining to the status of the species in Washington. It was reviewed by species experts and is available for a 90-day public comment period from 23 August - 21 November. All comments received will be considered during the preparation of the final periodic status review. The Department intends to present the results of this periodic status review to the Fish and Wildlife Commission at a meeting in December 2022.

Submit written comments on this document by 21 November 2022 via e-mail to TandEpubliccom@dfw.wa.gov, or by mail to:

Conservation Assessment Section Manager, Wildlife Program
Washington Department of Fish and Wildlife
P.O. Box 43141
Olympia, WA 98504-3141

This report should be cited as:

Azerrad, J. M. 2022. Draft Periodic status review for the Columbian White-tailed Deer in Washington. Washington Department of Fish and Wildlife, Olympia, Washington, 23+iii pp.

On the cover: photos of Columbian White-tailed Deer from USFWS.

This work was supported in part by personalized and endangered species license plates

DRAFT
Washington State Periodic Status Review for the Columbian White-tailed Deer

August 2022

Prepared by Jeffrey M. Azerrad
Wildlife Program, Diversity Division
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, Washington 98501-1091

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

Funding for this periodic status review came from Washington State background license plates for endangered wildlife and Washington State personalized license plates. Early review was provided by the following wildlife biologists in WDFW's Southwest Washington Region: Stefanie Bergh; Eric Holman; Sandra Jonker, Ph.D.; and Nicholle Stephens. Peer review comments were kindly provided by Alex Chmielewski; Melia DeVivo, Ph.D.; Juliette Fernandez; Kyle Garrison; Jon Heale; Kurt Licence; Paul Meyers; Toni Piaggio, Ph.D.; Jennifer Siani, Ph.D.; and Winston Smith, Ph.D.

Acronyms

AHD – Adenovirus Hemorrhagic Disease
BPA – Bonneville Power Administration
BTD – black-tailed deer
CAO – Critical Areas Ordinance
CLT – Columbia Land Trust
CRP – Columbia River Population of Columbian white-tailed deer
CSR – Columbia Stock Ranch
CWD – chronic wasting disease
CWTD – Columbian white-tail deer
DPS – Distinct Population Segment
EHD – Epizootic Hemorrhagic Disease
ESA – Endangered Species Act
FLIR – Forward-looking Infrared Videography
GMA – Growth Management Act
IDFG – Idaho Fish and Game
JBH – Julia Butler Hansen National Wildlife Refuge
LCFRB – Lower Columbia Fish Recovery Board
NWR – National Wildlife Refuge
ODFW – Oregon Department of Fish and Wildlife
PHS – Priority Habitats and Species
PSR – Periodic Status Review
RCW – Revised Code of Washington
RMZ – Riparian Management Zone
USFWS – U.S. Fish and Wildlife Service
WDFW – Washington Department of Fish and Wildlife
WSDOT – Washington Department of Transportation
WTD – white-tailed deer

EXECUTIVE SUMMARY

The Columbian white-tailed deer (*Odocoileus virginianus leucurus*) is a subspecies of white-tailed deer. Habitat loss and degradation as well as overhunting caused the species' range to significantly contract and their population numbers to decline. The subspecies exists in two isolated populations. The larger population occurs entirely in southwest Oregon, while the other is in southwest Washington and northwest Oregon along the lower Columbia River. The lower Columbia River deer population is the smaller of the two populations. Until recently this population was federally listed as endangered by the U.S. Fish and Wildlife Service (reclassified to threatened in 2016) and is currently a state endangered species in Washington.

Columbian white-tailed deer were listed at the federal level in 1970 and 1973, and by the State of Washington in 1980. Since 1980, the size of the lower Columbia River Columbian white-tailed deer population has fluctuated. Surveys conducted by U.S. Fish and Wildlife Service estimated a low of only 545 deer in 2002. The population is now substantially higher, with an estimated population of 1,296 deer in 2022.

Partners have helped this population increase through habitat protection and restoration, predator control, and translocations. These activities have increased productivity in occupied habitat and have expanded the range of the lower Columbia River Population. Translocations, particularly to Tenasillahe Island and more recently to Ridgefield National Wildlife Refuge, have also been greatly successful in creating new breeding subpopulations, although other translocations have been less successful.

A recent Columbian white-tailed deer population and habitat viability assessment shed light on this population's demography. The assessment concluded that the large, secure subpopulations around Ridgefield National Wildlife Refuge and Julia Butler Hansen Refuge for the Columbian White-tailed Deer are the most resilient of all subpopulations along the lower Columbia River. The assessment also showed a high potential for population growth around Ridgefield as well as a low overall risk of extinction in the next 50 years.

Compared to the other subpopulations, the viability assessment revealed low population growth potential and a greater risk of population decline in the centrally located subpopulations downriver of Longview, Washington. These subpopulations were also identified as a bottle neck to deer movement between the larger upriver and downriver subpopulations.

In our last periodic status review we stated our concerns about the vulnerability of occupied habitat to threats such as climate change, emerging diseases, and a lack of secure and functionally connected habitat. At that time, we were also uncertain about the viability of a newly established subpopulation at Ridgefield National Wildlife Refuge. Although the threats have not abated since then, we are no longer uncertain about the viability of the Ridgefield subpopulation given the encouraging projections of the viability assessment for this subpopulation. We are now much more confident that the deer at Ridgefield have established into a viable subpopulation with significant growth potential.

With this development, we believe the lower Columbia River Population no longer fits the definition of Endangered as it is no longer under "serious threat of extinction" (Washington Administrative Code 220-610-110). The Washington Department of Fish and Wildlife thus recommends reclassifying the Columbia River Population of Columbian white-tailed deer to Threatened.

INTRODUCTION

This publication focuses on the Lower Columbia River Population of Columbian white-tailed deer (CWTD) and is a review of information pertinent to this species' Washington State classification. It is not a comprehensive literature review for the species. It is an update to the 2016 Washington State Periodic Status Review for Columbian white-tailed deer (Azerrad 2016), as per WAC 220-610-110. A considerable amount of content from the 2016 periodic status review (PSR) is still relevant and updated in this PSR. This PSR also includes new content from recent survey, monitoring, and research efforts as well as a recommendation to reclassify the state status of the species due to increases in the subpopulation around Ridgefield.

DESCRIPTION AND LEGAL STATUS

The Columbian white-tailed deer (*Odocoileus virginianus leucurus*) is one of 38 recognized subspecies of white-tailed deer (*O. virginianus*; Smith 1991). Columbian white-tailed deer is considerably smaller than other white-tailed deer (WTD) in northern latitudes (Smith 1991, ODFW 1995). The CWTD is generally distinguishable from black-tailed deer (*O. hemionus*) by their longer brown tail (rather than black), smaller and lighter-colored metatarsal gland, and antler tines that arise from the main beam (Figure 1). The CWTD generally presents a red-brown coat in summer and a thicker, gray-colored coat in the fall, with distinct white rings around their eyes and just behind their nose (ODFW 1995).

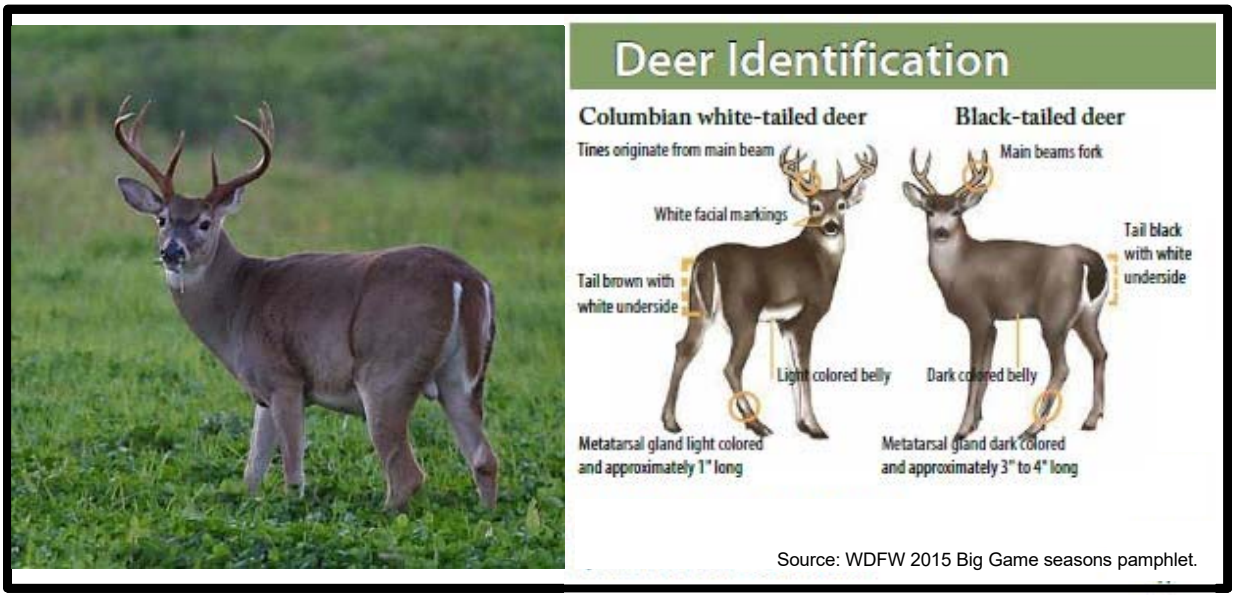


Figure 1. Columbian white-tailed deer: buck (left), and illustration (Right).

Columbian white-tailed deer were first federally listed as Endangered in 1970 under the Endangered Species Conservation Act of 1969 (USFWS 2013a). They were later designated Endangered under the Endangered Species Act (ESA) in 1973 (USFWS 2013a). A recovery team formed in 1974 was responsible for CWTD conservation and for drafting a recovery plan that was approved in 1976 (USFWS 1983). The Washington Department of Game designated CWTD a State Endangered Species in 1980. The U.S. Fish and Wildlife Service (USFWS) soon after published the Revised CWTD recovery plan (USFWS 1983), which set federal recovery goals for the lower Columbia River CWTD population.

In 2003, USFWS established two Distinct Population Segments (DPS) for CWTD (USFWS 2013a). One DPS, which is partially distributed in southwest Washington (hereafter referred to as the Columbia River Population or CRP), has not achieved recovery and is an ESA Threatened Species. The other DPS in Douglas County, Oregon, (hereafter referred to as the Roseburg Population) was recovered according to USFWS, resulting in its delisting in 2003. The Oregon Department of Fish and Wildlife (ODFW) removed both the Roseburg and CRP from their State Endangered Species List in 1995 (ODFW 2015). A limited number of controlled hunts have taken place in the Roseburg Population since 2006 (ODFW 2018). The USFWS reclassified the status of the CRP to a Threatened Species in November 2016 (USFWS 2016a).

