

**US Department of Agriculture Forest Service
Pacific Northwest Research Station
Olympic Peninsula Spotted Owl Demography Study
2016 Annual Report
March, 2017**

1. Title

Demographic Characteristics of Northern Spotted Owls (*Strix occidentalis caurina*) in the Olympic National Forest, Washington, 1987-2016.

2. Principal Investigator and Research Team

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3. Introduction

Background and potential benefits and utility of the study

This study was designed in conjunction with a simultaneous Olympic National Park study to document long-term information on the demographic structure and functioning of northern spotted owls of the Olympic Peninsula in Washington State (e.g., Gremel 2016). This document reports the results of surveys conducted by the Pacific Northwest Research Station on the Olympic National Forest. Together the Olympic National Park and Olympic National Forest studies compose the Olympic Peninsula Demographic Study Area. While the data collected annually are important incremental data on changes in population structure, the study also contributes to larger regional efforts as one of eight long-term demographic studies that constitute the federal monitoring program for the northern spotted owl under the Effectiveness Monitoring Program for the Northwest Forest Plan (Lint et al. 1999). These demographic studies are designed to document vital rates and population trends of spotted owls on federal lands in the Pacific Northwest. During regional meta-analyses that occur every 5 years, data collected from these individual studies are combined to derive inferences regarding the effects of regional and biological covariates on the population (Forsman et al. 1996, Franklin et al. 1999, Anthony et al. 2006, Forsman et al. 2011, Dugger et al. 2016).

Study Objectives

The primary study objectives are to estimate demographic rates, population trends, population age structure, reproductive rates, and over the longer term, survival rates of spotted owls in the Olympic Peninsula Demography Study Area. A secondary study objective is to estimate changes in occupancy of barred owls (*Strix varia*) within territories that were historically occupied by spotted owls.

4. Study Area

The Olympic National Forest study area (94,800 ha) consists of 40 spotted owl sites located on the Pacific (n=19) and Hood Canal (n=21) Ranger Districts of the Olympic National

Forest that have been surveyed each year for spotted owls since 1991 (Fig. 1) as well as adjacent non-demography sites which have been monitored opportunistically or when owls have been detected on adjacent surveys. The Pacific Ranger District lies west of Olympic National Park, and the Hood Canal lies east. The park includes 128,000 ha and is surveyed annually by the National Park Service (e.g., Gremel 2016). This report details the 40 long-term demography sites for the Olympic National Forest.

5. Methods

Survey design and field methods

Field and data collection methods used in this study have been described in a variety of sources and will be briefly recounted here (Franklin et al. 1996, Reid et al. 1999, Lint et al. 1999, Anthony et al. 2006). Each historical spotted owl territorial site is completely surveyed ≥ 3 times each year using standardized protocols to document residence and nesting status and reproductive success of all spotted owls detected within the study area (Franklin et al. 1996, Lint et al. 1999). A combination of daytime searches and nighttime call/response surveys are used to assess territory occupancy with a goal of 100% coverage of potential habitat within each site. Daytime searches target historic activity centers and associated high quality habitat in search of physical evidence and visual confirmation and identification of resident owls. Nighttime call/response audio surveys are conducted to provide complete coverage of the potential habitat within the territory and surrounding areas. Estimated locations of all *Strix* sp. owls detected are recorded and locations of night spotted owl detections are revisited during the day to confirm identity of the individuals and reproductive status. All captured spotted owls are marked with color band and US Fish and Wildlife Service numeric bands so that they can be identified visually, i.e., resighted. All spotted owl surveys and captures are conducted under USDI Fish and Wildlife Service recovery permit TE-026280-11, Washington State Scientific collection permit 10-139, master banding permit 21249, and Oregon State University Animal Care and Use Permit 3628.

Analytical methods

We calculate annual rates of naïve occupancy as the proportion of territories occupied by territorial spotted owls (i.e. excluding non-territorial owls and individuals of unresolved status). Reproductive statistics include the number of nest attempts confirmed and proportions of territories producing nestlings/fledglings. We also quantify barred owl presence at historic spotted owl territories. Capture and resighting histories of banded owls are used to estimate apparent annual survival, and apparent survival and recruitment are used to estimate the rate of population growth during a larger meta-analysis conducted every five years (Pradel 1996, Anthony et al. 2006, Forsman et al. 2011, Dugger et al. 2016).

