4.4.3 Analysis of the Northern Spotted Owl Conservation Strategy for the Olympic Experimental State Forest

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Affected Environment

The effectiveness with which the No Action, Zoned Forest, and Unzoned Forest alternatives address current and likely future threats to the viability of spotted owls on the Olympic Peninsula are a basis for evaluating these alternatives. Thus, it is necessary to understand current and likely future threats, how those threats are manifest (i.e., the information used to establish qualitative or quantitative measures of the threats), and how the three alternatives will address those threats in order to develop this evaluation. This section provides a brief summary and discussion of the current understanding of threats to spotted owls on the Olympic Peninsula, and information that can be used to evaluate those threats.

Threats to Owls on the Olympic Peninsula

There have been two major discussions and analyses of threats to the viability of spotted owls on the Olympic Peninsula, one presented by the recovery team in the federal Draft Recovery Plan for the Northern Spotted Owl (USDI 1992a), the other by the Reanalysis Team (Holthausen et al. 1994). These two teams discussed essentially the same risk factors, but used different approaches and information bases for their analyses. Many of the recovery team's interpretations were based on radio-telemetry and banding studies, conducted mostly on the Olympic National Forest between 1987 and 1991, and projections based on those data and then-current policies. The Reanalysis Team's interpretations were based on those data, plus 3 more years of banding studies that were expanded into Olympic National Park, extensive sampling of Olympic National Park that enabled a much better population estimate for that area, and an intensive radio-telemetry study of juvenile dispersal and survival. They used sophisticated computer modeling, a program that simulated spotted owl life histories in response to actual and hypothetical landscape conditions on the Olympic Peninsula, to project responses of the owl population to different sets of assumptions and habitat conditions. Their projections for changes to habitat conditions in the future were developed under a substantially different federal forest management policy (USDA and USDI 1994b).

The recovery team identified low population levels, declining populations, poor population distribution, habitat loss, population isolation, and natural disturbances as major threats to the viability of owls on the Olympic Peninsula. They estimated a population of 200, plus or minus 25 pairs, that was declining at an annual rate of 12 percent. They characterized the current distribution of owls as a "doughnut" with owls largely restricted to the mid-elevation forests on mainly federal lands because timber harvests on lower elevation, mostly nonfederal lands had largely eliminated their capability as habitat. And, they expected that habitat loss due to timber harvest would continue at high rates under then-current management regimes. They presumed that the isolation of the Olympic Peninsula sub-population from other reproductive owls placed it at risk of extinction or inbreeding if catastrophic or stochastic events caused it to decline severely. Catastrophic fire and/or wind were predicted under a worst-case scenario to be able to reduce the habitat capability by up to 30 percent over 100 years (USDI 1992a).

Holthausen et al. (1994) presented different interpretations of risks to the viability of spotted owls on the Olympic Peninsula than did the recovery team (USDI 1992a). They estimated a population size of 282 or 321 pairs, depending on which set of assumptions they used. They cautiously estimated that the population was stable. Their evaluations of risk to the Olympic Peninsula sub-population posed by the spatial and ecological distribution of habitat generally concurred with those of the recovery team. They concluded that it was unlikely that owls would continue to occupy coastal lowlands in the OESF area without habitat on nonfederal land. The current plans for management of the Olympic National Forest have established large reserves in which owl habitat will be maintained and/or restored (USDA and USDI 1994a). In light of these management plans for federal lands, Holthausen et al. (1994) concluded that "...it is likely, but not assured, that a stable population would be maintained on portions of the Olympic National Forest and the core area of the national park in the absence of any nonfederal contribution of habitat."

Holthausen et al. (1994) also evaluated the risks to viability of the sub-population posed by its isolation. They simulated the effects of establishing a significant (370,500 acres of high-quality habitat) chain of small reserves connecting owls in the southern Cascades and Olympic Peninsula. They concluded that these connecting reserves had little effect on the stability of the sub-population; in other words, isolation appeared not to be as serious a threat as the recovery team (USDI 1992a) thought. Based on their analyses, Holthausen et al. (1994) suggested that the total area managed for habitat on federal lands on the Olympic Peninsula is large enough that an otherwise stable population of owls would be robust to large-scale disturbances.

An additional threat that both groups identified but could not quantify is the risk that barred owls (*Strix varia*) could outcompete spotted owls for limited resources, thus excluding them from otherwise suitable habitat.

Size of the Olympic Peninsula Owl Population

The most up-to-date and rigorous estimate of the number of spotted owl pairs on the Olympic Peninsula was provided by Holthausen et al. (1994). They used three sources of data for their estimate: extrapolations from the WDFW interagency spotted owl database for DNR-managed, private, and tribal lands (a nearly complete inventory of territorial owls); extrapolations from nearly complete inventories of territorial owls conducted by the USFS Pacific Northwest Research Station since 1987 on the Olympic National Forest (Forsman 1992a); and estimates of density for Olympic National Park based on extrapolating from the density of territories located in randomly selected sample areas (Seaman et al. 1992). The Olympic National Park density estimates are the results of preliminary analyses, and await incorporation of data from the 1995 field season and further statistical analysis to refine the point estimate and develop confidence intervals for the estimate.[1] Holthausen et al. (1994) used two sets of assumptions to develop two

[1] Seaman (1995) reported results of completed analyses of Olympic National Park owl surveys. He estimated 229 owl pairs with a 90 percent confidence interval of 158-300 pairs. Combining his estimate with the two sets of assumptions of Holthausen et al. (1994) results in a revised estimate of 267-448 spotted owl pairs for the Olympic Peninsula.

estimates for the numbers of owl pairs on the Olympic Peninsula: a lower estimate derived by adding the known pairs (and, at least for DNR-managed lands, sites at which pairs had been observed in the past) on Olympic National Forest and DNR-managed lands to the estimated numbers in Olympic National Park; and a higher estimate derived by adding the known pairs and other sites where owls had been located but pairs not documented on Olympic National Forest and DNR-managed lands to the estimated numbers in Olympic National Park. Thus, they estimated either 282 or 321 pairs of spotted owls on the Olympic Peninsula.[2] This is substantially more pairs than previously estimated. For example, Thomas et al. (1990) estimated a population of 177 pairs, and the recovery team (USDI 1992a p. 41, 144) variously estimated 175 to 225 pairs and 175 to 200 pairs.

Trends in the Olympic Peninsula Owl Population

Burnham et al. (1994) used data from banding studies between 1987 and 1993 to estimate the rate of change in the population of resident female owls on the Olympic Peninsula (the population of resident females ultimately equates to the entire population because they produce the juveniles that maintain the population). They estimated the annual rate of population change (λ) for the Olympic Peninsula using: estimates of the annual probabilities of subadult and adult female survival; fecundity rates, i.e., the rates at which subadult and adult female owls produce female hatchlings; and, the "apparent" probability that juvenile female owls would survive 1 year (ϕ). They estimated that, during the period 1987 to 1993, the population of resident female owls on the Olympic Peninsula declined at a rate of 5.3 percent per year (standard error 2.6 percent).

Adult survivorship

Survival rates are estimated based on annual re-observation of banded owls. Simulation modeling suggests that the survival rate of adult females is the aspect of spotted owl life history that most strongly influences rates of population change (Noon and Biles 1990). Estimates of adult female survival probabilities average 0.844 plus or minus 0.005 across the owl's range, and 0.862 plus or minus 0.017 for the Olympic Peninsula sub-population (Burnham et al. 1994). While their meta-analysis of survival rates across the range of the owl indicated that survival rates were declining, they found that these rates did not change during the study on the Olympic Peninsula. Survival rates for males may be higher; Forsman (1992b) estimated annual survival probabilities for Olympic Peninsula males at 0.893 plus or minus 0.026 for the period 1987-1992.

Fecundity

Average annual fecundity rates from 11 geographically distinct study areas varied from 0.231 to 0.565; the median value was 0.323 (Burnham et al. 1994). Annual fecundity in the Olympic Peninsula study area was 0.380, or 0.76 young per pair per year. There is considerable annual variation in reproductive effort within and among sub-populations of spotted owls, and among individual owl pairs within years, e.g., Forsman et al. (1984) observed nesting in 16-89 percent ($\bar{x}$ = 62 percent) of pairs during a 5-year study in

[2] Ibid.

Oregon. Annual variation in fecundity in seven geographically distinct areas with at least 5 years of study ranged from 0.3 percent to 13.4 percent (coefficient of variation, median = 5.6 percent, see Thomas et al. 1993 Table 4-3). Annual variation in fecundity of the Olympic Peninsula sub-population was third highest, coefficient of variation = 10.2 percent. Reproductive rates of owls on the Olympic Peninsula thus seem to be consistent with those observed elsewhere in the species' range, but annual variability in reproduction is relatively high.

Juvenile dispersal

Spotted owls leave their natal territories after their first summer. This dispersal appears to be innate (Howard 1960), and may function to maintain the species' distribution in available habitat and maintain genetic diversity among sub-populations (Howard 1960; Greenwood and Harvey 1982). Early studies of dispersing juvenile owls used backpack-mounted radio-transmitters (Forsman et al. 1984; Guttièrez et al. 1985; Miller 1989) or relied on re-observations of owls banded as fledglings (Forsman 1992a) to track their movements and survival. These studies provided information on the directions and distances of movement, habitat associations, and survival rates. However, there is evidence that the relatively large, backpack-mounted radio-tags influenced survival (Paton et al. 1991) and reproduction (Paton et al. 1991; Foster et al. 1992) of adult owls (with the inference that they may have influenced behavior and survival of juveniles as well), and that emigration of banded owls from study areas causes underestimates of survival (Forsman 1992b).