DISTRIBUTION

An endemic species to the Pacific Northwest, CWTD are the westernmost subspecies of white-tailed deer (Smith 1991). The CRP is said to have originally occurred in both riparian and prairie habitat in the Columbia and Willamette River valleys of Washington and Oregon (Douglas 1829). They historically inhabited a contiguous area of Oregon and Washington roughly 60,000 square kilometers (km; 23,000 square miles) west of the crest of the Cascade Mountains (USFWS 2015; Figure 2). This range extended from Grants Pass in southern Oregon north to south Puget Sound. The Dalles, Oregon was the eastern extent of their historic range, while the western edge reached to nearly Astoria, Oregon (USFWS 2015).

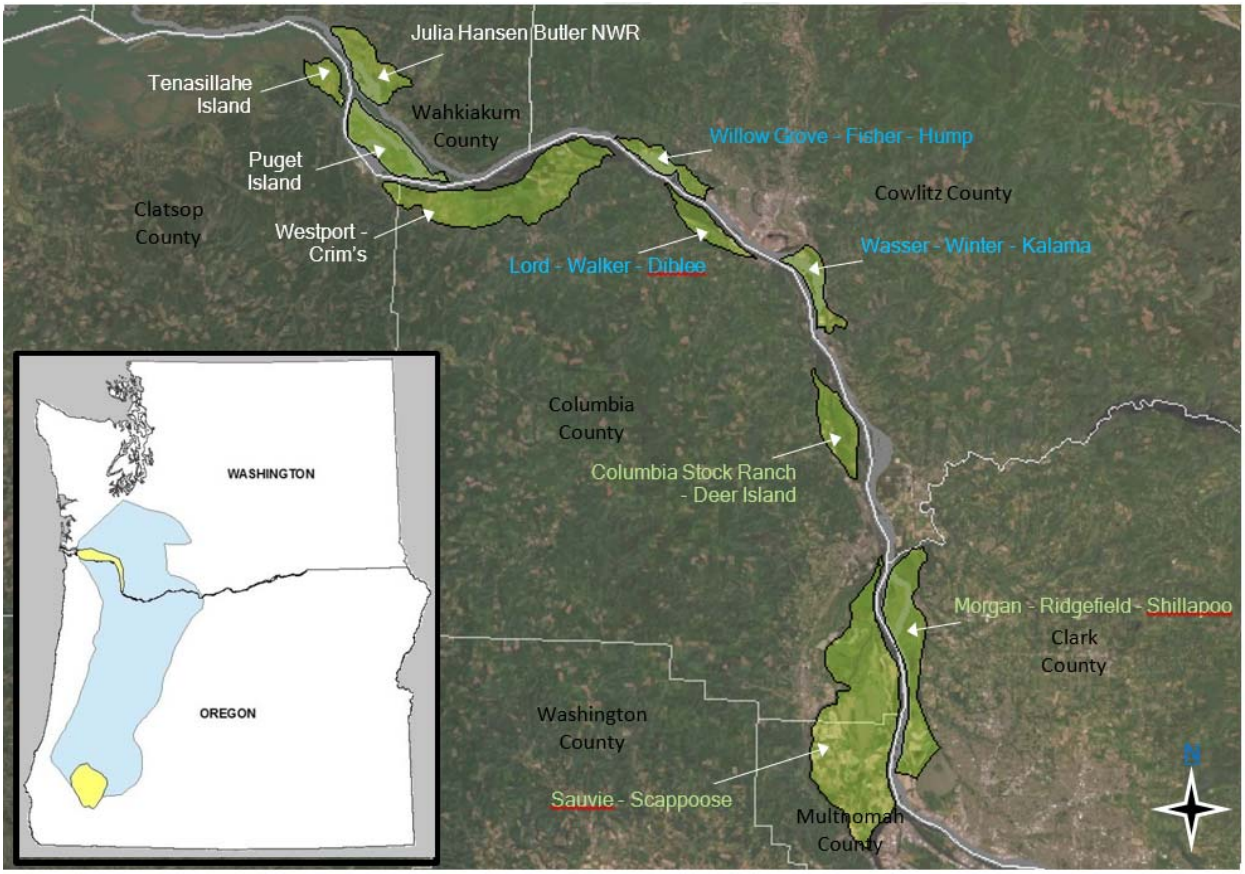


Figure 2. Ten recognized subpopulations occupied by CWTD along the Lower Columbia River divided into "A Group" in white text, "B Group" in blue text, and "C Group" in green text (Miller et al. 2020). Inset map is the CRP (top yellow) and the Roseburg.

The range contracted into two isolated populations (Smith 1985, USFWS 1983). The Roseburg Population encompasses about 800 square km (300 square miles) entirely in Douglas County, Oregon (USFWS 2003; Figure 2). The CRP covers about 240 square km (90 square miles) of mainland and island habitat along the Columbia River in Clatsop and Columbia counties in Oregon, and Cowlitz, Wahkiakum, and Clark counties in Washington (Smith 1985, USFWS 2015). Within that range CWTD occupy roughly 6,475 hectares (ha) or 16,000 acres (ac) of habitat in 10 distinct subpopulations fragmented by artificial (e.g., roads) and natural features such as river channels (USFWS 2013a, Miller et al. 2020; Table 1). Currently the most populous subpopulation is the Morgan-Ridgefield-Shillapoo subpopulation (hereafter referred to as the Ridgefield subpopulation) in Clark County. This is also the furthest upriver subpopulation along the Columbia River. The furthest downriver subpopulation is Tenasillahe Island in Clatsop County (Figure 2). Despite almost a half century of protection, range expansion for the CRP has occurred almost entirely by translocation (Meyers 2012a). The reason why the CRP cannot expand its range on its own is likely due to the lack of connectivity to unoccupied suitable habitat (LCFRB 2004).

Table 1. Subpopulation land area and percent of protected land area[1].

Site name	Components	Estimated acreage[2]	Estimated protected ownership [3]
Tenasillahe Island	Tenasillahe Island	1,950	100%
Julia Hansen Butler (JBH) National Wildlife Refuge (NWR)	Mainland JBH NWR; Price Island; Hunting Island; CLT Land; Elochoman Valley; Town of Cathlamet and surrounding areas	2,892	100%
Morgan / Ridgefield / Shillapoo	Morgan; Ridgefield NWR; Shillapoo plus neighboring CLT land; private land near Shillapoo	11,097	66%
Sauvie – Scappoose	Northern Sauvie; Southern Sauvie; Scappoose	10,280	28%
Puget Island	Puget Island; Little Island; Whites Island; Bradwood	5,840	19%
Columbia Stock Ranch – Deer	Columbia Stock Ranch; Deer Island (private land)	4,700	11%
Willow Grove – Fisher – Hump	Willow Grove; Fisher / Hump Islands; Longview Industrial	2,460	10%
Westport – Crim's	Westport/Karamanos; Marshland; Clatskanie; Crims Island	15,520	5%
Wasser – Winter – Kalama	Wasser – Winter; Cottonwood; Kalama	3,000	4%
Lord – Walker – Diblee	Lord Island; Walker Island; Dibblee	2,895	0%

NATURAL HISTORY

Habitat requirements. Columbian white-tailed deer historically preferred upland prairie edge/woodland habitat below the Douglas-fir (Pseudotsuga menziesii) zone (Bailey 1936; Douglas 1829; USFWS 2013a, 2015). Much of that habitat was lost to changing historical (e.g., secession of traditional Native American prairie-oak burning) and modern day (e.g., agriculture, forestry, urbanization) land-use practices (Smith 1981, Vesely and Rosenburg 2010, Hamman et al. 2011). This relegated the CRP to fragmented and suboptimal pockets of lowland and floodplain habitat, which is wetter and more flood-prone than what they historically used (Ricca 1999, Whitney 2001, Ricca et al. 2003, USFWS 2013a).

[1] Land area calculations excludes any large lakes. Protected lands comprised of a combination of public and land trusts owned lands.

[2] Acres within the areas mapped in Figure 1, which includes habitat that both is suitable and non-suitable to CWTD.

[3] Estimated from plat maps obtained from interactive mapping tools supplied online by local county assessor's offices.

The type of habitats now used by the CRP is more driven by habitat availability (USFWS 1983, 2010). Although not their historically preferred habitat, CWTD can use lower-elevation floodplains. They show a strong affinity for habitat edges between woody and open habitats, which may reflect the ease of access in these areas to food and cover or it could be a function of other factors such as favorable microclimates (Suring and Vohs 1979, Heale 2018). They also have an affinity for open understories, deciduous forested canopies, and riparian areas (Ricca et al. 2003, Brookshier 2004, Smith and Coblentz 2010, Whitney et al. 2011). They avoid conifer forest and areas of dense underbrush are avoided by all but young fawns. They also seem to avoid areas of potential habitat where livestock is present (Suring and Vohs 1979, Smith and Coblentz 2010, Heale 2018).

Abundant fawning habitat is important to maintain robust and resilient populations (Smith 1981, Smith and Coblentz 2010). Biologists at JBH have observed fawns on the Mainland Unit of JBH (hereafter referred to as Mainland JBH) in areas with tall grass and in mixed deciduous and Sitka spruce (Picea sitchensis) forest (USFWS 1983, Brookshier 2004). Fawns in the Roseburg Population also favored dense understory vegetation for concealment and were generally seen near streams absent of livestock (Ricca et al. 2003, Smith and Coblentz 2010).

An important element of habitat for CWTD is thermal and security cover (Smith 1981, Heale 2018). Heale (2018) observed a preference for habitat with cover over open habitat. This was most evident in winter, possibly due to the thermal protection that cover provides (Heale 2018). Although CWTD prefer forest, they will use the new growth of tall forbs as cover in spring and summer (Suring and Vohs 1979). They thrive where moderate cover, shrubs, and meadows are present for both browsing and grazing (Suring and Vohs 1979, USFWS 2014). This mixture of forage and cover makes riparian areas suitable as habitat (Suring and Vohs 1979, USFWS 2014).

Diet and foraging. Columbian white-tailed deer primarily are grazing animals but can be seen browsing on shrubs (Suring and Vohs 1979, Whitney et al. 2011). A two-year nutritional study on Mainland JBH showed a considerable preference for grasses, sedges, and forbs over browse (Suring and Vohs 1979). However, on nearby Tenasillahe Island and off-refuge near Westport, Oregon, browse was a greater part of their diet (USFWS 2010). Differences in foraging behavior from site-to-site is likely more a function of food availability and less their actual dietary preference (USFWS 2010). They also show seasonal dietary variation, likely also in response to food availability (Dublin 1980, USFWS 2010, Whitney et al. 2011).

Home Range and Movements. Columbian white-tailed deer are non-migratory and restrict their dispersal and movements to relatively small ranges (Gavin et al. 1984, LCFRB 2004). Gavin et al. (1984) and Ricca (1999) characterized CWTD as remarkably sedentary with no apparent tendency to disperse. Estimated distances traveled by CWTD between successive locations in the Roseburg Population averaged 1.3 km (0.8 miles) and was never more than 3.8 km (2.4 miles; Ricca 1999). Gavin et al. (1984) reported yearlings in the CRP moving further than other age classes and Ricca (1999) reported adult males in the Roseburg population moving significantly further than adult females.