6. Results

Population trends

From 1987 through 1998 approximately 79% of monitored sites were occupied (Fig. 2). After a sudden drop in 1999 only 35% retained owls. Although the proportion of sites occupied increased again for a few years to a high of 55% in 2001, the overall decline continued and since 2001 the rate of residency has never again exceeded 50%. Since 2007 residency has not

exceeded 20%. The lowest residency rates thus far measured occurred in 2014 when owls were detected in only 13% of territories (Fig. 2).

Occupancy

During the 2016 field season, we conducted 170 complete surveys to 40 historical demography study survey areas (mean complete surveys per site = $4.5 + 0.2$ SE). We detected spotted owls at 22.5% of sites. Additional surveys were conducted at 11 non-demography sites one of those was occupied by a pair of non-reproducing owls.

Numbers of owls detected

The total number of owls detected on demography study sites ($n = 14$; 12 after hatch year, 2 hatch year) declined by three from 2015 to 2016 (Table 1). In 2015 all birds were second year or greater, while in 2016 two individuals were young of the year (Table 2). Of the 14 owls we detected, 3 pairs, 1 single male, and 1 single female were territorial at the sites where they were detected. Two of the paired locations produced a single juvenile each. Four owls (all males) were detected as non-territorial or unknown status according to the survey protocol (Table 1-2; Lint et al. 1999). Two males were detected as floaters at the same site, one in the early and one the late season.

Age Distribution

Ten owls observed in 2016 were previously banded individuals at least two years old, five males and five females. A two-year-old owl recaptured in 2016 was originally captured and banded in 2015. It was originally judged a female but feather wear was extensive. Upon recapture it was determined to be a male. Two owls of unknown age were detected aurally but not identified as banded birds, and two juveniles were observed out of the nest. One juvenile was banded in August but the second fledgling refused capture.

Number of sites with spotted owls

In total our 2016 surveys documented spotted owls at ten territories, nine of which are included in the historic demography study area. All three pairs detected in 2016 were also on territory in 2015. In a fourth territory with a pair detected in 2015 only the male was observed in 2016, and only on the first visit of the season (28 April). Males detected at two sites may have been the same males from previous years, but no visual observations were made to confirm. Two males detected at a territory in 2016 were not previously found at this location. One was a known historic male from an adjacent territory, and the second was banded in 2015 as a one-year-old several territories away.

Barred owls

The proportion of study sites in which we detected at least one barred owl increased from 55% in 2015 to 60% in 2016 (Figure 2). While this is not the highest detection rate we've experienced in the Olympic National Forest (Figure 2) it is indicative of the overall increase in barred owl detections since the population started increasing somewhat linearly in about 1999. Broken out by district, the Pacific District North had a higher rate (74% of territories) of barred owl detections than Hood Canal (48%).

Reproduction

The proportion of females nesting on the Olympic National Forest has varied from zero to around 90% in a few years (Table 4). In general, reproductive output has declined as the population of paired adults has declined. In 2016 only four females were located on demography study sites and one was found on an adjacent non-demography site. Three of the study population females and the non-demography female were paired, and only two of the study population pairs were confirmed nesting. Each of these attempts resulted in a single fledgling.

Nest tree characterization

Two nests were located during 2016. One nest was in an historic western hemlock (*Tsuga heterophylla*) used once previously, in 2006. The approximately 59 cm DBH tree is alive but in decline, with a broken bole at 15 m. The open topped nest is situated in the top of the broken bole. The second nest tree is a live, 146 cm DBH, approximately 145-foot-tall Alaska yellow cedar (*Cupressus nootkatensis*). The nest was located in a side cavity 125 feet above the ground. The area has 75% canopy cover and canopy dominants average > 300 years old.

Diet

We recovered only a single pellet during the 2016 season. The pellet remains included skull fragments from a half-grown snowshoe hare.

7. Discussion

Trends

The overall population declines previously observed on the Olympic Peninsula appear to continue. Measured fecundity is below that necessary to sustain a population long term, though we continue to document some successful reproduction and unbanded birds continue to appear on demography sites suggesting reproduction is also occurring on unmonitored locations. The continued increases in apparent barred owl site occupancy are disconcerting due to the potential negative impacts of this non-native competitor on spotted owl survival and productivity (Dugger et al. 2016).