Dispersing juvenile owls in three study areas from the 1991 (Miller et al. 1992) and 1992 cohorts (Forsman 1992b) were radio-tagged with much smaller transmitters mounted on their tail feathers (a new system with presumably less effect on their behavior). These studies are beginning to provide important, additional information on habitat relationships, dispersal distances, rates of emigration, and survival probabilities. Preliminary estimates of first-year dispersal distances ($\bar{x}$ = 15.12 plus or minus 0.98 miles) of 111 juveniles from the Olympic Peninsula and the east slope of the Cascade Range (E. D. Forsman, USFS, Corvallis, OR, pers. commun., 1995) are similar to those reported by earlier radio-telemetry studies (Guttièrez et al. 1985; Miller 1989). Dispersal distances for 31 juveniles on the Olympic Peninsula ranged from 5.39 to 36.20 miles, and averaged 15.05 plus or minus 1.58 miles (E. D. Forsman, USFS, Corvallis, OR, pers. commun., 1995). In the four known cases of dispersal to and/or from DNR-managed land in the OESF, owls banded as fledglings were recaptured 9, 14, 18, and 30 miles from their natal sites as adult or subadult members of pairs.

Juvenile survivorship and estimating the rate of population change

There are several sources of bias in the Burnham et al. (1994) estimate of λ, the most serious of which is the negative bias introduced by using estimates of ϕ, the "apparent" rate of juvenile survival (Burnham et al. 1994; Holthausen et al. 1994; Bart 1995). Burnham et al. (1994) attempted to account for this bias while examining their hypothesis that the population was declining. They calculated that the juvenile survival rate needed to be 0.413 for a stable Olympic Peninsula sub-population (Burnham et al. 1994 Table 9), which when compared to their estimate of ϕ (0.245, Burnham et al. 1994 Table 5) suggests that their conclusion of a declining population was correct. Then, to correct ϕ, they estimated emigration rates *E*, based on radio-telemetry studies of juvenile owls in the Roseburg, Oregon area and on the Olympic Peninsula and used those rates to estimate the "true" juvenile survival probability (*S*). They estimated *S* for all study areas combined (11 areas across the range of the northern spotted owl) as 0.377 (standard error 0.060) and produced a less biased estimate of λ across all 11 study areas of 0.916 to 0.993.

However, Burnham et al. (1994) did not continue their analyses to the point of estimating adjusted *S* and the resultant λ for the Olympic Peninsula. But, using their data and available methods, it is possible to do so (methods and calculations are summarized in Appendix D). Using the data and methods of Burnham et al. (1994), $S = 0.358$, with a 95 percent confidence interval of 0.147 to 0.645 (Appendix D). Comparing that range to the value needed to result in a stable Olympic Peninsula sub-population ($S = 0.413$, Burnham et al. 1994 Table 9) suggests that their analysis failed to support their hypothesis that the Olympic Peninsula sub-population is declining. In fact, solving for λ using that estimate and range of *S* results in $\lambda = 0.984$, with lower and upper estimates of 0.915 and 1.068 for the Olympic Peninsula sub-population.

Furthermore, Burnham et al. (1994) argued that they did not have area-specific estimates of emigration rates, and thus could not derive area-specific, adjusted juvenile survival rates. But the *E* they used was derived by averaging over two study areas in which the estimates differ markedly (13/57 = 0.228 Roseburg, OR; 11/19 = 0.579 Olympic Peninsula, Burnham et al. 1994). These areas are profoundly different in the degree to which owls are able to disperse from them to areas inaccessible to normal re-observation techniques. Roseburg is entirely commercial forest lands, accessible by road throughout, and mostly surrounded by other study areas. In contrast, almost half of the owl habitat on the Olympic Peninsula study area is in Olympic National Park which is nearly roadless and extremely difficult to survey for owls. No other study areas border the Olympic Peninsula. Thus, while Holthausen et al. (1994) correctly note that the area-specific *E* and *S* should be viewed with caution because few data were used to derive them (they used a study of 35 owls over 2 years, one of which had an exceptionally mild winter that may have favored juvenile survival), there are some data and sound logic with which to develop an estimate of *E* specific to the Olympic Peninsula. Holthausen et al. (1994) used data additional to that reported by Burnham et al. (1994) to estimate *E* for the Olympics at 0.600 (standard error 0.083). This results in $S = 0.612$ (standard error 0.204). While this estimate is not conclusive, it suggests that survival rates may be substantially higher than the metapopulation estimate reported by Burnham et al. (1994). In fact, Holthausen et al. (1994) estimated $\lambda = 1.058$ (standard error 0.065), using their Olympic Peninsula-specific adjustment of juvenile survival rates. Their estimate was not significantly different from $\lambda = 1$, a stable population. They advised that this estimate be interpreted with caution for the reasons noted in the discussions of juvenile survival.

Geographic and Ecological Distribution of Spotted Owls and their Habitat

Stand-level habitat relationships

Old-forest stands are preferred by spotted owls in western Washington and Oregon for nesting, roosting, and foraging; however, it appears that owls' requirements become increasingly general from nesting to roosting to foraging habitat (reviewed by Horton in press). While few owls have been found nesting outside of old, unmanaged stands, some use younger managed and unmanaged stands for roosting, and many use those stand-types (at least occasionally) for foraging (Thomas et al. 1990; Horton in press). The relationships of owls to forest stand conditions in the western Olympic Peninsula mirrors that observed throughout their range. Preliminary analyses of foraging habitat selection by 20 owls (Forsman 1991) showed that trend.

Landscape-level habitat relationships

Spotted owls are known to occur up to 3,500 feet in elevation in the western Olympic Peninsula, but no nests are known above 2,500 feet (Holthausen et al. 1994). Forests at these elevations are within the Sitka spruce, western hemlock, or silver fir zones (Henderson et al. 1989). Spotted owls feed primarily on medium-sized arboreal and semi-arboreal mammals, which reach their lowest diversity and abundance within the owls' range in forests of these types (Carey et al. 1992). Owls in the western Olympic Peninsula use very large home ranges, probably because of the depauperate prey base (Carey et al. 1992). Forsman (in prep., cited in Holthausen et al. 1994) followed 10 pairs of owls on the western Olympic Peninsula, and they ranged over 4,497-27,309 acres annually
(median = 14,271 acres). Their ranges encompassed 2,787-8,448 acres of old-growth and mature forests (median = 4,579 acres), and pairs ranged more widely when old forests were scarce ($r = -0.73$, $P = 0.10$). The trend towards larger ranges in areas of scarce old forests is consistent with the findings of Carey et al. (1992) in southwestern Oregon. *Lehmkuhl and Raphael (1993) compared the composition and other characteristics of* various-sized circles around owl and random sites on the Olympic Peninsula. They found that the owl sites were located in concentrations of old forests at all scales examined.

Distribution of habitat

Forests in the western Olympic Peninsula above 3,000 feet in elevation are dominated by Pacific silver fir (Henderson et al. 1989) and offer little nesting, roosting, or foraging habitat to resident owls (Holthausen et al. 1994). Those forests occur almost exclusively on federal lands in the OESF area. In 1992, DNR contracted with WDFW to estimate and map land cover in the OESF area with an emphasis on classification accuracy of mid- and late seral forests (WDFW 1994b). Washington Department of Fish and Wildlife conducted a supervised classification of Landsat Thematic Mapper satellite imagery gathered in July 1991 to produce a digital map of the area that sorts land cover among nine categories: old-growth, large-saw, small-saw, pole, sapling, open canopy/mixed conifer, open areas, water, and cloud/cloud shadow (Map 26). The analysis encompassed 1.3 million acres of the northwestern Olympic Peninsula (Table 4.4.8). The majority of older forests, both above and below 3,000 feet in elevation, are in Olympic National Park, significant amounts are also on Olympic National Forest and on DNR-managed lands (Table 4.4.8). Younger forests increase markedly in their dominance of the landscape from east to west (Map 26), such that the coastal plain of the western Olympic Peninsula is markedly depauperate of owl habitat.

It is unlikely that productive spotted owl pairs can persist in coastal lowland forests of the western Olympic Peninsula without at least the maintenance of current habitat there (Holthausen et al. 1994). The persistence of a functional segment of the sub-population in the coastal lowlands is likely to provide significant conservation benefits by maintaining the geographic distribution of pairs on the Olympic Peninsula (potentially 20 percent of the owls' range on the peninsula is in coastal lowlands with abundant DNR-managed land in the OESF), and maintaining owls over the range of ecological conditions they historically occupied. Both benefits are consistent with the philosophy of "spreading the risk" (Den Boer 1981; Thomas et al. 1990) by broadening the geographic and ecological distribution of the sub-population.

Holthausen et al. (1994) concluded that retention of existing habitat in the low-elevation, coastal forests would result in a "...biologically significant contribution..." by maintaining owls in that portion of their distribution. Their simulations predicted that maintaining all current habitat on all nonfederal lands on the peninsula increased the numbers of pairs occupying sites on both federal and nonfederal lands by about 20 percent over simulations based on no nonfederal habitat.

Trends in Habitat

Over half of the area of the northwestern Olympic Peninsula, 712,000 acres, is in younger forest cover or other open conditions, the great majority of these cover-types are the result of harvests of older forests within the past 40 years (Table 4.4.8, Map 26). Over 73,000 acres of old-growth forests were harvested on the Olympic National Forest between 1974 and 1988 (Morrison 1988). Approximately 119,000 acres of DNR-managed forests in the OESF are 30 years old or younger (DNR 1995d); the great majority of these young forests regenerated after harvests of older forests that were potential owl habitat.

However, since about 1990, the rate of harvest of older forests that are potential owl habitat has slowed dramatically on the Olympic Peninsula. This reflects changing management practices by Olympic National Forest, DNR, and private landowners in response to policy changes (e.g., USDA and USDI 1994a) and legal requirements (the ESA, Washington Forest Practices Rules (WAC 222-16-080(1)(h))). It appears that a stable management policy for the Olympic National Forest will maintain and restore large areas of owl habitat (USDA and USDI 1994a) in areas of the Olympic Peninsula that currently support a large proportion of the sub-population. Future directions for policies and rules governing management of nonfederal forest lands are less certain.