Home range size for CWTD is generally at the low end for temperate WTD (Sparrowe and Springer 1970, Lesage et al. 2000, Grovenburg et al. 2009). As with other WTD, CWTD bucks generally occupy larger home ranges than does (Suring 1974, Gavin et al. 1984, Smith 1991, Ricca 1999). Fawns are generally the most sedentary age class and have the smallest home ranges (Gavin et al. 1984, Ricca 1999, Ricca et al. 2003). Mean home range on Mainland JBH was smallest for male fawns and largest for adult males when broken down by age class (Gavin et al. 1984). Suring (1974) found yearlings on Mainland JBH occupying some of the largest home ranges of any age class.

Given the present-day association with riparian habitat, CWTD home ranges are greatly influenced by river corridors, and thus take on a linear shape (Smith 1981, Gavin et al. 1984, Smith and Coblentz 2010). The shape of home ranges is also influenced by other linear features such as roads (Gavin et al. 1984).

Reproduction. Breeding season starts in mid-September and ends in late-February (USFWS 2015). A WTD male may breed with multiple females (Miller et al. 2020). Observations on Mainland JBH showed a rut beginning the first week of November and peaking by the second week of November (USFWS 1983). Male reproductive behavior noticeably declines by late November, although some males can breed as late as March (USFWS 1983). Gestation for CWTD averages about seven months (Verme and Ullrey 1984, Smith 1991). Observations on Mainland JBH showed peak fawning the second week of June. Fawns remained with their mothers until just before the next fawning season when does depart to give birth to the next generation (USFWS 2013b).

Adult females give birth to an average of two fawns per year (USFWS 2010). Does usually become pregnant as yearlings and give birth for the first time as 2-year-olds (Gavin 1979, Miller et al. 2020). Gavin (1979) found 70 percent of two-year-old and 100 percent of does older than three-years-old were pregnant. While not studied in CWTD, male WTD generally are also reproductively capable as yearlings (Miller et al. 2003, DeYoung and Miller 2011). White-tailed deer are capable of breeding and producing fawns throughout their entire lifespan (DelGiudice et al. 2007, Miller et al. 2020).

Although the reproductive potential of this subspecies is high, recruitment in the CRP is variable (USFWS 2010). This is mostly because fawn survival fluctuates dramatically from year to year and site to site (Meyers 2012b). A fawn to doe ratio is the primary index for measuring fawn recruitment as well as overall productivity (Meyers 2012b). The goal of JBH and Ridgefield NWRs is to maintain ratios, in late fall, that are at or above 45 fawns per 100 does when deer are more than 25 percent below population objectives, at or above 37 fawns per 100 does when deer are below population objectives by 25 percent or less, and 20 fawns per 100 does when deer exceed population objectives (USFWS 2010).

While Mainland JBH and Tenasillahe Island subpopulations have had annual adult rates of survival comparable to WTD in other regions (Phillips 2009), fawn recruitment has widely varied (USFWS 2010). Fawns per 100 does in the most populous sites have ranged between 3 and 60 on Mainland JBH, 0 and 50 on Tenasillahe Island, 22 and 75 on Puget Island, and 10 and 83 in Westport between 1996 to 2020 (Table 2; USFWS 2021). The average in this same period was 32, 35, 44 and 38 fawns per 100 does on Mainland JBH, Tenasillahe Island, Puget Island, and Westport, respectively (USFWS 2010). Fawn recruitment over the last decade for all four of these sites along with Ridgefield have generally ranged between 30 to 60 fawns per 100 does (USFWS 2013a). The exception is Mainland JBH, which has seen in recent years the lowest and most variable counts, with three of the last four years ranging between 9.1 to 15.4 fawns per 100 does (Table 2).

Coyote (Canis latrans) predation is the likely explanation for years when fawn recruitment is low (USFWS 2016a). Low fawn recruitment may also result from factors such as flooding, starvation, disease, or low-quality habitat (Smith 1991, USFWS 1997). Although no studies have drawn a clear link between predator control with increased fawn recruitment, unpublished data shows a potential link (Clark et al. Unpublished, USFWS 2010).

Table 2. Number of fawns/100 does on key occupied sites (USFWS 2021).

	Mainland JBH	Tenasil-lahe	Puget Island	West-port	Willow	Dibblee	Clatsk-anie	Bachelor Unit[1]	Roth Unit[2]	Marsh-land
1996	15.7	35.0	27.3	45.0						
1997	60.6	38.5	38.7	15.8						
1998	42.7	12.4	45.4	29.8						
1999	15.3	10.0	45.1	10.6						
2000	33.6	7.9	70.0	23.1						
2001	48.8	18.0	48.8	39.5						
2002	25.0	0.0	39.8	29.0			84.2			
2003	21.4	0.0	26.7	23.5	100.0					
2004	11.5	30.0	35.9	33.3	42.1	42.9				
2005	3.7	23.5	22.1	13.9	28.9	25.0	6.7			
2006	23.3	39.1	22.1	17.5	18.4	6.7	19.0			
2007	2.9	50.0	36.3	36.6	42.9	0.0				
2008	29.6	39.3	45.0	38.9	23.8	50.0	62.2			
2009	25.9	46.2	45.0	51.2	63.6	72.2	50.0			
2010	60.5	37.5	42.5	82.8	50.0	57.1				
2011	35.0	40.0	25.5	35.1		62.5	7.1			
2012	46.4	55.3	35.5	52.9	12.5	16.7	100.0			
2013	40.0	47.1	49.4	59.6	47.6	48.7	50.0			
2014	60.9	72.7	75.2	57.8	37.0	57.5	66.7			
2015	50.0	65.1	56.1	78.6	91.7	52.1	0.0			
2016	53.1	53.6	59.8	46.7	61.3	19.2	0.0			
2017	9.1	56.5	53.7	26.8	92.6	19.2	0.0	27.3		
2018	59.2	51.4	51.6	26.6	78.9	10.9	0.0	52.5		71.4
2019	15.4	45.3	61.4		60.0	13.3	37.5	48.2	42.1	31.0
2020	11.7	14.1	32.7		43.5	22.0		54.9	39.9	56.3

Survival. The life expectancy for WTD varies, with life expectancy in non-hunted populations often exceeding that of harvested populations (Cypher and Cypher 1988, Ditchkoff 2011). While the annual rate of survival of adult CWTD is relatively stable, fawn survival in the CRP is highly variable (Table 2; Meyers 2012b, 2021). This variability with fawn survival is closely tied to predation and environmental conditions (USFWS 2021). Other major factors influencing the survival of CWTD in the CRP is disease and flooding. Other direct causes of adult mortality include malnutrition, vehicle collisions, and poaching (Smith 1981, Gavin et al. 1984, Ricca et al. 2002). Less common causes of adult mortality include predation and fence entanglement (Smith 1981).

POPULATION AND HABITAT STATUS

Archeological records and 19th Century journal entries suggest that CWTD were once much more abundant with a significantly larger distribution in Oregon and Washington (Bailey 1936, Lyman 2006). By the mid-19th Century, habitat loss and overhunting led to population declines (Lyman 2006). The CWTD was nearly extirpated by the early 1900s (Bailey 1936, Jewett 1914). The first comprehensive population survey of the CRP after it was federally listed estimated a population of 720 CWTD deer in 1984 (USFWS 1983).

[1] Bachelor Unit is part of Ridgefield National Wildlife Refuge.

[2] Roth Unit is part of Ridgefield National Wildlife Refuge.

The USFWS issued a recovery plan and set recovery goals soon after listing the population (USFWS 1983). This included a population goal of at least 400 deer maintained in at least three viable[1] subpopulations, two of which must be on secure[2] habitat as a requirement for downlisting to Threatened. The USFWS considered a subpopulation viable when at least 50 deer are maintained. A population of 400 deer must be maintained in at least three viable and secure subpopulations to delist deer in the CRP (USFWS 1983). A population and habitat viability assessment for CWTD recommended revisiting and possibly updating these recovery goals because we now know much more about population viability than when the goals were adopted nearly 40 years ago (Miller et al 2020).

The CRP is made up of 10 recognized subpopulations (Table 1; Miller et al. 2020). The number of deer in the CRP has varied considerably since it was first listed under ESA in 1973. The estimated population in the CRP has ranged from 545 to 1,296 CWTD since aerial population surveys were first carried out in 1997. This population sharply increased in size post-listing through the late 1980s. The population then gradually declined until 2006, when numbers stagnated for several years. Then began another increase beginning in 2014, reaching an estimated population of just over 1,200 deer in 2021 (USFWS 2016a, 2019, 2021). The 2021 population is currently the highest estimate on record for the CRP. While the population and distribution has grown, the core of the population from the 1970s (Mainland JBH, Tenasillahe Island, Puget Island, and Westport) still supports about half of the overall deer numbers in the CRP (USFWS 2021; Table 3). A lack of quality habitat outside of these areas may explain why this core of the population remains concentrated in these locations.

Until about a decade ago the overall population trend of the CRP was significantly influenced by shifts in the population at Mainland JBH (USFWS 2013a). This population dramatically increased from 200-300 deer after the refuge was established in the early 1970s to roughly 500 deer in 1986 (USFWS 1992, 2016a). This population of 500 CWTD was much higher than Mainland JBH's estimated carrying capacity of 165 CWTD (Miller et al. 2020). Mainland JBH then fell to a low of 59 deer in 2007 (USFWS 2021). Consistent coyote predation and flooding in 1996, 2006, and 2009 were partly responsible for that decline (USFWS 2013a). Translocations to Mainland JBH between 2006 and 2010 augmented declining numbers, and by 2011 the subpopulation supported an estimated 83 deer (USFWS 2016a). Thirty-seven deer were later translocated in 2014 from Mainland JBH to Ridgefield NWR to protect deer from flooding after a dike was breached. That breach removed about 3.5 percent of terrestrial habitat from Mainland JBH (USFWS 2016a). The most recent population on Mainland JBH is estimated at 106 deer (USFWS, In Prep.).

Ridgefield NWR is now the largest subpopulation in the CRP (USFWS 2019; Table 3). Other comparatively large CWTD populations are found on Tenasillahe Island, Puget Island, and in Westport (USFWS 2021). Except for Puget Island and Westport, most larger populations are on public lands (Table 1). Whereas Tenasillahe Island was at an all-time high of 216 CWTD in 2021, the Puget Island population has generally held stable over the years and Westport has declined in recent years (Table 3). The latter is believed to be due to recent changes in habitat management practices by the largest private landowner on the Westport site (P. Meyers, pers. comm.).

---

[1] A population whose probability of extinction is relatively low as determined from annual estimates of population size, and whose population is large enough to minimize effects of inbreeding.

[2] Habitat is secure only if it is free of adverse human activities in the foreseeable future and is relatively safe from natural phenomena that would destroy its value to Columbian white-tailed deer. The Service originally interpreted secure habitat as having a designated protected status (USFWS 1983). They later broadened their interpretation "to include locations that, regardless of ownership status, have supported viable subpopulations for 20 or more years and have no anticipated change to land management in the near future that would make the habitat less suitable" (USFWS 2013a).

Table 3. Yearly population estimates for key sites (USFWS, In Prep; USFWS 2013a, 2021) and yearly numbers of deer translocated to (+) or from (-) each site. Cells are blank when a population estimate was not calculated that year[1, 2].