Reduced timber operations could provide increases and improvements in habitat availability for spotted owls in the future as younger secondary forests regenerate mature structure. A habitat suitability bookend analysis comparing 1993 to 2012 habitat levels showed little effective change in habitat suitability on the Olympic Peninsula compared to other areas (Davis et al. 2016) thus any anticipated improvements in habitat suitability are occurring slowly and likely have had little impact thus far. An additional aspect of the Olympic Peninsula population differentiating it from other populations is the longer period of isolation from other core areas.

Summary

The Olympic Peninsula spotted owl population continues to decline despite attempts to reduce habitat loss and reverse long-term population trends. The isolation of the population inhibits the immigration of owls from other subpopulations and continuing encroachment by competing Barred Owls reduces local reproduction and successful recruitment of new breeders. Despite these facts a small population persists and the study continues to document low levels of productivity and the discovery of previously unknown individuals moving throughout the study

area. While the current long-term prospects for the population are not positive, the long lifespan of Spotted Owls suggests that the population will continue to exist for some time and as such provides critical information in the ongoing quest to understand species persistence and competitive interactions.

8. Acknowledgments

Numerous individuals and organizations over many years of study have contributed resources and feedback to the success of this project. The staff of the Pacific and Hood Canal Ranger Districts of the Olympic National Forest have provided information, support and housing. Scott Gremel and the Olympic National Park have freely shared information across ownership boundaries and have coordinated data collection efforts on territories common to both organizations. Katie Dugger and Ann Leen have proved invaluable for our biologists interfacing with Oregon State University and the Department of Fisheries and Wildlife. Ray Davis regularly provides necessary geospatial data and expertise. Jimmy Swingle was instrumental in the smooth transition of data, information, and historical context to the incoming crew leader.

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10. Tables

Table 1. Number of spotted owls detected per year on the Olympic National Forest, as part of the Olympic Peninsula Demography Study, 1987–2016. Data subdivided by spotted owl sex and age. ^aTotal does not include young of the year.

Year	Sites	Males			Females			Total ^a
		Adults	Subadults	Age unknown	Adults	Subadults	Age unknown	
1987	14	10	0	1	9	0	2	22
1988	20	11	2	2	12	0	1	28
1989	28	22	0	1	16	0	3	42
1990	36	20	2	2	26	0	2	52
1991	40	27	1	2	25	1	3	59
1992	40	29	3	2	30	2	1	67
1993	40	27	3	2	27	0	5	64
1994	40	27	0	6	30	1	1	65
1995	40	28	0	3	24	0	1	56
1996	40	26	1	2	26	0	0	55
1997	40	25	0	1	20	1	4	51
1998	40	26	1	3	22	1	4	57
1999	40	10	0	2	10	0	1	23
2000	40	21	1	0	13	0	3	38
2001	40	13	0	5	17	0	1	36
2002	40	14	0	5	11	0	2	32
2003	40	13	0	3	8	0	3	27
2004	40	13	0	1	12	1	2	29
2005	40	12	0	0	11	2	0	25
2006	40	8	0	1	6	0	1	16
2007	40	9	0	2	4	0	4	19
2008	40	11	0	0	10	0	3	24
2009	40	6	0	0	3	1	1	11
2010	40	5	1	2	6	0	2	16
2011	40	3	0	3	4	0	2	12
2012	40	3	0	3	4	0	3	13
2013	40	4	1	0	5	0	2	12
2014	40	5	0	0	5	0	0	10
2015	40	4	0	5	2	0	4	15
2016	40	5	0	3	4	0	0	12

Table 2. Number of spotted owl territories on the Olympic National Forest as part of the Olympic Peninsula Demography Study in which we located territorial pairs and singles, floaters, status uncertain, or no spotted owls, 1987–2016.

Year	Sites	Pairs	Singles	Floaters	Status uncertain	No owls
1987	14	9	3	0	0	2
1988	20	12	3	0	0	5
1989	29	19	4	0	0	6
1990	36	23	5	0	0	8
1991	40	24	5	2	2	7
1992	40	32	2	0	0	6
1993	40	28	6	0	0	6
1994	40	30	2	1	1	6
1995	40	22	9	0	1	8
1996	40	26	3	0	0	11
1997	40	20	6	1	1	12
1998	40	23	6	1	0	10
1999	40	6	9	0	1	24
2000	40	14	8	0	0	18
2001	40	15	4	1	2	18
2002	40	13	3	0	3	21
2003	40	8	6	0	4	22
2004	40	13	0	0	1	26
2005	40	11	2	0	1	26
2006	40	7	2	0	0	31
2007	40	4	7	0	3	26
2008	40	9	3	0	2	26
2009	40	3	2	0	3	32
2010	40	6	3	0	1	30
2011	40	2	4	0	3	31
2012	40	5	2	2	0	31
2013	40	4	3	0	0	33
2014	40	5	0	0	0	35
2015	40	4	1	0	5	30
2016	40	3	2	1	3	31