Population Isolation, Natural Disturbances, and Barred Owls

Spotted owls on the Olympic Peninsula represent the most northwesterly segment of the species' distribution in the United States, with the most northerly extent of its range in extreme southwestern British Colombia. The Olympic Peninsula is surrounded to the west, north, and east by marine waters, and to the south by large areas of young-aged forest plantations and other developed lands. The nearest areas where owls are reasonably common are 200 miles to the south in the Oregon Coast Range and 75 miles to the east in the Cascade Range in southern Washington. Spotted owls on the Olympic Peninsula are effectively an isolated sub-population. Holthausen et al. (1994) simulated a variety of habitat and population configurations to examine threats to the viability of owls there. The only simulations in which a robust demographic connection to the Cascades sub-population made significant contributions to the viability of owls in the Olympics were those in which very few owls but much habitat remained in the Olympics (an arbitrary reduction in owl numbers by 80 percent relative to habitat capability). They considered this to represent an "extremely unlikely" combination, and concluded that demographic isolation was not a significant threat to the sub-population so long as it is stable or nearly stable. And, they concluded that the stability of the Olympic Peninsula sub-population was primarily dependent on local habitat conditions.

Holthausen et al. (1994) evaluated the effects of a worst-case fire by simulating a complete loss of habitat in portions of the eastern and northern Olympic Peninsula that are at high risk of large-scale fires (33 percent of federal land on the peninsula) (Holthausen et al. 1994 Figure 5). Their analyses suggested that the total area managed for habitat on federal lands is large enough that an otherwise stable population of owls would be robust to a disturbance of this scale. They discussed, but did not analyze, the effects of a large-scale windstorm on the western peninsula in combination with the simulated fire loss. They concluded that such a scenario would cause significantly greater impacts to the peninsula owl population, but that the combination was extremely unlikely. Their choice to forgo analysis of the impacts of a major windstorm on the western peninsula was reasonable because relatively little habitat currently remains on mostly DNR-managed and private lands on the wind-prone coastal plain (Map 26, Table 4.4.8).

Barred owls have expanded their range into western North America and become increasingly sympatric with spotted owls over the past 40 years (Taylor and Forsman 1976; Dunbar et al. 1991). Barred owls may displace and are known to hybridize with spotted owls (Dunbar et al. 1991; Hamer et al. 1994a). They have increased in abundance on the Olympic Peninsula, and will probably continue to do so (Holthausen et al. 1994). They are widely thought to have the potential to represent a threat to spotted owls in many parts of their range, including on the Olympic Peninsula (e.g., Dunbar and Blackburn 1993; Thomas et al. 1993; Holthausen et al. 1994), but there is no way to predict the long-term outcome of interactions among these congeners. Thomas et al. (1993) suggest that there is little that forest management can or should do to influence this outcome.

Matrix 4.4.3a: Management strategies for alternatives related to the OESF Planning Unit

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Spotted Owl			
Nesting, Roosting, and Foraging (NRF) Habitat	Two-year surveys conducted on proposed timber sales to collect/update information on owl sites (no surveys since 1993 in OESF). Within spotted owl site centers, no harvest of owl habitat if existing owl habitat in the (2.7 mile) circle is equal to or less than 40% of the total area. Management of non-habitat will result in maintaining these stands in a non-habitat condition. As owls move or survey information shows an owl activity circle has been abandoned, additional acres would be available for harvest (consistent with the regulatory and policy decertification guidelines currently available). 15,000 acres of suitable habitat are (continued)	Emphasis on developing future habitat distributed across the entire 270,000-acre forest through integrated forest management consists of 2 phases: (1) initiate habitat recovery within each landscape until (a) old-forest habitat (NRF) exceeds 20% of the acres; and, (b) sub-mature and old-forest habitat (RF & NRF), including the 20% above, exceeds 40%; (2) maintain and enhance a mosaic of habitat that shifts over time guided by analyses and plans for individual landscape planning units, working to achieve habitat goals at or greater than the 20% and 40% minimum standards. Near-term harvest of potential habitat is not limited by 40% threshold (this will not delay achieving the target since new acres acquire the structures), but is limited by riparian and murrelet (continued)	Emphasis on strategically located areas designated for owl habitat management. Prescriptions to be achieved within the designated areas over time: (1) Nest Grove - 100% old forest; each 200 acres in size (5,000 acres total) (2) Core Area - 50% sub-mature or better; each 2,000 acres in size (78,000 acres total) (3) Range Area - 40% young-forest marginal or better; each 14,000 acres (40,000 acres total) (4) Special Pair Areas - 40% habitat within 2.7 miles of five selected owl sites (40,000 acres) *Interim provision:* Special pair areas will not be retained after range areas meet or exceed thresholds.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Spotted Owl (continued)			
Nesting, Roosing, and Foraging (NRF) Habitat (continued)	being deferred until 2005. Criteria have not been developed for determining whether the deferral will end or be extended beyond year 2005. Initially this decision was expected to be linked with OESF research results, but that portion of the Commission on Old Growth Alternatives' recommendations was not implemented and is not part of No Action.	strategies and 20% old-forest habitat threshold. Guidelines provided for harvest of suitable owl habitat are linked to (a) riparian and marbled murrelet conservation, (b) old-forest habitat thresholds, (c) an emphasis on the harvest of habitat being a combination of young- and old-forest habitat scheduled somewhat evenly across the recovery period, and (d) opportunities to learn new silvicultural techniques for achieving habitat goals. Known owl nests will not be disturbed during nesting season.	
Dispersal Habitat	No provision for dispersal habitat.	Provided within the landscape requirements for percentage of young-forest marginal and better habitat.	Provided within the nest, core, and range area requirements.
Experimental Areas	No provision for experimental areas.	Entire forest plays role in innovative experimental management, research and monitoring program.	Conduct limited research activities within zones designated to support clusters of spotted owl pairs. Conduct limited second-growth research activities outside zones.

Evaluation of the Alternatives

Summary Evaluation

Three criteria were used in evaluation of the alternatives. Two criteria were the degree to which each alternative addressed major threats to the viability of spotted owls on the Olympic Peninsula: the amount and distribution of owl habitat, and the size and trends in size of the sub-population. The third evaluation criteria was the degree to which each alternative placed owl sites at risk for incidental take.

Two independent analyses of the ability of habitat to support spotted owl pairs generally concurred in their findings. Habitat currently capable of supporting owl pairs is concentrated on the mid-elevation, mostly federal lands at the interior of the Olympic Peninsula. The low-elevation coastal plain, (mostly nonfederal) forest lands that dominate the OESF have little current capability as habitat for owl pairs. Two projections of the No Action alternative 100 years into the future showed that the habitat capability of the interior Olympic Peninsula increases with time, but that little change occurs on the low-elevation lands of the OESF. Two projections of the Zoned Forest alternative 100 years into the future predicted substantial increases in the ability of the low-elevation, coastal plain forests of the OESF to support owl pairs relative to current conditions: one analysis predicted a two-fold increase in the area of DNR-managed lands in the OESF capable of supporting owl pairs; another analysis predicted that the area that included DNR-managed lands in the OESF would be capable of supporting 50 percent more owl pairs. Two projections of the Unzoned Forest alternative 100 years into the future predicted even greater increases in the ability of the low-elevation, coastal plain forests of the OESF to support owl pairs relative to current conditions: one analysis predicted a greater than three-fold increase in the area of DNR-managed lands in the OESF capable of supporting owl pairs, another analysis predicted that the area that included DNR-managed lands in the OESF would be capable of supporting 80 percent more owl pairs.

Projections of each of the alternatives 100 years into the future predicted that, regardless of alternative, the spotted owl sub-population on the Olympic Peninsula would decline for approximately 60 years. After that time the population would reverse its negative trend and begin to increase in size because of the increase in habitat capability resulting from habitat development on federal lands. There were no statistically significant differences among predicted population trends under the No Action alternative or either action alternative. Projections of the Zoned Forest and Unzoned Forest alternatives 100 years into the future predicted an Olympic Peninsula spotted owl sub-population that was 2 percent and 5 percent larger, respectively, relative to projections of the No Action alternative 100 years into the future.

Estimates of the risk for incidental take of owl sites were developed for the No Action and action alternatives based on the currently known 60 spotted owl sites in the OESF area. No Action is based on avoiding risk for incidental take of owl sites, thus, by definition it avoids placing sites at risk for take. The Zoned Forest alternative was estimated to place nine sites at risk for incidental take. The Unzoned Forest alternative was estimated to place 31 sites at risk for incidental take, although an alternative analysis suggests that 24 sites could be estimated to be at risk for incidental take. It is likely that the risk to existing, but currently unknown, owl sites for incidental take under each alternative is similar to the risk estimates for known sites. Risk to future owl sites for incidental take may be relatively even among the No Action and action alternatives because the overall greater habitat capability that will result under the action alternatives will provide landscape-wide conditions that can support owls and thus minimize risk, whereas the limited number of sites that will result in the future from the No Action alternative and its risk-avoidance approach will also minimize risk.

The No Action alternative only manages to protect the (frequently inadequate, see Table 4.4.11) *status quo*. Under both action alternatives, the landscape is managed for habitat capability at broader scales with potentially much more positive outcomes for owl conservation in the OESF area. It appears that one risk to the viability of the spotted owl sub-population on the Olympic Peninsula remains under the President's Forest Plan; that resulting from a relatively restricted geographic and ecological distribution of owls and their habitat in the mid-elevation forests of the interior Olympic Peninsula. Both action alternatives are predicted to extend the geographic and ecological distribution of owls and habitat into the low-elevation, coastal plain forests in the OESF area. Predictions are that the habitat capability of this area will increase by 27 percent under the Zoned Forest alternative, and by 51 percent under the Unzoned Forest alternative.