Year	Puget Island	Translocated	Tenasillahe Island	Translocated	Westport	Translocated	Mainland JBH	Translocated	Ridgefield NWR	Translocated	Crim's Island	Translocated	Cottonwood Island	Translocated	Dibblee Flats	Willow Grove	Wallace Island
1984	170		40				360										
1985	215	-21		+21			480										
1986	195	-19	55	+19			500										
1987	185	-19	70	+19													
1988	205	-21	80	+21			410										
1989			90				375										
1990	200		105				345										
1991			130				280										
1992			165														
1993			195				175										
1994			205				140										
1995							120										
1996			87				51										
1997			105				55										
1998																	
1999	150	-18	190			-12	96				14	+30					22
2000		-30	140				85				8	+30					23
2001	125																
2002			108				104				19						15
2003		-12				-16											
2004	110	-11				-8											
2005	125																
2006		-15	86			-14	81	+5			23	+5					18
2007			82				59				33						19
2009	138		97	-20			74	+20			17				7	32	27
2010			143		132	-15	68	+8			29			+15			31
2011	171		90				83				18				18	18	22
2012			91				72										
2013		-12						-37		+37				+12			
2014	227	-11	154			-10	88			+21	29				70		
2015		-8	155		182	-22				+30					68		0
2016			199		162		119		71		46				66	47	0
2019	212		187		99		95		137		17				58	33	9
2020				-15					234				19				
2021			216	-12	98		80				51		28				
2022				-10	81		106		228						46	53	0

The remaining deer in the CRP are in smaller subpopulations (e.g., Columbia Stock Ranch-Deer Island) and in isolated residual populations such as Brownsmead Island (USFWS 2021). Most of these smaller populations are on private lands (Table 1).

Columbian White-tailed Deer Translocations. A large part of the recovery effort is an ongoing translocation program to augment existing subpopulations and to establish new subpopulations (USFWS 2000, 2005, 2013c). Over 75 percent of translocated deer have originated from Puget Island and Westport (Table 3).

[1] Table does not account for residual and smaller subpopulations nor deer translocated from Roseburg or to Lord / Fisher islands.

[2] Population numbers in this table and throughout the report come from surveys overseen by USFWS.

Both these areas have robust deer populations that have quickly rebounded after deer were removed (USFWS 2013a). Translocated deer have also come from Tenasillahe Island, Mainland JBH, and Roseburg (USFWS 2013a).

The Tenasillahe Island and Ridgefield translocations have been the most successful sites receiving deer (Table 3). Both have exceeded refuge goals through a combination of translocations, predator control, and habitat restoration (USFWS 2015; A. Chmielewski, pers. comm.). Just prior to the first set of translocations to Tenasillahe Island, the population was estimated at 40 deer. After translocations in the mid-1980s Tenasillahe Island has reliably maintained over 100 deer, peaking at just over 216 deer in 2021 (Table 3). Tenasillahe Island has also become a source population for some translocations.

The Ridgefield subpopulation received 88 deer from Mainland JBH, Puget Island, and Westport between 2013-2015. This subpopulation has since increased to an estimated 228 deer in 2022 and is now considered a viable subpopulation (USFWS, In Prep; Miller et al 2020). Translocations to Ridgefield have also expanded the range of the CRP further upriver. Many Ridgefield deer have also since moved off refuge across the Columbia River to Sauvie Island and to adjacent lands, including to WDFW's Shillapoo Wildlife Area.

Other sites receiving translocated deer have not seen results as positive as the Tenasillahe Island and Ridgefield subpopulations (USFWS 2013a, 2016a). Although these other translocations have expanded the occupied range, many have not gained a strong foothold. This includes a group of islands near Longview that USFWS identified for establishing a secure subpopulation. Sites there that received deer were Fisher (33 deer received), Lord (33 deer received), and Crim's islands (65 deer received; USFWS 2016a). Fisher and Lord islands has since dropped to a handful of deer, while Crim's Island has maintained modest numbers (USFWS 2016a). The most recent estimate at Crim's Island was 51 deer in 2021 and 6 deer on Fisher and nearby Hump islands in 2022 (USFWS, In Prep). No recent population data has been collected on Lord Island. The USFWS believes that some deer translocated to Fisher and Lord islands have moved to nearby Willow Grove, Dibblee Flats, and Clatskanie (P. Meyers, pers. comm.).

Just upriver of Fisher, Lord and Crim's islands, the Cowlitz Tribe and USFWS moved 27 deer between 2010 and 2013 to Cottonwood Island, which was listed in the Recovery Plan as a potential relocation site (USFWS 1983, Cowlitz Tribe of Indians 2010). This population has not seen much growth and as of 2021 was estimated at 28 CWTD (USFWS 2021). Mainland JBH also received 33 deer between 2006 and 2010 to augment a population in decline. This is the only translocation to include deer from outside the CRP (8 deer taken from Roseburg). Mainland JBH has consistently maintained a post-translocation population of 75 to 120 deer, even after 37 deer from Mainland JBH were moved to Ridgefield in 2013. The population estimates for Mainland JBH's are below the site's estimated carrying capacity of 165 CWTD (Miller et al. 2020)

The most recent translocations have resulted in deer being moved from Tenasillahe Island to Columbia Stock Ranch (CSR). The CSR site was a recent Columbia Land Trust acquisition intended to create and maintain a new subpopulation. Thirty-seven deer were moved there from Tenasillahe Island between 2020 and 2022 (P. Meyers, pers. comm.). Restoration of habitat for CWTD has been ongoing at CSR as well as monitoring of translocated deer and their offspring.

Columbian White-tailed Deer Habitat Status. Several CWTD subpopulations occur on state or federal protected lands (Table 1). The Julia Butler Hansen NWR is a protected site managed specifically for CWTD. The refuge includes the Mainland JBH (3,000-ac [1,215 ha]), Tenasillahe Island (1,825-ac [738 ha]), Wallace Island (560-ac [227 ha]), Crim's Island (470-ac [191 ha]), and Westport (175-ac [70 ha]) units (USFWS 2013a).

Habitat on the two largest units are predominantly grasslands mixed with riparian forest and shrublands (USFWS 2013a). The remaining refuge islands occupied by CWTD are dominated by cottonwood/willow swamp, scrub-shrub tidal wetlands/marsh, and pasture (USFWS 2013a).

Ridgefield NWR also supports a translocated CWTD subpopulation. Ridgefield unlike JBH is not primarily managed for CWTD. The deer nevertheless are a high priority to the refuge since their translocation to Ridgefield in 2013. Ridgefield NWR has over 5,200-ac (2104 ha) of marshes, grasslands and woodland habitat, of which 3,800-ac (1537 ha) is terrestrial habitat (USFWS 2013a). Some of the original translocated deer and their offspring have since dispersed to nearby lands including land that is owned and managed by WDFW and ODFW.

Although mostly private and not managed to conserve CWTD, Puget Island has long maintained a relatively large and stable CWTD population (Table 1; USFWS 2013a). This shows that a mosaic of public-private ownerships in a semi-rural landscape may not be incompatible with CWTD persistence. In fact, Puget Island has shown even greater stability than the protected, though much more flood prone, Mainland JBH subpopulation (USFWS 2015). Puget Island has undergone land use changes such as the conversion of large farms to small hobby farms (USFWS 2015).

Westport, which also supports a relatively large CWTD population, was until recently owned by a single private landowner who intensively controlled coyotes and managed the property in a condition suitable as CWTD habitat (USFWS 2016a; P. Meyers, pers. comm.). Although the management had kept this large population stable, the Westport CWTD population has recently declined. The timing of this decline coincides with a change in land tenure from a single landowner to a trust and likely to a change in how the habitat used to be managed (P. Meyers, pers. comm.).

The Columbia Land Trust (CLT) in 2012 acquired the CSR property with funds from Bonneville Power Administration and with the intent to transfer it to USFWS (BPA 2019). This nearly 939-ac (380 ha) site adjacent to Deer Island, Oregon received deer translocated from Tenasillahe Island between 2020 and 2022. The CSR property is now protected and actively managed by CLT to create and enhance habitat for CWTD. Currently CSR is made up of a mix of floodplain and lowland riparian forest and uplands dominated by a mix of Douglas-fir and hardwood forests (BPA 2019). In 2021, CLT also purchased an additional 520-ac (210 ha) of habitat specifically for CWTD along Westport Slough (Columbia Land Trust 2022).

The remaining occupied habitat is used by small or residual populations of CWTD. Some of these smaller occupied areas are seeing changes in land use. Crim's Island, which supported an estimated 51 deer in 2021 (USFWS 2021), is about 85 percent publicly owned. Persistent deer populations have established at Willow Grove and Dibblee Point, which are made up of semi-rural, privately owned lands. Both Willow Grove and Dibblee Point are close to Longview, Washington and Rainier, Oregon, and are likely to see changes from an agricultural to a suburban landscape. This could negatively impact the deer on these sites depending on the future development density (USFWS 2013a). Islands (Lord, Walker, Fisher, and Hump islands) occupied by small residual CWTD populations also near Longview are owned by public and private entities. Upriver of Longview is Cottonwood Island, which is largely owned by multiple private entities. No one lives on Cottonwood Island and there is no known interest in residential or commercial development there (USFWS 2016a). Over two-thirds of Cottonwood Island is secured for the protection of CWTD through a landowner agreement (USFWS 2013a). Other residual CWTD populations are in Clatskanie Flats, Brownsmead, Barlow Point, and Rainier, all of which are primarily owned by the shipping ports or are in other forms of private ownership (USFWS 2015).

FACTORS AFFECTING COLUMBIAN WHITE-TAILED DEER IN WASHINGTON

Adequacy of Regulatory Mechanisms

Federal measures. The Columbian white-tailed deer was among the first ESA listed species. In 1971, USFWS established JBH near Cathlamet, Washington, to preserve and protect CWTD. The Refuge regularly worked to enhance and improve habitat and to control predators. To date USFWS has protected 3,604 ha (8,905-ac) of habitat for CWTD along the lower Columbia River (USFWS 2015).

The USFWS released a recovery plan for CWTD in 1976 that they revised in 1983 (USFWS 2015). The plan separately addressed the Columbia River and Roseburg populations and laid out recovery criteria for each population. The recently published CWTD population and habitat viability assessment conducted by the Conservation Planning Specialist Group stressed the need to reevaluate the recovery criteria, saying it does not adequately identify the conditions necessary for long-term demographic or genetic viability of the CRP (Miller et al. 2020).

The USFWS published a 5-year status review in 2013 and reclassified the CRP to Threatened in 2016 (USFWS 2016a). At the same time, they issued a rule under Section 4(d) of ESA to permit lethal take of up to 5 percent of the CRP annually for the following activities: (1) Damage management of problem CWTD, (2) misidentification during black-tailed deer (BTD) damage management, and (3) misidentification during BTD hunting. The rule also provided an incentive to states, tribes, and private landowners to support the translocation of CWTD by easing concerns about unauthorized take. No take has occurred under the section 4(d) rule as of 2022 (J. Siani, pers. comm.).