Table 3. Number of spotted owls banded on the Olympic National Forest as part of the Olympic Peninsula Spotted Owl Demography Study, 1987–2016. Non-fledglings are classified as adults (≥ 3 years) and subadults (S1 = 1 year and S2 = 2 years).

Year	Fledglings	Males			Females			Total
		Adults	S1	S2	Adults	S1	S2	
1987	0	15	2	1	15	0	0	33
1988	13	11	1	3	13	0	0	41
1989	46	22	1	0	25	0	1	95
1990	62	19	6	3	22	1	7	120
1991	31	17	5	3	15	2	2	75
1992	78	23	1	2	21	0	1	126
1993	0	15	1	1	12	1	1	31
1994	32	8	1	1	11	1	1	55
1995	0	13	3	1	2	0	0	19
1996	58	5	0	2	9	0	3	77
1997	25	2	0	1	6	1	0	35
1998	26	2	1	1	4	2	0	36
1999	0	0	0	0	1	0	0	1
2000	1	6	0	0	5	0	0	12
2001	26	2	1	0	7	1	0	37
2002	28	1	1	0	4	0	0	34
2003	0	5	1	0	1	1	0	8
2004	36	6	0	0	5	1	0	48
2005	1	1	2	0	3	3	3	13
2006	6	0	0	0	0	0	0	6
2007	0	1	0	0	1	0	0	2
2008	11	2	0	0	3	0	0	16
2009	0	0	0	0	0	0	1	1
2010	0	0	0	1	0	0	0	1
2011	1	0	0	0	1	0	0	2
2012	1	0	0	0	1	0	0	2
2013	0	0	0	0	0	0	0	0
2014	5	2	0	0	2	0	0	9
2015	0	0	0	0	0	1	0	1
2016	1	0	1	0	1	0	0	3

Table 4. Annual reproductive statistics for female spotted owls from the USDA Forest Service Pacific Northwest Research Station Olympic Peninsula Demography Study, 1987–2015. Sample size only includes females where protocols for nesting status or the number of young produced where met.

Year	Proportion of females that nested			Proportion of females that produced young			Proportion of nesting females that produced young		
	n	π	95% C.I.	n	π	95% C.I.	n	π	95% C.I.
1987	16	0.19	0.00–0.38	19	0.11	–0.03–0.24	3	0.67	0.13–1.20
1988	19	0.26	0.07–0.46	27	0.33	0.16–0.51	5	1.00	–
1989	20	0.40	0.19–0.61	39	0.67	0.52–0.81	8	1.00	–
1990	35	0.71	0.56–0.86	52	0.56	0.42–0.69	24	0.63	0.43–0.81
1991	46	0.41	0.27–0.56	53	0.34	0.21–0.47	19	0.79	0.61–0.97
1992	48	0.90	0.81–0.98	63	0.78	0.68–0.88	43	0.86	0.76–0.96
1993	51	–	–	54	0	–	0	–	–
1994	49	0.84	0.73–0.94	56	0.54	0.41–0.67	41	0.66	0.51–0.80
1995	35	–	–	36	–	–	0	–	–
1996	37	0.89	0.79–0.99	50	0.68	0.55–0.81	33	0.67	0.51–0.83
1997	34	0.5	0.33–0.67	45	0.36	0.22–0.50	17	0.76	0.56–0.97
1998	43	0.56	0.41–0.71	45	0.42	0.28–0.57	24	0.71	0.53–0.89
1999	10	–	–	12	–	–	0	–	–
2000	25	0.12	–0.01–0.25	30	0.03	–0.03–0.10	3	0.33	–0.20–0.87
2001	31	0.55	0.37–0.72	34	0.44	0.27–0.61	17	0.88	0.73–1.04
2002	29	0.76	0.60–0.91	30	0.5	0.23–0.54	22	0.68	0.49–0.88
2003	26	–	–	26	–	–	18	–	–
2004	32	0.78	0.64–0.93	32	0.75	0.60–0.90	25	0.84	0.70–0.98
2005	29	0.03	–0.03–0.10	29	0.03	–0.03–0.10	29	0.03	–0.03–0.10
2006	8	0.88	0.65–1.10	9	0.67	0.36–0.98	8	0.75	0.45–1.05
2007	7	–	–	0	–	–	0	–	–
2008	4	0.5	0.01–0.99	9	0.78	0.51–1.05	4	0.5	0.01–0.94
2009	6	–	–	6	–	–	0	–	–
2010	5	0.8	0.45–1.15	5	–	–	5	–	–
2011	4	–	–	4	–	–	–	–	–
2012	6	–	–	6	0.33	n0.04–0.71	5	0.2	n0.15–0.55
2013	2	–	–	0	–	–	–	–	–
2014	6	0.83	0.53–1.13	6	0.67	0.29–1.04	5	0.8	0.45–1.15
2015	2	–	–	0	–	–	0	–	–
2016	2	0.5	0.01–0.99	2	0.5	0.01–0.99	2	1	–