Introduction

Three techniques are used to evaluate the alternatives: (1) an evaluation of the general habitat capability of the OESF area that will result, in the near and long term, from each alternative; (2) evaluations of the ability of the landscape to provide suitable sites for resident owls, and computer simulations of spotted owl life histories in response to landscape conditions that will result from each alternative; and, (3) the degree to which each alternative places owl sites at risk for incidental take. Techniques 1 and 2 are, in essence, analyses of the "cumulative effects" of the alternatives in that they predict the outcomes of 100 years of management under each of those alternatives. A brief summary of each evaluation technique is provided below. Appendix D provides a detailed discussion of methods. It is essential that the careful reader of these evaluations refer to Appendix D to understand the methods and assumptions underlying the results and conclusions reported here.

Methods for a general evaluation of habitat capability

Both stand- and landscape-level characteristics of forests are important to their capability as habitat for spotted owls (see Horton in press for a review). Forest stands with a particular structure and composition have been defined as either young- or old-forest spotted owl habitat in western Washington (see Hanson et al. 1993). Stands with these characteristics have been otherwise variously classified as small sawtimber, large sawtimber, and old growth (Brown 1985) or young, mature and old growth (Spies and Franklin 1991). An estimate of the current amount and distribution of forest stands of these types, in the OESF area, has been derived from analysis of Landsat Thematic Mapper satellite imagery (WDFW 1994b, Map 26 and Table 4.4.8). Projections of future amounts and distributions of these stand-types under the alternatives can be based on: (1) the relationships among stand age, structure, and composition; and, (2) succession and harvest patterns under the alternatives, and other assumptions about land use. These estimates of current and likely future landscape conditions can then be used to evaluate the capability of current and likely future landscapes as habitat for spotted owl pairs. Analyses were conducted at the scale of pair ranges, approximated by a circle of 2.7 miles radius (Holthausen et al. 1994). The methods and assumptions used for the analyses reported here are described in Appendix D.

Methods for conducting computer simulations of spotted owl life histories
Schumaker (1995) provides a detailed description of the simulation model. The simulation model is designed to be used with raster GIS data showing the spatial distribution of habitat, and consists of three separate modules that conduct habitat analysis, movement simulation, and demographic simulation. The habitat analysis module is used to generate a data file that specifies the locations and qualities of hexagon-shaped units of land cover. The resulting data are used in both the movement and demographic simulations. The movement module is individual-based, and simulates the dispersal of fledglings and the seasonal wandering of floaters. A key feature of the demographic module is the ability to link certain life history parameters -- survivorship, fecundity, and site fidelity -- to habitat quality. An owl surrounded by high habitat is less likely to disperse, more likely to survive, and more likely to produce a large brood. Results of modeling can then be used to estimate habitat capability of both current and likely future landscapes, as well as to estimate spotted owl population size, trends, and distribution in the future. The methods and assumptions used for the analyses reported here are described in Appendix D.

Methods for estimating incidental take of spotted owls
It is anticipated that during the life of the HCP, some spotted owls may be displaced, and habitat conditions for some individual owls or owl pairs may be degraded by DNR activities in the OESF such that their ranges are temporarily incapable of supporting them. These activities will constitute incidental take of spotted owls as defined by the ESA. The degree to which each alternative either avoids or allows incidental take is another method for comparing those alternatives. The evaluation criteria of the USFWS to estimate the risk of incidental take (Frederick 1994) were used for these analyses. Their criteria are based on maintaining a threshold proportion of habitat in home range-sized circles around known owl sites as defined by the WDFW. The methods and assumptions used for the analyses reported here are described in Appendix D.

Evaluation Criterion 1 - Abundance and Distribution of Habitat
Evaluations of the current and likely future abundance and distribution of spotted owl habitat were based on results of two analysis methods described above, the habitat capability method (Appendix D) and the simulation model (Schumaker 1995: Appendix D).

Evaluations based on Habitat Capability Estimates
Current Habitat Conditions
Current conditions were estimated to provide 338,900 acres on all ownerships and 48,900 of the 270,000 DNR-managed acres within the 1,066,300-acre OESF area that had at least 40 percent potential habitat at the scale of pair ranges (Figure 4.4.7a, Table 4.4.9). That suggests that 32 percent of the total area and 18 percent of DNR-managed land within the

OESF area is currently capable of supporting owl pairs. That percentage can be used as a base line against which to evaluate the conservation benefits of the No Action, the Zoned Forest, and Unzoned Forest alternatives.

ALTERNATIVE 1

Projections of the No Action alternative 100 years into the future resulted in 359,600 acres on all ownerships and 36,800 DNR-managed acres within the analysis window that had at least 40 percent potential habitat at the scale of pair ranges (Figure 4.4.7b, Table 4.4.9). Under the No Action alternative, the habitat capability of the overall OESF area is predicted to improve such that 34 percent of the land area will be capable of supporting owl pairs, but the habitat capability of DNR-managed lands is predicted to decline such that only 14 percent could support owl pairs (see Appendix D). The overall improvement in habitat capability within the approximately 1-million-acre OESF area is predicted to result from habitat development on the Olympic National Forest resulting from current policy (USDA and USDI 1994a). The decline in habitat capability on DNR-managed lands will result from a predicted redistribution of habitat, even though the overall proportion of habitat on DNR-managed land is predicted to remain constant (Appendix D). The predicted outcomes of the No Action alternative can be used as another basis for evaluation of the conservation benefits of the action alternatives.

ALTERNATIVE 2

Projections of the Unzoned Forest alternative 100 years into the future resulted in 511,300 acres on all ownerships and 153,600 acres of DNR-managed land in the OESF area that had at least 40 percent potential habitat at the scale of pair ranges (Figure 4.4.7d, Table 4.4.9). Under the Unzoned Forest alternative, the habitat capability of the OESF area is predicted to improve such that 48 percent of all and 57 percent of DNR-managed lands will be capable of supporting owl pairs. This improvement in habitat capability is predicted to result from: habitat development on all DNR-managed lands in the OESF under the Unzoned Forest alternative, habitat development on the Olympic National Forest resulting from current policy (USDA and USDI 1994a), and generally static habitat conditions on other lands.

The Unzoned Forest alternative is predicted to provide substantially more habitat capability, on DNR-managed lands and across the OESF, in 100 years than either current conditions or than under the No Action alternative in 100 years. A greater than three-fold increase in habitat capability relative to current conditions on DNR-managed lands is predicted under the Unzoned Forest alternative, while the capability of the entire OESF area should increase by 51 percent (Table 4.4.9).

The Unzoned Forest alternative produces a greater than four-fold increase in the capability of DNR-managed lands as habitat for spotted owls than does the No Action alternative (Table 4.4.9). A long-term, 42 percent increase in habitat capability of the entire OESF area is also predicted relative to no action (Table 4.4.9). The Unzoned Forest alternative is predicted to provide the greatest long-term increases in habitat capability among all alternatives.

ALTERNATIVE 3

Projections of the Zoned Forest alternative 100 years into the future resulted in 429,600 acres on all ownerships and 97,200 acres of DNR-managed land in the OESF that had at least 40 percent potential habitat at the scale of pair ranges (Figure 4.4.7c, Table 4.4.9). Under the Zoned Forest alternative, the habitat capability of the OESF area is predicted to improve such that 40 percent of all and 36 percent of DNR-managed lands will be capable of supporting owl pairs. This improvement in habitat capability is predicted to result from: habitat development on some DNR-managed lands (the owl zones) under the Zoned Forest alternative for the OESF, habitat development on the Olympic National Forest resulting from current policy (USDA and USDI 1994a), generally static habitat conditions on other DNR-managed lands (outside the owl zones), and generally static conditions on other lands.

The Zoned Forest alternative is predicted to provide substantially more habitat capability, on DNR-managed lands and across the OESF, in 100 years than either current conditions or than under the No Action alternative in 100 years. Under this alternative, the habitat capability of DNR-managed lands is predicted to nearly double relative to current conditions while the capability of the entire area should increase by 27 percent (Table 4.4.9). The Zoned Forest alternative produces a greater than two-fold increase in the capability of DNR-managed lands as habitat for spotted owls than does the No Action alternative (Table 4.4.9). A long-term, 19 percent increase in habitat capability of the entire OESF area is also predicted relative to the No Action alternative (Table 4.4.9).

Evaluations based on the Simulation Model

Current Habitat Conditions

Figure 4.4.8 shows the hexagonal habitat map developed for the current conditions on the Olympic Peninsula. The two-dimensional pattern reflects model predictions of sites suitable and unsuitable for occupancy by owl pairs (Appendix D). The suitable sites (dark gray hexagons) on the mostly federal lands are surrounded by unsuitable sites (light gray hexagons) on mostly state-managed and private lands. A "hole" in the center of the federal ownership is created by the nonforested subalpine and alpine areas of the Olympic Mountains. In the highest portions of the mountain range these areas act as barriers to owl movement (black hexagons). The pattern of suitable sites approximates the known distribution of many spotted owl sites. For example, suitable sites along the west coast of the peninsula match areas of known occupancy by spotted owl pairs in the coastal strip of Olympic National Park. The Queets River corridor of the park is seen to extend in a southwesterly direction from the habitat doughnut. The large block of suitable sites extending westward in the northwestern portion of the doughnut corresponds with many known sites on federal lands in the Calawah and Bogachiel watersheds. The Clallam River area, in the northwest corner of the peninsula, contains three suitable sites oriented in a horizontal strip. A pair of owls is known to inhabit this area.