The USFWS has restored and enhanced habitat, translocated deer, and conducted predator control activities all to enhance deer numbers on occupied sites and to expand the range of the CRP. However, no critical habitat was designated as part of the federal protection for the CRP (USFWS 2013b).

State, county, and city measures. The Washington Fish and Wildlife Commission has authority to list species (RCW 77.12.020). The CWTD was first listed as a State Endangered Species in 1980, protecting them from direct take (WDFW 2013). All state listed species are also priority species in WDFW's List of Priority Habitats and Species (PHS; WDFW 2008). The PHS program is used by the agency as well as voluntarily by others to conserve PHS-listed species and habitats. As part of the PHS Program, WDFW published recommendations to provide science-driven guidance for activities that could negatively impact this species and its habitat (Brookshier 2004). The agency also enforces hunting regulations as well as a roadkill salvage rule[1] for deer and elk. As a State Endangered Species, it is illegal to hunt, possess, or control CWTD in Washington.
All of Washington's jurisdictions must adopt a critical areas ordinance (CAO; RCW 36.70A.060) to protect fish and wildlife habitat conservation areas under the Growth Management Act (GMA). The planning goals of GMA include reducing urban sprawl and protecting the habitat of state listed wildlife such as CWTD. Clark, Cowlitz, and Wahkiakum counties are all required to designate and protect CWTD and riparian management zones (RMZ) in their CAOs, which is important as habitat by CWTD.

Clark, Cowlitz, and Wahkiakum counties are required to revise their CAOs by 2025, 2026, and 2027, respectively (Washington State Department of Commerce 2021). At the same time, they will also be updating their comprehensive plans, which could include proposals to adjust and expand where new

[1] Only elk – not deer – may be salvaged in Clark, Cowlitz, and Wahkiakum counties, because federal laws prohibit handling endangered CWTD in southwest Washington.

development can occur. This period will be a good opportunity to advise counties on strengthening their standards of protection to benefit CWTD. This could include recommendations to increase the size of RMZs, tighten language and close harmful loopholes, and offer advice about where to avoid new development and growth.

There is not a State Forest Practices Rule in Washington for CWTD. The Washington Department of Natural Resources and WDFW take a voluntary approach with forest landowners to manage and protect state-listed species. The Forest Practice Act may afford some limited protection to CWTD habitat given this species' close affinity to riparian areas.

Habitat Loss and Fragmentation

The loss of and limited access to high-quality habitat is the greatest present-day threat to CWTD recovery (USFWS 2013a). The effects that future habitat conversion could have on this species is compounded by historical habitat losses that have left this population with a scarcity of suitable habitat.

The loss and degradation of riparian habitat is of particular concern, as this is the primary habitat that they currently occupy (USFWS 1983, Brookshier 2004). It is vitally important to the recovery of this species that further loss or degradation of riparian habitat is minimized within the CRP.

Although not impossible, reintroducing deer to their historical range farther away from the Columbia River presents many challenges. This is because urbanization has fragmented much of that range (Figure 3). The city of Ridgefield and Clark County, home to the largest CWTD subpopulation, are also the fastest growing city and county in Washington, respectively (U.S Census Bureau 2021a, 2021b). This rapid growth limits opportunities for natural range expansion into areas of habitat that are not already protected.

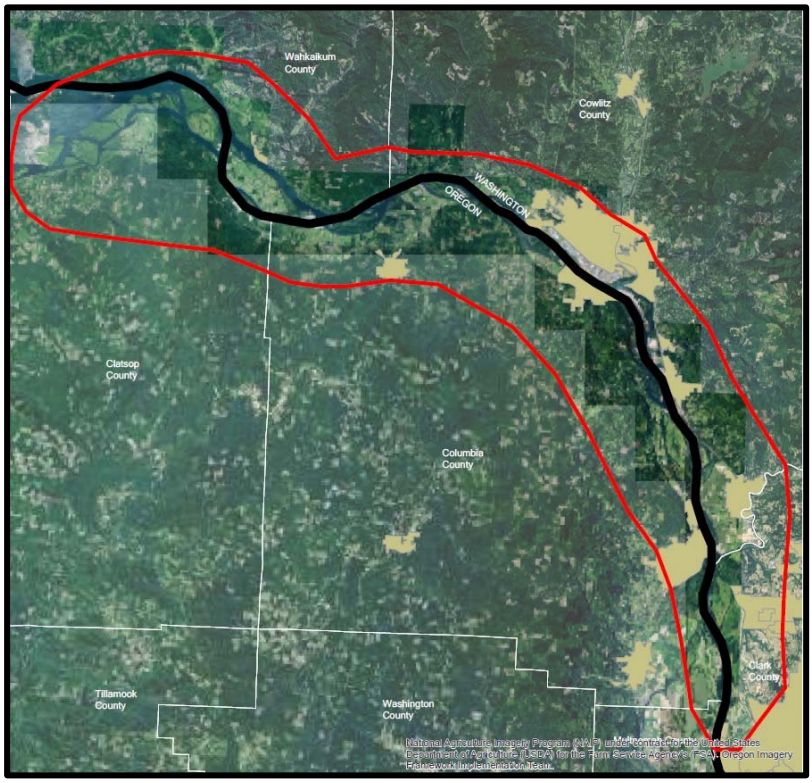


Figure 3. The urban growth areas (shown as tan areas) in and around the Columbia River Population of CWTD (shown in the red bounded area). The thick black line is the Washington-Oregon state boundary.

Small and Insular Populations

The estimated size of the CRP has risen since it was first designated an endangered species. Still there are relatively few deer compared to the delisted Roseburg DPS. That DPS was estimated at over 6,000 deer when USFWS delisted it in 2003. That population's larger size and recovery is likely a result of significantly more suitable habitat than the amount of habitat available in the CRP (USFWS 2013a).

Because a relatively small number of deer make up the isolated CRP, they are vulnerable to events such as flooding, sea-level rise, disease, and inbreeding (Hopken et al. 2015, Marco and Peha 2018). The smallest, most

isolated, and least secure subpopulations are in the "B Group" (Figure 2), which is the most vulnerable to stochastic events and extinction (Miller at al. 2020). The "B Group" subpopulations have also been identified as a major bottle neck to deer movement between the larger upriver and downriver subpopulations.

Although not all the subpopulations occur on actual islands, they function like islands because they are isolated by surrounding suboptimal habitat, such as conifer forest (WSDOT 2016). The CRP is also mostly surrounded by a network of railroads and busy highways such as State Highway 4, U.S. Highway 30, and Interstate 5. For these reasons, the deer are much less likely to move away from the river into areas that are currently unoccupied (WSDOT 2016). This along with the fragmented pattern of small-parcel ownership makes it difficult for CWTD to naturally expand their range beyond the narrow lowland confines of the Columbia River (WDFW, unpublished GIS data). Although opportunities are limited to expand farther from the mainstem Columbia River, there is a potential pathway for movement, particularly along nearby drainages such as the East Fork Lewis River (WSDOT 2016). However, this would require translocating deer, securing lands either by acquisition or landowner agreements, and retrofitting roads with wildlife crossing structures.

The CRP could be more resilient to stochastic events (e.g., die-offs from disease or flooding) if areas farther upland were occupied, and especially if those areas were functionally connected to subpopulations along the Columbia River. However, this comes with great obstacles given the amount of permanent infrastructure, the limited amount of available habitat, and a potential lack of support from the public.

Interspecies Relationships

Predation has long been a major factor limiting the CRP (USFWS 1998, 2013a, 2014). Young fawns are especially vulnerable, primarily to predation by coyotes (USFWS 1998, Smith 1991). Coyotes are the most significant impact on fawn recruitment and thus USFWS has controlled predators to increase fawn survival in the CRP (USFWS 2013a, 2016a). The largest fawn survival study concluded only about 20 percent of 131 radio-collared fawns on JBH survived throughout the fawning period (Clark et al. Unpublished). That study found coyotes to be the primary driver of fawn mortality (69 percent of deaths) followed by disease and starvation (16 percent).

Resource competition with other ungulates is also a potential problem. Competition for food and cover with elk (*Cervus canadensis*) has threatened CWTD on Mainland JBH (USFWS 2013a). Elk impacts include competition for forage, antler rubbing, which kills young trees that reduce favored forest cover, and disease transmission (USFWS 2004; E. Holman, pers. comm.). The WDFW removed 291 elk between 1984 to 2001 and later allowed limited public antlerless elk hunts. Future increases in elk may be controlled with additional limited public hunting. Refuge personnel have also built about 4 miles of fence to deter elk immigration into JBH (USFWS 2013a).

Limited hybridization in CWTD with BTD has been detected in the CRP. Gavin and May (1988) found evidence of hybridization in six of 33 CWTD sampled around Mainland JBH. A later study found 32 percent of CWTD on Tenasillahe Island with BTD genes (Piaggio and Hopken 2009).

Disease

Diseases that can reduce deer survival include necrobacillosis (Gavin 1979, USFWS 2016a). Necrobacillosis risk increases with damp soils and frequent flooding increases the risk of necrobacillosis in the CRP (Langworth 1977, USFWS 2016a). Although this disease does not seem to limit population growth or

stability, a handful of CWTD deaths in the CRP have been attributed to this disease (Gavin et al. 1984). More deadly and contagious are hemorrhagic diseases (i.e., Adenovirus Hemorrhagic Disease [AHD], Epizootic Hemorrhagic Disease [EHD], and bluetongue) and chronic wasting disease (CWD). Periodic detections of AHD have been reported near the CRP, including one in a CWTD in Clatskanie, Oregon in 2019 (Miller et al. 2020). There is no cure for AHD, which is transmitted by direct contact between deer (WDFW 2021). Neither EHD nor bluetongue have been detected in the CRP, although in 2014 AHD and EHD was detected in CWTD in Roseburg. That outbreak caused a significant die-off in that population (J. Burco, pers. comm.). Both bluetongue and EHD are incurable, with outbreaks occurring more often during drought (Maclachlan et al. 2019, Christensen et al. 2020). Chronic wasting disease is also incurable, highly transmissible, and is a potential population-level threat to CWTD (WDFW 2021). White-tailed deer are susceptible to CWD, which is spreading across North America. For this reason, a cross-agency team is developing a surveillance and response plan for CWD in the CRP (J. Azerrad, pers. comm.). The closest detection of CWD to date is about 300 miles east of the CRP in west-central Idaho (IDFG 2021).

Flooding and Altered Flood Regimes

Significant flooding in 1996, 2006, and 2009 were partially implicated in the decline of deer on Mainland JBH (USFWS 2013a). The greatest loss to flooding happened in 1996, when roughly 50 percent of the deer on Mainland JBH died or emigrated (USFWS 2016a). Although flooding has led to significant short-term population declines, flood-impacted populations have generally recovered to pre-flood levels after a few years (USFWS 2013a).

Much of the usable habitat in the CRP is below the high tide level and thus has been protected by flood control structures. A portion of the levee protecting Mainland JBH eroded in 2011 and was subsequently repaired, leading to the loss and degradation of about 70-ac (28 ha) of occupied habitat (USFWS 2015). Other levees protecting Tenasillahe Island, Puget Island, Westport, and Ridgefield NWR were built in the same era and thus are also aging and subject to degradation (P. Meyers, pers. comm.). The condition of these levees represents a threat to CWTD given expected sea level rise (USFWS 2016a).