11. Figures

Figure 1.

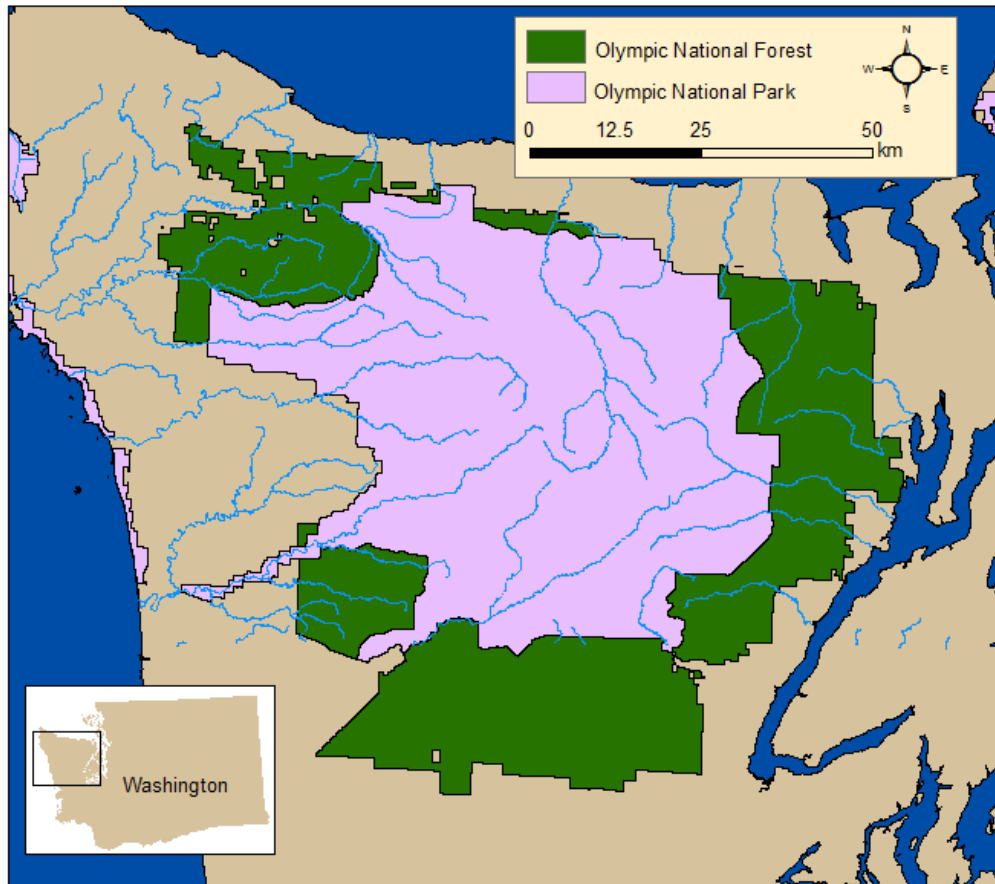


Figure 1. USDA Forest Service Pacific Northwest Research Station spotted owl demography study area. Olympic National Park spotted owl monitoring conducted by NPS. Map insert outlines study area within Washington State.

Figure 2.