The habitat model partitioned the Olympic Peninsula into 1,239 hexagonal, 3,134-acre sites, of which 435 were classified as suitable (Table 4.4.10). A suitable site is one in which the quality and quantity of habitat within it, or within it and its adjacent sites, is adequate to support a nesting pair of spotted owls (Appendix D). One hundred seventy-two suitable sites had scores greater than five, the suitable site threshold. Those suitable sites with scores less than five were classified as suitable because of available habitat in adjacent sites. The distribution of site scores resembled an exponential distribution, but suitable site scores were normally distributed (Figure 4.4.9). Suitable sites scores ranged from 0.248 to 8.99, and the median score equaled 4.4 (Table 4.4.10). Two hundred thirty-four sites, of which 61 were classified as suitable, contained some DNR-managed lands in the OESF (Table 4.4.10). Twenty-seven sites, of which nine were classified as suitable, contained more than 90 percent DNR-managed lands in the OESF (Table 4.4.10).

ALTERNATIVE 1

Over the next 100 years, under the No Action alternative, habitat development on federal lands is predicted to increase the number of suitable sites from 435 to 470 (Table 4.4.11, Figure 4.4.10). Two hundred twenty-five of these suitable sites had scores greater than the suitable site threshold, and the median suitable site score increased to 4.8 (Table 4.4.11). The average score of sites classified as unsuitable for spotted owl nesting also increased. In the population simulations, unsuitable sites can be occupied by floaters, and therefore, survivorship of floaters increases with habitat quality at these sites (Appendix D). Relative to current conditions, DNR's forest management under the No Action alternative did not contribute to the development of additional suitable sites, nor did the median score of sites with greater than 90 percent DNR-managed land change (Tables 4.4.10, 4.4.12).

The No Action alternative does not result in an appreciable change in the predicted spatial distribution of suitable sites in the OESF area (Figure 4.4.11).

ALTERNATIVE 2

Habitat development on DNR-managed lands under the Unzoned Forest alternative, relative to the No Action alternative, is predicted to increase the number of suitable sites by 35 to a total of 505 (Table 4.4.11, Figure 4.4.10). This effect was not confined to DNR-managed lands, as the number of suitable sites with some DNR-managed lands increased by 32 relative to the No Action alternative (Table 4.4.11). Habitat development on DNR-managed lands thus increased the number of suitable sites on some adjacent federal lands as well (Appendix D). Habitat quality on DNR-managed lands, as reflected by the median score of suitable sites with greater than 90 percent DNR-managed lands, increased more than 2.5 times relative to No Action (Table 4.4.11). The quality and quantity of habitat on DNR-managed lands increased their capability as habitat such that 89 percent (24 of 27) of sites with greater than 90 percent DNR-managed lands were suitable (Table 4.4.11). Similar to the No Action alternative, the average score of all sites increased with similar, positive results for the survivorship of non-territorial owls.

The Unzoned Forest alternative resulted in a noticeable increase in the numbers and density of suitable sites west of the core of federal ownership in the OESF area, beginning in 60 years (Figure 4.4.13). DNR's management under this alternative resulted in the westward extension of suitable sites from the federal core towards the Olympic National Park coastal strip. Suitable sites also develop in the northwest portion of the peninsula because of concentrations of DNR-managed lands there. Extended model runs that allowed predictions of occupancy of suitable sites by territorial owls and both suitable and unsuitable sites by non-territorial owls showed an appreciable change in the spatial distribution of occupied sites. Under the No Action alternative, 502 sites were predicted to receive some occupancy compared to 559 sites for the Unzoned Forest alternative. The most westerly portion of the Olympic Peninsula is dominated by nonfederal lands and can be approximated by the westernmost set of sites that include two-thirds of the sites with some DNR-managed lands. Relative to the No Action alternative (56 sites with some occupancy), there was a nearly two-fold increase in the numbers of sites that were occupied at some time during the model runs in this portion of the peninsula (101 sites). Nearly all the increase in occupancy, peninsula-wide, occurred in this portion of the peninsula under the Unzoned Forest alternative (45 of 57 more sites with some occupancy).

ALTERNATIVE 3

Habitat development on DNR-managed lands under the Zoned Forest alternative, relative to the No Action alternative, is predicted to increase the number of suitable sites by 29 to a total of 499 (Table 4.4.11, Figure 4.4.10). This effect was not confined to DNR-managed lands, as the number of suitable sites with some DNR-managed lands increased by just 25 relative to the No Action alternative (Table 4.4.11). Habitat development on DNR-managed lands thus increased the number of suitable sites on some adjacent federal lands. Habitat quality on DNR-managed lands, as reflected by the median score of suitable sites with greater than 90 percent DNR-managed lands, increased 2.5 times relative to No Action (Table 4.4.11). The quality and quantity of habitat on DNR-managed lands increased their capability as habitat such that 78 percent (21 of 27) of sites with greater than 90 percent DNR-managed lands were suitable (Table 4.4.11). Similar to the No Action alternative, the average score of all sites increased with similar, positive results for the survivorship of non-territorial owls.

The Zoned Forest alternative resulted in a noticeable increase in the numbers and density of suitable sites west of the core of federal ownership in the OESF area, beginning in 60 years (Figure 4.4.12). DNR's management under this action alternative resulted in the predicted westward extension of suitable sites from the federal core towards the Olympic National Park coastal strip. Suitable sites also develop in the northwest portion of the peninsula because of concentrations of DNR-managed lands there. Extended model runs that allowed predictions of occupancy of suitable sites by territorial owls and both suitable and unsuitable sites by non-territorial owls showed an appreciable change in the spatial distribution of occupied sites. Under the No Action alternative, 502 sites were predicted to receive some occupancy compared to 553 sites for the Zoned Forest alternative. The most westerly portion of the Olympic Peninsula is dominated by nonfederal lands and can be approximated by the westernmost set of sites that include two-thirds of the sites with some DNR-managed lands. Relative to the No Action alternative (56 sites with some occupancy), there was a nearly two-fold increase in the numbers of sites that were occupied at some time during the model runs in this portion of the peninsula (98 sites). Nearly all the increase in occupancy, peninsula-wide, occurred in this portion of the peninsula under this action alternative (42 of 51 more sites with some occupancy).

Evaluation Criterion 2 - Population Trends

Projected Population Trends

Numbers of spotted owl pairs on the Olympic Peninsula are predicted to decrease for 60 years based on model assumptions (Appendix D) and current habitat conditions (Figure 4.4.14). Projected habitat development on federal lands and under the OESF action alternatives were not able to reverse this trend under the most conservative set of model assumptions (juvenile survivorship of 0.41, Figure 4.4.14). But under the other sets of model assumptions (juvenile survivorship of 0.47 and 0.53), numbers of owl pairs were predicted to begin increasing after 60 years (Figure 4.4.14). Trends were similar for the No Action and both action alternatives; thus population trends were primarily due to habitat development on federal lands. Neither the No Action or the action alternatives for the OESF were predicted to have much effect on the overall size of the Olympic Peninsula sub-population in the future (Figure 4.4.14). Assumptions about juvenile survivorship did not alter this basic finding. Model runs projected 10 more pairs resulting from the Zoned Forest alternative (2 percent more overall) and 20 more pairs from the Unzoned Forest alternative (5 percent more overall) in 100 years, relative to the No Action alternative.

The model predicts fewer owl pairs than suitable sites over the long term. This relationship of populations to habitat is believed to occur in natural populations that occur in heterogenous environments, due to the responses of populations to habitat quality (e.g., Brown 1969; Fretwell and Lucas 1969; Pulliam 1988). These relationships of population size and distribution with the quality, abundance, and distribution of suitable sites are also apparent in model projections. A fuller explanation of this theoretical construct is developed by Wilhere et al. (in prep.); suffice it to say that all suitable sites will never be occupied, and that the ratio of occupied sites to unoccupied sites is a function of habitat-dependent demographic parameters and the spatial arrangement of habitat.

A dramatic change occurs at year 60 in the population trajectories predicted by model runs with juvenile survivorship values of 0.47 or 0.53 (Figure 4.4.14). From year 0 to year 59 the population is steadily declining, and from year 60 on this trend is reversed. This abrupt change is the result of simulated population responses to current landscape characteristics and assumptions about forest succession used to develop habitat maps (Table 4.4.8 and Appendix D). The 60-year future landscapes see all large sawtimber, which was assigned the median class age of 150 years, become old growth and all recent clearcuts become small sawtimber (Appendix D), each resulting in increased value as habitat (Appendix D). While incremental increases in the numbers of suitable sites occur in the 20- and 40-year habitat maps (Figure 4.4.10), numbers of high-quality sites do not change until year 60 and nearly half of the overall increase in numbers of suitable sites occurs between the 40- and 60-year habitat maps. It is the population response to that stepwise increase in habitat quality and quantity that produces the reversal in the simulated, declining Olympic Peninsula sub-population.

Evaluation Criterion 3 - Estimates of the Risk for Incidental Take of Spotted Owl Sites

There are 69 owl sites within 2.7 miles of DNR-managed land in the OESF (WDFW 1995c). Washington Department of Fish and Wildlife assigned these sites a status based on the nature of the observations recorded there: 45 are classified as pair sites, two as sites occupied by two owls of unknown pair status, 13 territorial single sites, and nine sites where owls were observed but could not be assigned a resident status. A more complete discussion and definition of the concept of incidental take is provided elsewhere in this DEIS, however, a summary follows. Incidental take could result from either the harm or harassment of owls (60 Fed. Reg. 9484 (1995)). Harassment would occur when pairs or territorial single owls were disturbed at activity centers (60 Fed. Reg. 9484 (1995)), while harm would result from significant habitat removal around site centers (60 Fed. Reg. 9484 (1995)). Site centers are defined as the nest or activity center of pairs or territorial single owls (60 Fed. Reg. 9484 (1995)). Thus, take could occur from harm or harassment of pairs, two owls of unknown pair status, or territorial singles of which a total of 60 site centers are known from within 2.7 miles of DNR-managed land in the OESF. Estimates of take under each alternative are based on potential DNR harvests of owl habitat either within 2.7 mile radius circles around those site centers in which habitat comprises 40 percent or less land cover, or within 0.7-mile radius circles around those site centers in which habitat comprises 50 percent or less land cover (Frederick 1994). In analyzing the effects of potential harvests within 0.7 miles of site centers, estimates of incidental take in the OESF differ from analyses for the other HCP planning units because the limited geographic scope of the problem allowed more detailed analyses.