Climate change is projected to change the flood regime along the lower Columbia River. A recent study by the Lower Columbia Estuary Partnership on the effects of sea-level rise on tidally influenced wetlands shows a potential for sea-level rise to overtop levees, particularly levees closer to the mouth of the Columbia River (Marco and Peha 2018). An earlier study also projects some losses of Columbia River shoreline habitat due to rising sea level (Glick et al. 2007). This could pose a risk to low-lying habitat used by CWTD (USFWS 2015).

Recent interest and discussion about restoring natural tidal regimes led to an evaluation of the feasibility to re-introduce estuarine processes to the interior of Tenasillahe Island for juvenile salmon rearing and refugia (PC Trask and Associates 2017). This activity would require removing several tidegates as well as breaching the levee (PC Trask and Associates 2017). While this would benefit salmon, it would reduce the island's carrying capacity for CWTD and thus necessitate translocating most of Tenasillahe Island's CWTD to alternative locations, including to lands acquired as mitigation to compensate for reducing the carrying capacity of Tenasillahe Island (Miller et al. 2020).

MANAGEMENT ACTIVITIES

Habitat Protection. To date the USFWS has conserved 8,905-ac (3,604 ha) of habitat to protect CWTD (USFWS 2015). Although JBH makes up the bulk of land set aside for CWTD, federal, state, and private partners have also protected other sites for CWTD. These include a relatively large acquisition of 630-ac (256

ha) adjacent to Mainland JBH, 310-ac (126 ha) near Longview, as well as another 1,460-ac (590 ha) on CSR and Westport Slough managed by CLT to conserve CWTD and other species (McGewan 2008; Columbia Land Trust 2018, 2022). The WDFW owns and manages over 185-ac (75 ha) of White Island and roughly 245-ac (100 ha) of Fisher Island for CWTD (WDFW 2019). Although not secured specifically for CWTD, Ridgefield NWR and the Shillapoo and Sauvie Island wildlife areas are also occupied by CWTD and protected. Most of Cottonwood Island has also been secured for the protection of CWTD through a landowner agreement (USFWS 2013a).

***Monitoring*.** Population monitoring is needed to assess progress towards federal recovery goals and to measure the population's response to conservation activities. The USFWS has estimated population numbers since 1997 using Forward-looking Infrared (FLIR) videography (USFWS 2019). Before FLIR USFWS generated population numbers by ground-based surveys. In 2010 and 2017 USFWS conducted controlled trials to validate FLIR and to generate habitat-specific correction factors to adjust FLIR-derived population estimates (USFWS 2017). The proportion of CWTD to BTD viewed on trail cameras is also used to adjust FLIR estimates (USFWS 2016a). Ground counts and professional judgement have sometimes been used in years when FLIR surveys were not completed to identify unusual changes in deer numbers (USFWS 2013a).

While FLIR is used regularly on all larger established subpopulations, sites with smaller or residual populations are surveyed much more sporadically. For these residual and smaller subpopulations, the USFWS has either brought forward the most current population numbers available to generate range-wide population estimates or they have relied on other methods such as ground-based counts or best professional judgement (USFWS 2021). The more sporadic survey of residual or smaller subpopulations has made it hard to accurately estimate the total population of CWTD in the CRP at any point in time. The population and habitat viability assessment recommended establishing more regular survey intervals sufficient to routinely evaluate trends across the entire CRP (Miller et al 2020). It also recommended consulting with a biometrician to help develop a survey protocol. We are currently pursuing these recommendations with our partners

***Predator Management*.** Studies on Mainland JBH have found that most fawn mortality is caused by coyote predation (USFWS 1998). The refuge has long implemented a program to control coyotes (USFWS 2016a). The USFWS will continue this practice on both JBH and Ridgefield NWRs as needed (USFWS 2015). While predator control seems to have increased short-term fawn survival, it does not address the ultimate causes of CWTD being a listed species, namely habitat loss and degradation.

Predator control on both Mainland JBH and Tenasillahe Island in many cases has been followed by increased fawn survival (USFWS 2013a). Ridgefield NWR began controlling coyotes in May 2013 (USFWS 2013a) and then halted predator control in 2018 when surveys determined that it was no longer necessary to meet refuge goals (A. Chmielewski, pers. comm.).

Coyotes are a ubiquitous predator, although coyote monitoring and control does not occur in all occupied CWTD habitat (USFWS 2013a). Predator control occurs on private lands (USFWS 2015), but typically not for the benefit CWTD. Rather it is used to reduce poultry and livestock depredation (USFWS 2015, 2016a). Because the extent of coyote control is not as closely monitored on private lands, less is known about the effects it has had on fawn survival on private property.

Translocations. Habitat for the CRP is highly fragmented with many subpopulations disconnected from each other. Fragmentation has made it nearly impossible for deer to naturally expand their range. A total of 396 deer (P. Meyers, pers. comm.) have been translocated to enhance already occupied habitat and to

expand the range of the CRP. Although the translocation program has generally been successful, some translocation sites have not gained a strong foothold.

There are several plausible reasons why some sites have seen only a nominal population response to translocations while others have been much more successful. The most plausible explanation is that sites with successful translocation programs are made up of much larger areas of protected and suitable habitat. Thus, they have much more capacity to support larger viable populations (E. Holman, pers. comm.). Another possibility is that while more successful translocation sites have shown a resilience to flooding, the least successful sites have generally been more flood prone. This in effect could reduce survival, particularly of more vulnerable fawns. Other possible contrasts that may explain successful versus unsuccessful translocations include differences in the levels of human disturbance, levels of competition with other species of deer and elk, as well as differences in the rates of post release mortality attributed to differing capturing and handling protocols (USFWS 2013d; E. Holman, pers. comm.).

***Habitat creation and restoration*.** The USFWS focuses on restoring refuge habitat to provide high-quality browse, forage, and cover (USFWS 2013a). Pasture enhancements have improved CWTD habitat quality through active cattle grazing to reduce invasive reed canary grass and to keep pasture grasses young and high in protein (USFWS 2010, 2013a). They also actively manage lands to enhance and restore a mosaic of short-grass pasture, early successional riparian forest, and wetlands (USFWS 2010). A recent enhancement program at Ridgefield NWR is focused on plantings to increase browse and forage availability (USFWS 2015). Restoration on CSR has included forest thinning and enhancement, weed control, reestablishing native plants, and the construction of deer-friendly fencing (Columbia Land Trust 2018, 2019).

Although restoration on unprotected lands is limited (USFWS 2010), fields dominated by nonnative reed canary grass on Crim's Island have seen some restoration as has Cottonwood Island. This has improved tidal marsh and riparian forest (USFWS 2010). The previous owner of the Westport property also restored habitat, although that seems to have ceased after the property was placed in a trust (P. Meyers, pers. comm.).

Recent Research: The WDFW recently coordinated the development of a population viability assessment and a population and habitat viability assessment for CWTD in collaboration with state and federal partners (Miller et al. 2020). These assessments of viability look at the current and future demographic dynamics in the CRP. The USFWS remarked about the importance of this tool to support recovery (USFWS 2013a). The viability assessments include expertly reviewed modeled outputs, including estimates of CWTD carrying capacity, simulated demographics, impacts of threats to population viability, information about demographic connectivity between neighboring subpopulations, as well as recommendations for successfully managing CWTD. It also includes a prioritized list of conservation actions and working group reports to help implement each action.

The Washington Department of Transportation led research to model habitat connectivity in the historical range of the CRP (WSDOT 2016). This project was initiated in response to the harmful impacts of transportation corridors on deer movements. This collaborative effort used vegetation and land use data to model deer movements across the landscape. This product can inform land-use decisions to eliminate impediments to movement to improve local and landscape scale habitat connectivity for CWTD.

CONCLUSIONS AND RECOMMENDATIONS

The population of CWTD along the Columbia River has grown in the last five years. This contrasts with the preceding few years where growth was stagnant, and a longer period of decline before that. Recent increases in overall CRP numbers are attributed mostly to a successful translocation of CWTD to Ridgefield NWR. Most other larger subpopulations have shown either small population increases or decreases. A notable exception is in Westport, where the population markedly decreased, likely due to changes in habitat management. Also notable is Tenasillahe Island, which quickly recovered all its pre-translocated population after 37 deer were moved from there to CSR. It is still too soon to tell if the newly established deer at CSR represent a viable subpopulation.

The success at Ridgefield NWR and surrounding areas is by far the largest development since we last reviewed the status of CWTD (Azerrad 2016). The Ridgefield subpopulation grew to an estimated 228 deer in 2022 after 88 deer were moved there between 2013 and 2015. Some deer and their offspring have since dispersed, including to nearby Shillapoo and Sauvie Island wildlife areas. This new part of the range in and around Ridgefield also has considerable population growth potential.

A vital need is to increase the resiliency of this species to emerging threats. A strategy of targeted acquisitions to secure more acres of quality habitat would help in achieving this goal. A priority area for targeting acquisitions is just downriver of Longview where small populations mainly occupy Columbia River islands. The acquisition of quality habitat in this area is important because of its strategic position in the landscape. Its location specifically makes it an important linkage for dispersal and genetic exchange across the CRP. Another key area is along rivers feeding into the Columbia River. Securing land along drainages, particularly the East Fork Lewis River, and connecting them to other subpopulations would create populations in less flood prone areas outside the Columbia River floodplain.

We were concerned in our last PSR about the threats to the CRP from the effects of climate change, emerging diseases, and a lack of secure and functionally connected habitat. Back then we were also uncertain about the viability of a newly established subpopulation at Ridgefield National Wildlife Refuge. Although the threats still exist, we are no longer uncertain about the viability of the Ridgefield subpopulation. We are now confident that Ridgefield has established into a viable subpopulation with significant growth potential. With this development, we believe the lower Columbia River Population no longer fits the definition of Endangered as it is in no “serious threat of extinction” (Washington Administrative Code 220-610-110). The Washington Department of Fish and Wildlife thus recommends reclassifying the Columbia River Population of Columbian white-tailed deer to Threatened.

REFERENCES CITED

The references cited in the Periodic Status Review for the Columbian white-tailed deer are categorized for their level of peer review pursuant to section 34.05.271 RCW, which is the codification of Substitute House Bill 2661 that passed the Washington Legislature in 2014. A key to the review categories under section 34.05.271 RCW is provided in Table A.

Individual papers cited cover a number of topics discussed in the report, including information on: 1) the species' description, taxonomy, distribution, and biology; 2) habitat requirements; 3) population status and trends; 4) conservation status and protections; 5) research, monitoring, and restoration activities; and 6) factors affecting the continued existence of the species.