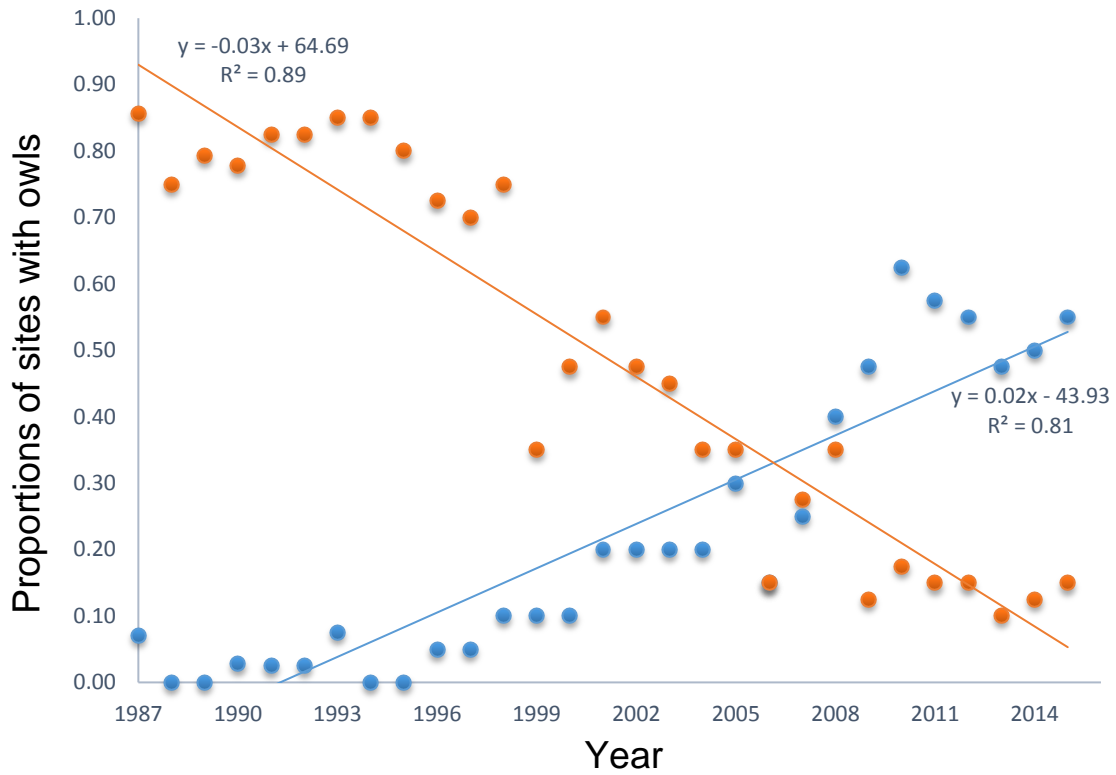


Figure 2. Proportion of monitored owl territories ($n = 40$) with detection of ≥ 1 spotted owls (red dots) and ≥ 1 barred owl (blue dots) on the USDA Forest Service Pacific Northwest Research Station Olympic Peninsula spotted owl demography study area, 1987-2016.

12. Publications, Presentations, and Data Transfer

Publications

- a. Lesmeister, D., Sovern, S., Davis R. & Pruett, S. (2017). LiDAR-based canopy cover measurement of Northern Spotted Owl activity centers. In prep.

Data Transfer

- a. S. Pruett attended a meeting and presentation on the use of LIDAR data in habitat suitability modeling at the Roseburg BLM District office (July 2016).
- b. S. Pruett attended two meetings in preparation of updating long-term data structure and accessibility across all collaborative research on Northern spotted owls at Oregon State University (Nov. 2016).

13. Interesting Observations and Problems Encountered

Problems encountered

Lack of maintenance and road closures in the Olympic National Forest continue to complicate access to historic study areas. Reduced accessibility increases approach and exit time which reduces time spent onsite and often inhibits multiple site visits during one outing. Concerns for safety increase as access routes become overgrown and potential for fatigue-induced personal injury or property damage increases with longer periods in the field.

Decreased detection of Spotted Owls has resulted in an increase in the numbers of both nocturnal aural surveys and daytime core habitat visits necessary to confirm territory vacancy. During mild periods the workload remains largely manageable, however inclement weather conditions caused some difficulty in completing survey protocol on schedule. Crew flexibility ensured that all site visits occurred in reasonable time frame and met expectations of site closure as much as possible.

14. No Appendices