Estimates of the Risk for Incidental Take at Known Spotted Owl Sites

ALTERNATIVE 1

The No Action alternative would avoid incidental take by deferring harvest of habitat in circles with 40 percent or less habitat. In fact, recent DNR policy has been to avoid harvest of potential owl habitat throughout the OESF area in anticipation of an HCP or HCP-like agreement. It is reasonable to assume that if no such agreement is reached, DNR harvests of potential owl habitat would proceed after owl surveys located areas in which such harvests could be conducted without risk of incidental take. Those areas would be habitat farther than 2.7 miles from site centers, including areas formerly occupied by owls but demonstrated through surveys to be abandoned; and habitat within 2.7 miles of site centers with more than 40 percent habitat.

The No Action alternative can thus be said to avoid placing known owl sites at risk for incidental take. However, it should be noted that many of those known sites were already at risk of being unable to support resident owls (because more than 40 percent of the surrounding habitat had been harvested) when the owl was listed in 1990. Thus, while the No Action alternative nominally avoids risk of incidental take, the risk that many of those sites are incapable of supporting resident owls remains.

ALTERNATIVE 2

The Unzoned Forest alternative is based on managing all landscapes in the OESF to maintain or restore threshold proportions of owl habitat (Chapter 2). However, harvests of some owl habitat may occur without regard for current landscape conditions in anticipation of habitat development in those landscapes (those harvests are predicted to occur in the first 40-60 years of management under the alternative). Throughout the life of an HCP under this alternative, harvests of habitat would proceed under the guidance of general, landscape-level management plans and without regard for then-current locations of owl sites (Chapter 2). Those harvests could result in incidental take. However, habitat capability would increase across the OESF for most of the life of an HCP under this alternative until stabilizing a much higher level than currently exists. Levels of take after the first 40-60 years would likely be lower because of the greater habitat capability that would result on DNR-managed lands and across all ownerships on the OESF, i.e., landscape-level abundance of potential owl habitat would frequently exceed 50 percent (Figure 1d, Appendix D).

Estimates of habitat and land ownership around owl site centers were used to classify these sites for estimates of the potential for incidental take under the Unzoned Forest alternative for the OESF (Table 4.4.13). DNR-managed habitat provides the margin above 40 percent at 11 site centers (Table 4.4.13), thus there is some potential that DNR harvests could result in take at these sites. One site is peripheral to the OESF; less than 1 percent of the habitat is within DNR-managed lands in the OESF although 8 percent of the habitat is on other DNR-managed lands. The Unzoned Forest proposal for the OESF can not put this site at risk for incidental take. This site could potentially be taken under either HCP action alternative for other DNR-managed lands and is discussed in Chapter 4.2.1. Six of these 11 sites have at least 30 percent habitat on federal lands, overall habitat of at least 50 percent, and current estimates of harvest patterns under the Unzoned Forest alternative suggest that habitat will remain above 40 percent around each of these sites. Thus, these sites should not be considered at risk for take under this alternative. In total, four of the 11 site centers at which DNR-managed habitat provides the margin above 40 percent are at risk for take under the Unzoned Forest alternative for the OESF.

Thirty-one site centers within 2.7 miles of DNR-managed lands in the OESF are estimated to have less than 40 percent cover of potential habitat within their circles. Any DNR harvest of habitat within those circles could put owls at risk for incidental take. However, four of those sites are far from concentrations of DNR-managed lands and habitat on DNR-managed lands is estimated to cover from none to less than 1 percent of the circles around those sites. It is reasonable to conclude that these sites should not be considered at risk for take under the Unzoned Forest alternative. Thus, 27 of the 31 site centers surrounded by less than 40 percent habitat should be considered to be at risk for take under the Unzoned Forest alternative for the OESF.

In summary, the simplest estimate is that 31 of the 60 site centers within 2.7 miles of DNR-managed lands in the OESF are at risk for take under the Unzoned Forest alternative. Those not at risk for take are: 18 site centers with greater than or equal to 40 percent habitat on federal land; seven sites with greater than or equal to 40 percent habitat on all ownerships, and at which DNR harvests in the OESF are estimated to maintain greater than or equal to 40 percent habitat on federal and DNR-managed land; and four sites with less than 1 percent habitat on DNR-managed land in the OESF.

Additional information can be used to refine the simple estimate derived above, the habitat conditions around sites and the recent history of observations at sites. This information allows inferences about the likelihood that sites can actually support resident owls and the recent occupancy of sites, and thus, refined estimates of the risk of actually taking real owls. Eleven sites that are considered above to be at risk for take under the

Unzoned Forest alternative are surrounded by less than 20 percent habitat, a level which is associated with significantly lower occupancy (Bart and Forsman 1992). Four of the 11 sites are in the coastal strip of Olympic National Park and have received only sporadic owl surveys. There are insufficient data with which to infer occupancy rates at those sites. The other seven sites are on DNR-managed lands in the OESF and are surrounded by state, federal, and private lands. They have been monitored regularly by biologists from state and federal agencies and private consulting firms since 1991 or 1992. No spotted owls have been found at six of those sites since 1993, and a single owl was observed on one visit only in 1995 at a site where no owls had been detected since 1991. It is reasonable to infer that these seven sites are not currently occupied by resident owls because they have insufficient habitat to support residents, and owls do not appear to be currently residing at these sites. Thus, a refined estimate of the number of sites that appear to have the potential to support resident owls, and/or may currently support resident owls, and that should be considered to be at risk for take under the Unzoned Forest alternative for the OESF is 24 sites. These 24 sites thus estimated to be at risk for take should be considered a legitimate alternative estimate to the 31 sites identified in the simple estimate above.

ALTERNATIVE 3

The Zoned Forest alternative is based on delineating areas (owl zones) in which management for the retention and restoration of owl habitat until threshold proportions are attained (predicted to be in 40-60 years) is a priority (Map 26, and see Chapter 2). An additional feature of this alternative is the designation of several high priority areas (approximated by current owl circles, Map 27) for interim conservation of owl habitat (until threshold proportions are attained in the owl zones). Harvests of habitat would be deferred for 40-60 years within the owl zones, as well as the interim conservation areas. To the extent that boundaries of the owl zones and current, high priority owl circles coincide with boundaries of owl circles over the deferral period, then incidental take would be avoided within those circles. Take could occur in circles whose boundaries are not entirely within the zones or interim protection areas. After threshold proportions of habitat are attained, harvests of habitat would proceed under the guidance of more general, landscape-level management plans and without regard to then-current locations of owl sites. But the overall level of take would likely be lower then because of the greater habitat capability that would result on DNR-managed lands and across all ownerships in the OESF, i.e., landscape-level abundance of potential owl habitat would frequently exceed 50 percent (Figure 1c, Appendix D).

Estimates of habitat and land ownership around owl site centers were used to classify these sites for estimates of the potential for incidental take under the Zoned Forest alternative for the OESF (Table 4.4.12). Some potential exists for incidental take of eight pair and four single sites during the first 40-60 years of management under this alternative (Table 4.4.12). The potential for lower levels of take exists after that time as described above. DNR-managed habitat provides the margin above 40 percent at four of the eight pair sites away from owl zones or high priority circles (Table 4.4.12), thus there is some potential that DNR harvests could result in take at these site centers. One of these four sites is peripheral to the OESF; less than 1 percent of the habitat is within DNR-managed lands in the OESF, although 8 percent of the habitat is on other DNR-managed lands.

The Zoned Forest proposal for the OESF can not put this site at risk of incidental take. This site could potentially be taken under either HCP action alternative for other DNR-managed lands and is discussed in Chapter 4.2.1. One additional pair site has at least 30 percent habitat on federal lands, overall habitat of at least 50 percent, and current estimates of harvest patterns under the Zoned Forest alternative suggest that habitat will remain above 40 percent around this site. Thus, these two sites should not be considered at risk for take under this alternative. In total, two of the four pair sites at which DNR-managed habitat provides the margin above 40 percent are at risk for take under the Zoned Forest alternative for the OESF.

The other eight site centers (four pair and four single territorial sites) within 2.7 miles of DNR-managed lands in the OESF are estimated to have less than 40 percent cover of potential habitat within their circles and are located away from owl zones or high priority sites under the Zoned Forest alternative (Table 4.4.12). Any DNR harvest of habitat within those circles would put owls at risk for incidental take. However, one of those sites is far from concentrations of DNR-managed lands and habitat on DNR-managed lands is estimated to cover less than 1 percent of its circle. It is reasonable to conclude that this site should not be considered at risk for take under the Zoned Forest alternative. Thus, seven of the eight site centers surrounded by less than 40 percent habitat should be considered to be at risk for take under the Zoned Forest alternative for the OESF. In total, nine of the 60 site centers within 2.7 miles of DNR-managed land in the OESF should be considered at risk for take under the Zoned Forest alternative.