Table A. Key to 34.05.271 RCW Categories:

34.05.271(1)(c) RCW	**Category Code**
(i) Independent peer review: review is overseen by an independent third party.	i
(ii) Internal peer review: review by staff internal to the department of fish and wildlife.	ii
(iii) External peer review: review by persons that are external to and selected by the department of fish and wildlife.	iii
(iv) Open review: documented open public review process that is not limited to invited organizations or individuals.	iv
(v) Legal and policy document: documents related to the legal framework for the significant agency action including but not limited to: (A) federal and state statutes; (B) court and hearings board decisions; (C) federal and state administrative rules and regulations; and (D) policy and regulatory documents adopted by local governments.	v
(vi) Data from primary research, monitoring activities, or other sources, but that has not been incorporated as part of documents reviewed under the processes described in (c)(i), (ii), (iii), and (iv) of this subsection.	vi
(vii) Records of the best professional judgment of department of fish and wildlife employees or other individuals.	vii
(viii) Other: Sources of information that do not fit into one of the categories identified in this subsection (1)(c).	viii

Reference	**Category**
Azerrad, J. M. 2016. Periodic status review for the Columbian White-tailed Deer in Washington. Washington Department of Fish and Wildlife, Olympia, Washington, 28+iii pp.	iv
Bailey, V. 1936. The mammals and life zones of Oregon. North American Fauna 55: 89-91.	i
Brookshier, J. 2004. Management recommendations for Washington's Priority Species. Columbian white-tailed deer *Odocoileus virginianus leucurus*. Volume 4: Mammals.Washington Department of Fish and Wildlife. Olympia, Washington.	iii
Bonneville Power Administration (BPA). 2019. Columbian white-tailed deer Translocation from Tenasillahe Island to Columbia Stock Ranch Final Environmental Assessment. DOE/EA 2088. U.S. Department of Energy - Bonneville Power Administration Department of the Interior – U.S. Fish and Wildlife Service. Portland, Oregon.	v
Clark, A., G. Phillips, K. Kilbride, and T. Kollasch. Unpublished. Factors affecting Columbian white-tailed deer fawns in the lower Columbia River. 21 pp.	viii

Columbia Land Trust. 2018. Conservation Report: 2017-2018.	viii
Columbia Land Trust. 2019. Conservation Report: 2018-2019.	viii
Columbia Land Trust. 2022. The Start of Stewardship along the Westport Slough: Restoring riparian forest and shrubland. The Moss Newsletter. January 2022.	viii
Cowlitz Tribe of Indians. 2010. Columbian white-tailed deer summary report. 7 pp.	viii
Christensen, S.A., Ruder, M.G., Williams, D.M., Porter, W.F., and Stallknecht, D.E. 2020. The role of drought as a determinant of hemorrhagic disease in the eastern United States. Global Change Biology 26: 3799-3808.	i
Cypher, B. L., and E. A. Cypher. 1988. Ecology and management of white-tailed deer in northeastern coastal habitats: a synthesis of the literature pertinent to National Wildlife Refuges from Maine to Virginia. U.S. Fish and Wildlife Service Biological Report 88(15). 52	i
DelGiudice, G. D., M. S. Lenarz, and M. C. Powell. 2007. Age-specific fertility and fecundity in northern free-ranging white-tailed deer: evidence for reproductive senescence?. Journal of Mammalogy, 88: 427-435.	i
DeYoung, R. W., and K. V. Miller. 2011. White-tailed deer behavior. Pages 311-351 *in* D. G. Hewitt, Editor. Biology and Management of White-tailed Deer. CRC Press, Boca Raton, Florida.	i
Ditchkoff. 2011. Anatomy and physiology. Pages 43-73 *in* D. G. Hewitt, Editor. Biology and Management of White-tailed Deer. CRC Press, Boca Raton, Florida.	i
Douglas, D. 1829. Observations on two undescribed species of North American mammals. Zoology Journal 4: 330–332.	i
Dublin, H. T. 1980. Relating deer diets to forage quality and quantity: the Columbian white-tailed deer (*Odocoileus virginianus leucurus*). University of Washington, Seattle, Washington.	viii
Gavin, T. A. 1979. Population ecology of the Columbian white-tailed deer. Dissertation, Oregon State University, Corvallis, Oregon, USA.	i
Gavin, T. A.,. 1984. Pacific Northwest. Pages 487-496 in L. K. Halls, editor. Whitetailed deer: ecology and management. Stackpole Books, Harrisburg, Pennsylvania, USA	i
Gavin, T. A., and B. May. 1988. Taxonomic Status and Genetic Purity of Columbian white-tailed deer. The Journal of Wildlife Management 52:1-10.	i
Gavin, T. A., L. H. Suring, P. A. Vohs, Jr., and E. C. Meslow. 1984. Population characteristics, spatial organization, and natural mortality in the Columbian white-tailed deer. Wildlife Monographs 91.	i
Glick, P., J. Clough, and B. Nunley. 2007. Sea-level rise and coastal habitats in the Pacific Northwest: an analysis for Puget Sound, southwestern Washington, and northwestern Oregon. Available at: www.nwf.org/~/media/PDFs/Water/200707_PacificNWSeaLevelRise_Report.ashx. Accessed December 6, 2021.	i
Grovenburg, T. W., Jenks, J. A., Klaver, R. W., Swanson, C. C., Jacques, C. N., and Todey, D. 2009. Seasonal movements and home ranges of white-tailed deer in north-central South Dakota. Canadian Journal of Zoology, 87: 876-885.	i
Hamman, S. T., P. W. Dunwiddie, J. L. Nuckols, and M. McKinley. 2011. Fire as a restoration tool in Pacific Northwest prairies and oak woodlands: challenges, successes, and future directions. Northwest Science 85:317-328.	i
Heale, J.D. 2018. Habitat Selection by Columbian white-tailed deer (*Odocoileus Virginianus Leucurus*) Along the Lower Columbia River. M.S. Thesis. Washington State University, Pullman. 83 pp.	i
Hopken, M. W., T. M. Lum, P. M. Meyers, and A. J. Piaggio. 2015. Molecular assessment of translocation and management of an endangered subspecies of white-tailed deer (Odocoileus virginianus). Conservation Genetics 16:635-647.	i

IDFG (Idaho Department of Fish and Game). 2021. Chronic Wasting Disease detected in two Idaho mule deer. Press Release dated 2021 November 17.	viii
Jewett, S. G. 1914. The white-tailed deer and other deer in Oregon. Oregon Sportsman 2:5-9.	viii
Langworth, B. F. 1977. Fusobacterium necrophorum: Its Characteristics and Role as an Animal Pathogen. Bacteriological Reviews 41:373-390	i
Lesage, L., Crête, M., Huot, J., Dumont, A., and Ouellet, J. P. 2000. Seasonal home range size and philopatry in two northern white-tailed deer populations. Canadian Journal of Zoology 78: 1930-1940.	i
LCFRB (Lower Columbia Fish Recovery Board). 2004. Columbian white-tailed deer. Pages 13- 1 to 13-20 *in* Lower Columbia Salmon and Steelhead Recovery and Subbasin Plan, Volume III. Report prepared for the Northwest Power and Conservation Council.	viii
Lyman R. L. 2006. Late prehistoric and early historic abundance of Columbian white-tailed deer, Portland Basin, Washington and Oregon, USA. Journal of Wildlife Management 70:278–282	i
Maclachlan, N.J., Zientara, S., Wilson, W.C., Richt, J.A., and Savini, G. 2019. Bluetongue and epizootic hemorrhagic disease viruses: recent developments with these globally re-emerging arboviral infections of ruminants. Current Opinion in Virology 34: 56-62.	i
Marcoe, K.E., N. Peha. 2018. Lower Columbia Estuary Partnership Sea Level Rise Impacts Study: Summary of Results. Lower Columbia Estuary Partnership. Portland, Oregon.	vi
McGewan, S. 2008. Magical Willow Grove. in Trust Talk, Columbia Land Trust Newsletter, Volume 15, Issue 3, 8 pp.	viii
Meyers, P. 2012a. Report of Activities for Columbian white-tailed deer, Recovery Subpermit WNWR-9, Calendar Year 2012. U.S. Fish and Wildlife Service, Cathlamet, Washington.	vi
Meyers, P. 2012b. Columbian white-tailed deer Population and Fawn Recruitment in Winter 2011–2012. Final Report. U.S. Fish and Wildlife Service, Cathlamet, Washington.	vi
Miller, K. V., L. I. Muller, S. Demarais. 2003. White-tailed deer (*Odocoileus virginianus*). Pages 906-930 *in*: G. A. Feldhamer, B. C. Thompson, Chapman, J. A., Editors. Wild Mammals of North America: Biology, Management, and Conservation. 2nd edition. Johns Hopkins University Press, Baltimore, Maryland.	i
Miller, P.S., S. Jonker, S. Sullivan, J. Copsey, and K. Goodrowe (eds.) 2020. Columbian White Tailed Deer (Odocoileus virginianus leucurus) Columbia River Distinct Population Segment: Population and Habitat Viability Assessment. Apple Valley, MN: IUCN/SSC Conservation Planning Specialist Group.	iii
ODFW (Oregon Department of Fish and Wildlife). 2018. Southwest Area: Identifying Columbian white-tailed and black-tailed deer. Retrieved from https://myodfw.com/articles/identifying-columbian-white-tailed-and-black-tailed-deer on 2021 December 17.	viii
ODFW. 2015. Oregon Big Game Regulations. Salem, Oregon.	v
ODFW. 1995. Backgrounder: The Columbian white- tailed deer and the Oregon Endangered Species Act. Salem Oregon.	viii
Phillips, G. E. 2009. Modeling population dynamics and coyote control for Columbian White-tailed Deer at the Julia Butler Hansen Refuge. U. S. Department of Agriculture Animal and Plant Health Inspection Service Wildlife Service's National Wildlife Research Center Submitted to the U.S. Fish and Wildlife Service. 36 pp.	vi
Piaggio, A., and M. Hopken. 2009. Evolutionary relationships and population genetic assessment of Oregon white-tailed deer. USDA/APHIS/WS/National Wildlife Research Center Report, Fort Collins, Colorado.	vi
P.C. Trask and Associates. 2017. Tenasillahe Island Levee Removal and Tidal Surge Plain Reconnection. Document # ERTG 2017-XX. 28 pp.	viii
Ricca, M. A. 1999. Movements, habitat associations, and survival of Columbian white-tailed deer in western Oregon. M.S. Thesis, Oregon State University, Corvallis. 129 pp.	i
Ricca, M. A., R. G. Anthony, D. H. Jackson, and S. A. Wolfe. 2002. Survival of Columbian White- Tailed Deer in Western Oregon. The Journal of Wildlife Management	i

Ricca, M. A., R. G. Anthony, D. H. Jackson, and S. A. Wolfe. 2003. Spatial use and habitat associations of Columbian white- tailed deer fawns in southwestern Oregon. Northwest	i
Smith, W.P. 1981. Status and Habitat Use of Columbian white-tailed deer Douglas County, Oregon.. Dissertation. Oregon State University, Corvallis, Oregon.	i
Smith, W. P. 1985. Current geographic distribution and abundance of Columbian white-tailed deer, Odocoileus virginianus leucurus (Douglas). Northwest Science 59(4):243-251.	i
Smith, W. P. 1991 Odocoileus virginianus. Mammalian Species. Number 388.	i
Smith, W. P., and B. E. Coblentz. 2010. Cattle or sheep reduce fawning habitat available to Columbian white-tailed deer in western Oregon. Northwest Science 84 (4):315-326.	i
Sparrowe, R. D., and P. F. Springer. 1970. Seasonal activity patterns of white-tailed deer in South Dakota. Journal of Wildlife Management 34:420-431.	i
Suring, L. H. 1974. Habitat use and activity patterns of the Columbian white-tailed deer along the lower Columbia River. Thesis, Oregon State University, Corvallis, Oregon.	i
Suring, L. H., and P. A. Vohs, Jr. 1979. Habitat use by Columbian white-tailed deer. Journal of Wildlife Management 43:610-619.	i
U.S. Census Bureau. 2021a. 2020 Population and Housing State Data. Retrieved from https://www.census.gov/library/visualizations/interactive/2020-population-and-housing-state-data.html on 2021 December 3.	vi
U.S. Census Bureau. 2021b. City and Town Population Totals: 2010-2020. Retrieved from https://www.census.gov/programs-surveys/popest/technical-documentation/research/evaluation-estimates/2020-evaluation-estimates/2010s-cities-and-towns-total.html on 2021 December 3.	vi
USFWS (U.S. Fish and Wildlife Service). 1983. Revised Columbian white-tailed deer recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 86 pp	v
USFWS. 1992. Julia Butler Hansen Refuge for the Columbian white-tailed deer annual narrative report. U.S. Fish and Wildlife Service. Department of the Interior, Cathlamet, Washington.	viii
USFWS. 1997. Julia Butler Hansen National Wildlife Refuge predator management plan and environmental assessment. Julia Butler Hansen National Wildlife Refuge. Cathlamet, WA.	vi
USFWS. 1998. Management of coyotes at the Julia Butler Hansen Refuge for the Columbian Whitetailed Deer. Supplemental Environmental Assessment. United States Fish and Wildlife Service, Cathlamet, Washington.	vi
USFWS. 2000. Annual report of activities and request for amendment, recovery subpermit WNWR-3. U.S. Fish and Wildlife Service. Department of the Interior, Ilwaco, Washington. 12 pp.	vi
USFWS. 2003. Final Rule to Remove the Douglas County Distinct Population Segment of Columbian white-tailed deer From the Federal List of Endangered and Threatened Wildlife. Federal Register 68(142):43647 -43659.	v
USFWS. 2004. Environmental Assessment for Control of Elk on the Julia Butler Hansen Refuge for the Columbian white-tailed deer. U.S. Fish and Wildlife Service. Cathlamet, Washington. 58 pp.	v
USFWS. 2005. 2004 Report of activities permit WNWR-6: Establish a second new subpopulation of Columbian white-tailed deer. U.S. Fish and Wildlife Service. Department of the Interior, Ilwaco, Washington. 13 pp.	vi
USFWS. 2010. Lewis and Clark National Wildlife Refuge and Julia Butler Hansen Refuge for the Columbian white-tailed deer: final comprehensive conservation plan and environmental impact statement. U.S. Fish and Wildlife Service, Department of the Interior, Ilwaco, Washington. 557 pp.	v
USFWS. 2013a. Columbia River distinct population segment of the Columbian white-tailed deer (*Odocoileus virginianus leucurus*). Five-year review: summary and evaluation. U.S. Fish and Wildlife Service, Lacey, Washington.	v
USFWS. 2013b. Species fact sheet: Columbian white-tailed deer (*Odocoileus virginianus leucurus*). Accessed October 5, 2015. Available online at: http://www.fws.gov/oregonfwo/Species/Data/ColumbianWhiteTailedDeer	viii

USFWS. 2013c. Proposed translocation of deer from the Julia Butler Hansen Refuge for the Columbian white-tailed deer and Puget Island to Ridgefield National Wildlife Refuge and Cottonwood Island. U.S. Fish and Wildlife Service. Department of the Interior, Julia Butler Hansen Refuge for the Columbian white-tailed deer and Ridgefield National Wildlife Refuge, Wahkiakum, Cowlitz, and Clark counties, Washington. 37 pp.	viii
USFWS. 2013d. Biological opinion on the effects of issuing recovery permits related to the translocation of the endangered Columbian white-tailed deer from the Julia Butler Hansen National Wildlife Refuge to the Ridgefield National Wildlife Refuge and from Puget Island, Washington to Cottonwood Island, Washington. FWS Reference Number 01EOFW00-2013-F-0086. Portland, Oregon.	viii
USFWS. 2014. Final Environmental Assessment: Proposed Translocation of Columbian white-tailed deer from Puget Island to Ridgefield National Wildlife Refuge and Julia Butler Hansen Refuge. Cathlamet, Washington. 40 pp.	v
USFWS. 2015. Endangered and Threatened Wildlife and Plants; Reclassifying the Columbian white-tailed deer from Endangered to Threatened with a Rule Under Section 4(d) of the Act. Federal Register 80(195): 60850-60871.	v
USFWS. 2016a. Endangered and Threatened Wildlife and Plants; Reclassifying the Columbia River Distinct Population Segment of the Columbian white-tailed deer as Threatened with a Rule Under Section 4(d) of the Act. Federal Register 81(200): 71386- 71410.	v
USFWS. 2017. 2017 Columbian White-tailed Deer FLIR Human Trials, Final Report. Julia Butler Hansen National Wildlife Refuge Willapa National Wildlife Refuge Complex. Cathlamet, Washington. 8pp.	vi
USFWS. 2019. Columbian white-tailed deer Population and Fawn Recruitment, 2017–2019. Final Report. U.S. Fish and Wildlife Service, Cathlamet, Washington.	vi
USFWS. 2021. Columbian white-tailed deer Population and Fawn Recruitment, 2020–2021. Final Report. U.S. Fish and Wildlife Service, Cathlamet, Washington.	vi
USFWS. In Prep. Columbian white-tailed deer Population and Fawn Recruitment, 2021–2022. Final Report. U.S. Fish and Wildlife Service, Cathlamet, Washington.	vi
Verme, L. J., and D. E. Ullrey. 1984. Physiology and nutrition. Pages 91-118 *in* R. E. McCabe and L. R. Jahn, Editors. White-tailed Deer Ecology and Management. Stackpoll Books Press, Harrisburg, Pennsylvania.	
Vesely, D. G., and D. K. Rosenberg. 2010. Wildlife Conservation in the Willamette Valley's Remnant Prairie and Oak Habitats: A Research Synthesis. Oregon Wildlife Institute, Corvallis, Oregon.	vi
Washington State Department of Commerce. 2021. Growth Management Services Periodic Update Schedule.	v
WDFW (Washington Department of Fish and Wildlife). 2019. Mount Saint Helens Wildlife Area Management Plan. Wildlife Program, Olympia, Washington.	ii
WDFW. 2008. Priority Habitat and Species List. Olympia, Washington.	iii
WDFW. 2013. Threatened and Endangered Wildlife in Washington: 2012 Annual Report. Listing and Recovery Section, Wildlife Program, Washington Department of Fish and Wildlife, Olympia. 251 pp.	iii
WDFW. 2021. Chronic Wasting Disease webpage. Accessed November 24, 2021. Available online at: https://wdfw.wa.gov/species-habitats/diseases/chronic-wasting.	viii
WDFW. Unpublished GIS Data. GIS project file displaying an overlay of public and private landowner parcel data within the range of the Columbia River population of Columbian white-tailed deer. Map project developed by Jeff Azerrad in 2021.	vi

WSDOT (Washington State Department of Transportation). 2016. Columbian white-tailed deer (*Odocoileus virginianus leucurus*) habitat connectivity analysis. WSDOT Olympia, Washington. 34 pp.	viii
Whitney, L. W. 2001. Ecological relationships between Columbian white-tailed and black-tailed deer in southwest Oregon. M.S. Thesis, Oregon State University, Corvallis. 106 pp.	i
Whitney, L. W., R. G. Anthony, and D. H. Jackson. 2011. Resource partitioning between sympatric Columbian white-tailed and black-tailed deer in western Oregon. The Journal of Wildlife Management 75:631-645.	i

PERSONAL COMMUNICATIONS

Jeffrey Azerrad
Environmental Planner
Washington Department of Fish and Wildlife
Ridgefield, Washington

Dr. Julia Burco
Wildlife Veterinarian
Oregon Department of Fish and Wildlife
Corvallis, Oregon

Alex Chmielewski
Refuge Biologist
Ridgefield National Wildlife Refuge
Ridgefield, Washington

Eric Holman
District Wildlife Biologist
Washington Department of Fish and Wildlife
Ridgefield, Washington

Paul Meyers Refuge
Biologist
Julia Butler Hansen NWR Cathlamet,
Washington

Jennifer Siani
Recovery Coordinator
U.S Fish and Wildlife Service
Portland, Oregon

WASHINGTON STATE STATUS REPORTS, PERIODIC STATUS REVIEWS, RECOVERY PLANS, AND CONSERVATION PLANS

Periodic Status Reviews

2021 Ferruginous Hawk
2021 Stellar Sea Lion
2021 Gray Whale
2021 Humpback Whale
2021 Greater Sage-grouse
2020 Mazama Pocket Gopher
2019 Tufted Puffin
2019 Oregon Silverspot
2018 Grizzly Bear
2018 Sea Otter
2018 Pygmy Rabbit
2017 Fisher
2017 Blue, Fin, Sei, North Pacific Right, and Sperm Whales
2017 Woodland Caribou
2017 Sandhill Crane
2017 Western Pond Turtle
2017 Green and Loggerhead Sea Turtles
2017 Leatherback Sea Turtle
2016 American White Pelican
2016 Canada Lynx
2016 Marbled Murrelet
2016 Peregrine Falcon
2016 Bald Eagle
2016 Taylor's Checkerspot
2016 Columbian White-tailed Deer
2016 Streaked Horned Lark
2016 Killer Whale
2016 Western Gray Squirrel
2016 Northern Spotted Owl
2016 Snowy Plover

Conservation Plans

2013 Bats

Recent Status Reports

2021 Oregon Vesper Sparrow
2019 Pinto Abalone
2017 Yellow-billed Cuckoo
2015 Tufted Puffin
2007 Bald Eagle
2005 Aleutian Canada Goose
1999 Northern Leopard Frog
1999 Mardon Skipper
1999 Olympic Mudminnow
1998 Margined Sculpin
1998 Pygmy Whitefish
1997 Aleutian Canada Goose

Recovery Plans

2020 Mazama Pocket Gopher
2019 Tufted Puffin
2012 Columbian Sharp-tailed Grouse
2011 Gray Wolf
2011 Pygmy Rabbit: Addendum
2007 Western Gray Squirrel
2006 Fisher
2004 Sea Otter
2004 Greater Sage-Grouse
2003 Pygmy Rabbit: Addendum
2002 Sandhill Crane
2001 Pygmy Rabbit: Addendum
2001 Lynx
1999 Western Pond Turtle

Status reports and plans are available on the WDFW website at: http://wdfw.wa.gov/publications/search.php