Estimates of the Risk for Incidental Take at Spotted Owl Sites as yet Unknown

Incidental take of owls that are not yet known will also occur under all alternatives for the OESF. Two types of situations describe these owls: those that currently live within 2.7 miles of DNR-managed lands in the OESF but have not been discovered; and owls that in the future, during the period of the HCP, will live within 2.7 miles of DNR-managed lands in the OESF. An estimate of the numbers of nearby, but unknown, owls can be developed by increasing the number of sites on DNR-managed, private, and Olympic National Forest lands by 10 percent (after Holthausen et al. 1994), and increasing the numbers of sites on Olympic National Park by a much greater, although unknown, number because those lands have not been thoroughly surveyed (Holthausen et al. 1994). There are 48 known site centers on Olympic National Forest and nonfederal lands, plus 10 percent gives an estimate of 53 site centers. Olympic National Park contains 12 site centers within 2.7 miles of the OESF; doubling that number may provide a reasonable estimate of 24 site centers. Thus there are an estimated 77 current site centers (compared to 60 known site centers) that could be within 2.7 miles of DNR-managed lands in the OESF. It also may be reasonable to assume that those sites are distributed with respect to land ownership patterns and habitat amounts such that the proportions of sites that are and are not at risk for take under the three alternatives are similar to those estimated for known sites. Thus, the risk for incidental take of unknown owls may be lowest in the near term for the No Action alternative, slightly greater for the Zoned Forest alternative, and highest for the Unzoned Forest alternative.

It is difficult to estimate the numbers of owls that will, in the future, be at risk for take under the three alternatives for the OESF. Part of that uncertainty is because the numbers and locations of resident owls over the course of the proposed HCP are unknown. Assuming that conditions for owls will improve over time as habitat restoration proceeds under federal land management plans, variously change over time under the three alternatives, and that the Olympic Peninsula sub-population will be reasonably stable, then the OESF area will likely be inhabited by a fairly constant number of resident owls that varies with the habitat provided by each alternative. Habitat in the OESF area is predicted to support increasingly more resident owls from the No Action, to the Zoned Forest, to the Unzoned Forest alternative. Those owls will inhabit sites that move both in response to patterns of forest growth and harvest, and in response to other characteristics of owl behavior and ecology. It may be that risk for take at these future owl sites will be related to the abundance of sites, because harvests may displace resident owls and more resident owls are likely if more suitable sites are available. But it is likely that such displacement in landscapes with relatively abundant habitat would have much less detrimental effects on those owls than in landscapes in which habitat capability is critically low, such as the current OESF landscape or the predicted future landscape under the No Action alternative. Thus, it may be that the risk for incidental take at future owl sites is relatively even among the No Action and action alternatives.

Summary and Comparison of the Alternatives

It is important to directly compare the characteristics of the action alternatives to the No Action alternative as they relate to the threats to spotted owls discussed above. The No Action alternative only manages to protect the (frequently inadequate, see Tables 4.4.12, 4.4.13) *status quo* around relatively geographically-fixed owl site centers, thus ensuring that regulatory incidental take is unlikely. Under both action alternatives, the landscape is managed for habitat capability at broader scales with potentially much more positive outcomes for owl conservation in the OESF area. This distinction between the No Action and action alternatives is manifest in an examination of the effects each alternative has on threats to the viability of spotted owls on the Olympic Peninsula.

Population Size and Trends

Segments of the owl population on the Olympic Peninsula are almost certainly not at equilibrium with their environment, as habitat has been removed more rapidly than the long-lived, site-faithful territory-holders relinquish occupancy of their territories. Even without further removals of owl habitat, segments of the population may continue to decline to a new equilibrium with the available habitat (Thomas et al. 1990). This is suggested by the recent (over the past 4 years) loss of formerly reproductive owl pairs from several sites on DNR-managed lands around which most habitat was removed before the sites were protected following the listing of the owl in 1990. And, it is apparent in the predictions of two independent modeling efforts (Figure 4.4.14; Holthausen et al. 1994). Occupancy rates of other marginal sites on or near DNR-managed lands in the OESF will probably decline further, at least until habitat capability begins to recover.

No Action and Action Alternatives

Further reductions in numbers of owls occupying marginal sites are likely under all alternatives (Figure 4.4.14). It is possible that additional reductions in habitat capability could exacerbate declines at some marginal sites, perhaps more so with increasing harvest of habitat (as under either action alternative). This prediction, however, could not be demonstrated by modeling. There were no statistically significant differences among the predicted numbers of owl pairs for either action alternative, No Action, or for a static landscape (Wilhere et al. in prep.) during the continued, predicted population declines that persist for 60 years (Figure 4.4.14).

Rates of habitat development significantly exceed rates of harvest of habitat under both action alternatives for the OESF. For example, Table 4.4.14 shows trends in habitat over time from an exploratory analysis of the outcomes of potential management scenarios under the Unzoned Forest alternative for the OESF (Martin 1995). Very small interim reductions in old-forest habitat are accompanied by very large increases in young-forest habitat with long-term increases in both young- and old-forest habitat. Numbers of suitable sites predicted by modeling begin to increase immediately for each action alternative, relative to the No Action alternative. Population modeling predicts a very slight gain, 2 percent to 5 percent, in overall numbers of owl pairs on the Olympic Peninsula for the Zoned and Unzoned Forest alternatives, respectively, relative to the No Action alternative. Each OESF alternative differs in the degree to which it protects or enhances habitat capability on and near DNR-managed lands in the OESF and thus, numbers of owls on the Olympic Peninsula. However, given the current estimates of a fairly sizable sub-population on the Olympic Peninsula (Holthausen et al. 1994) and predictions of a fairly sizable sub-population in the future (Figure 4.4.14; Holthausen et al. 1994), it may be that those relatively small differences on a peninsula-wide scale are not important.

The effects of the alternatives on population trends are likely to resemble those on population size. Owls on or near DNR-managed lands were incorporated into the banding studies approximately in proportion to their abundance in the sub-population, so the distinct sets of habitat conditions they experienced are represented in the analyses derived from those data. Simulation modeling predicts that population trends for spotted owls on the Olympic Peninsula are independent of the alternatives for the OESF (Figure 4.4.14). Habitat conditions on the much larger area of federal lands on the Olympic Peninsula are the most important factor affecting the viability of the sub-population. Given the current conditions of habitat on the Olympic Peninsula and model assumptions, the spotted owl population may continue to decline for several decades. Then, under the President's Forest Plan, peninsula-wide habitat conditions are predicted to reach a state that supports a viable population. Holthausen et al. (1994) concurred, and concluded that, regardless of habitat conditions on nonfederal lands "...it is likely, but not assured that a stable population would be maintained..." on portions of the federal lands at the core of the Olympic Peninsula. Thus, it appears that neither near- or longer term trends in the size of the sub-population will change as the result of any of either the No Action or action alternatives for the OESF.

Geographic and Ecological Distribution of Owls and Habitat

Threats to the viability of owls on the peninsula resulting from a restricted geographic and ecological distribution would remain if owls only inhabited the mid-elevation forests in the federal lands. Holthausen et al. (1994) concluded that "...a biologically significant contribution..." could result from maintaining a more widely distributed, stable population of owls.

ALTERNATIVE 1

Projections of the No Action alternative 100 years into the future predict no change in the geographic and ecological distribution of owls and their habitat relative to the current condition (Figure 4.4.7a-d, 4.4.11, 4.4.12, 4.4.13; and Tables 4.4.9, 4.4.10, and 4.4.11).

ALTERNATIVE 2

The Unzoned Forest alternative contributes to the broadest geographic and ecological distribution of owls and their habitat relative to either the current condition, the No Action alternative, or the Zoned Forest alternative projected into the future (Figures 4.4.7a-d, 4.4.11, 4.4.12, and 4.4.13; and Tables 4.4.9, 4.4.10, and 4.4.11). The density of predicted, suitable sites on and around DNR-managed lands west of the mid-elevation, federally-owned core of the Olympic Peninsula slowly increases over the first 40 years of this alternative, then more rapidly after 60 years (Figure 4.4.13). The Unzoned Forest alternative contributes appreciably to the overall habitat capability of mostly the lower elevation, coastal plain forests in the OESF, adding 51 percent to the current, overall habitat capability in this area (Figures 4.4.7a,b,d, Table 4.4.9), and resulting in a greater than three-fold increase in the habitat capability of DNR-managed lands (Figures 4.4.7a,b,d; Table 4.4.9). Under this alternative, areas of capable habitat extend increasingly farther from the federal lands at the core of the Olympics (Figures 4.4.7a,b,d, 4.4.11, and 4.4.13). It may be that the most significant contribution of the Unzoned Forest alternative to spotted owl conservation would result from its substantial increase in the geographic and ecological distribution of owls and their habitat on the Olympic Peninsula.

ALTERNATIVE 3

The Zoned Forest alternative contributes to a broader geographic and ecological distribution of owls and their habitat relative to either the current condition, or the No Action alternative projected into the future (Figures 4.4.7a,b,c, 4.4.11, 4.4.12, 4.4.13; and Tables 4.4.9, 4.4.10, and 4.4.11). The density of predicted, suitable sites on and around DNR-managed lands west of the mid-elevation, federally-owned core of the Olympic Peninsula slowly increases over the first 40 years of this alternative, then more rapidly after 60 years (Figure 4.4.12). The Zoned Forest alternative contributes appreciably to the overall habitat capability of mostly the lower elevation, coastal plain forests in the OESF, adding 27 percent to the current, overall habitat capability in this area (Figures 4.4.7a,b,c, Table 4.4.9), and resulting in a nearly two-fold increase in the habitat capability of DNR-managed lands (Figures 4.4.7a,b,c, Table 4.4.9). Under this alternative, areas of capable habitat extend increasingly farther from the federal lands at the core of the Olympics (Figures 4.4.7a,b,c, 4.4.11, and 4.4.12). It may be that the most significant contribution of the Zoned Forest alternative to spotted owl conservation would result from increasing the geographic and ecological distribution of owls and their habitat on the Olympic Peninsula.

Population Isolation
None of the alternatives considered for the OESF can be considered to significantly influence risks to the viability of owls on the Olympic Peninsula based on their demographic isolation from other sub-populations.

Natural Disturbances
As the abundant young stands on DNR-managed lands in the wind-prone areas of the OESF mature, they will increasingly function as owl habitat and become increasingly prone to windthrow. Silviculture in the OESF is anticipated to increasingly focus on retention of structural and compositional elements at harvest, in order to support ecological functions (such as owl habitat) in those stands. Windthrow is anticipated to be a challenge to forest managers in the OESF, and it is anticipated that considerable effort will be devoted to learning techniques to minimize wind damage. It can be argued that the Unzoned Forest alternative is at risk numerically to the most wind damage, because it attempts to manage for the most owl habitat in the wind-prone coastal plain areas and because it attempts to experiment with more novel silvicultural prescriptions in which retention of wind-prone structural elements are important. However, the other alternatives only incur less risk because they intend less aggressive habitat restoration.

Barred Owls
It is uncertain the degree to which barred owls will continue to increase in abundance on the Olympic Peninsula, and the degree to which they might interact with spotted owls to the detriment of the viability of spotted owls on the Olympic Peninsula. However, it can be argued that either action alternative for the OESF (because of their emphasis on research and monitoring) might be more likely to detect such interactions, learn, and implement management strategies to deal with them.

Table 4.4.8: Estimates of forest cover on lands of different ownership in the Olympic Experimental State Forest, July 1991[1]

Landowner	Cover-type	Total Area (acres)	Percent of Area[2]	Percent of Cover-type[3]
Olympic National Park	late seral[4] mid-seral[5] other[6]	216,137 16,298 143,857	16.5 1.2 11.0	59.1 18.7 16.8
Olympic National Forest	late seral mid-seral other	66,325 15,434 93,294	5.0 1.2 7.1	18.1 17.7 10.9
DNR-managed, OESF[7]	late seral mid-seral other	52,150 20,990 197,974	4.0 1.6 15.1	14.3 24.1 23.1
Other[8]	late seral mid-seral other	30,983 34,293 421,558	2.4 2.6 32.1	8.4 39.4 49.2
TOTAL		1,312,758	100	

[1] Land cover estimated by supervised classification of Landsat Thematic Mapper scenes taken July 1991, (WDFW 1994b). Land ownership estimated from DNR's digital public land map (DNR 1995d).

[2] The area within the cover-type within the ownership class, divided by the total area described.

[3] The area within the cover-type within the ownership class, divided by the total area within the cover-type.

[4] Late seral forests = old-growth and large-saw cover.

[5] Mid-seral forests = small-saw cover.

[6] Other land cover = pole, sapling, open-canopy/mixed conifer, open areas (clearcuts, high-elevation barrens, towns, etc.), water, cloud/shadow cover.

[7] DNR-managed lands proposed as the Olympic Experimental State Forest (OESF).

[8] Other lands include all private ownerships, tribal lands, DNR-managed lands outside the OESF.

Table 4.4.9: Estimates of the habitat capability for spotted owls of DNR-managed and all lands in the Olympic Experimental State Forest area, currently and projected 100 years into the future under the No Action, Zoned Forest, and Unzoned Forest alternatives

Areas estimated to provide capable habitat had at least 40 percent potential habitat at the scale of 2.7-mile radius circles. Cover types that were assumed to be current potential habitat were old growth, large, and small sawtimber (WDFW 1994b). Cover types that were assumed to be potential habitat in 100 years were areas that were reserved from harvest and areas of DNR-managed forest or the Olympic National Forest that were managed for integrated outputs of commodity and ecosystem products and were predicted to be older than 50 years.

All lands in the OESF area

	Acres	Percent[1]	Percent Change from Current[2]	Percent Change from Projected No Action Alt.[3]
Currently Capable as Habitat	338,900	32		
Predicted to be Capable Habitat in 100 years under the No Action alternative	359,600	34	6	
Predicted to be Capable Habitat in 100 years under the Unzoned Forest alternative	511,300	48	51	46
Predicted to be Capable Habitat in 100 years under the Zoned Forest alternative	429,600	40	27	19
Total Land Area	1,066,300			

[1] Percent of total land area that is capable as habitat.

[2] Predicted area of capable habitat under each alternative divided by current area of capable habitat minus 1, expressed as a percent.

[3] Predicted area of capable habitat under each action alternative divided by predicted area of capable habitat under the No Action alternative minus 1, expressed as a percent.

Table 4.4.9 (cont'd.)

DNR-managed Lands in the OESF area

	Acres	Percent[1]	Percent Change from Current[2]	Percent Change from Projected No Action Alt.[3]
Currently Capable as Habitat	48,900	18		
Predicted to be Capable Habitat in 100 years under the No Action alternative	36,800	14	-25	
Predicted to be Capable Habitat in 100 years under the Unzoned Forest alternative	153,400	57	214	317
Predicted to be Capable Habitat in 100 years under the Zoned Forest alternative	97,200	36	99	164
Total Land Area	270,000			

[1] Percent of total land area that is capable as habitat.

[2] Predicted area of capable habitat under each alternative divided by current area of capable habitat minus 1, expressed as a percent.

[3] Predicted area of capable habitat under each action alternative divided by predicted area of capable habitat under the No Action alternative minus 1, expressed as a percent.

Table 4.4.10: Model estimates of the current capability of hexagonal sites on DNR-managed and all lands on the Olympic Peninsula to provide habitat suitable to support pairs of spotted owls

	All Sites	Suitable Sites			
	Number	Number	Median Score	Max. Score	Min. Score
All Sites	1,239	435	4.40	8.99	0.25
Sites with some DNR-managed land	234	61	1.10	7.64	0.00
Sites with >90 percent DNR-managed land	27	9	1057	4.50	0.63

Table 4.4.11: Model estimates of the capability in 100 years of hexagonal sites on DNR-managed and all lands on the Olympic Peninsula to provide habitat suitable to support pairs of spotted owls under the No Action, Zoned and Unzoned Forest HCP alternatives for the OESF

ALTERNATIVE 1	All Sites	Suitable Sites			
	Number	Number	Median Score	Max. Score	Min. Score
All Sites	1,239	470	4.77	8.99	0.45
Sites with some DNR-managed land	234	67	1.12	7.64	0.00
Sites with >90 percent DNR-managed land	27	8	1.57	4.50	0.63
ALTERNATIVE 2	**All Sites**	**Suitable Sites**			
	Number	**Number**	**Median Score**	**Max. Score**	**Min. Score**
All Sites	1,239	505	4.67	8.99	0.15
Sites with some DNR-managed land	234	99	1.98	7.69	0.04
Sites with >90 percent DNR-managed land	27	24	4.13	5.27	2.39
ALTERNATIVE 3	**All Sites**	**Suitable Sites**			
	Number	**Number**	**Median Score**	**Max. Score**	**Min. Score**
All Sites	1,239	499	4.65	8.99	0.64
Sites with some DNR-managed land	234	92	1.82	7.69	0.03
Sites with >90 percent DNR-managed land	27	21	3.95	4.73	1.38

Table 4.4.12: An estimate of the proportion and ownership[1] of potential spotted owl habitat[2] within 2.7 miles of the 69 owl sites within 2.7 miles of DNR-managed lands in the Olympic Experimental State Forest, and the potential for DNR activities under the Zoned Forest alternative to result in incidental take at these sites

Site Characteristics	Site Status (number of sites)		*Zoned Forest Impacts*
>40 percent habitat on federal lands	pair 2 birds single unknown[3]	12 2 4 0	no potential for incidental take of these sites
≥40 percent habitat, federal minus DNR habitat <40 percent, inside owl zones or high priority circles or general management considerations will avoid take	pair 2 birds single unknown[4]	6 0 1 0	no potential for incidental take in first 40-60 years
≥40 percent habitat, federal habitat-DNR habitat <40 percent, Zoned Forest alternative or other considerations do not avoid take	pair 2 birds single unknown[4]	4 0 0 0	some potential for incidental take at these sites
<40 percent habitat, inside owl zones or high priority circles	pair 2 birds single unknown[4]	19 0 4 4	no potential for incidental take in first 40-60 years, no take of unknown sites (see footnote 4)
<40 percent habitat, Zoned Forest alternative or other considerations do not avoid take	pair 2 birds single unknown[4]	4 0 4 5	some potential for incidental take at these sites, not take of unknown sites (see footnote 4)

[1]Estimated from digital maps of public land ownership (DNR 1995d).

[2]Estimates of spotted owl habitat, including old forest, and younger forest habitat (Hanson et al. 1993), were based on a supervised classification of Landsat Thematic Mapper (TM) scenes taken July 1991 (WDFW 1994b). Habitat proportions reflect all old growth and large-saw cover, and half of the small-saw cover as estimated by TM.

[3]Based on the WDFW Interagency spotted owl database, July 1995: pair - observations of two owls behaving as a pair; 2 birds - observations of two birds not behaving as a pair; single - repeated observations of a single owl suggesting territorial status; unknown - isolated observations that do not suggest territorial status.

[4]Take can occur at sites occupied by pairs, two birds pair status unknown, and territorial singles only (60 Fed. Reg. 9484 (1995)).

Table 4.4.13: An estimate of the proportion and ownership[1] of potential spotted owl habitat[2] within 2.7 miles of the 69 owl sites within 2.7 miles of DNR-managed lands in the Olympic Experimental State Forest, and the potential for DNR activities proposed under the Unzoned Forest alternative to result in incidental take at these sites

Site Characteristics	Site Status[3] (number of sites)		Unzoned Forest Impacts
>40 percent habitat on federal lands	pair 2 birds single unknown [4]	12 2 4 0	no potential for incidental take of these sites
≥40 percent habitat, federal habitat- DNR habitat <40 percent	pair 2 birds single unknown [4]	10 0 1 0	no potential for incidental take at these sites, no take of unknown sites (see footnote 4)
<40 percent habitat	pair 2 birds single unknown [4]	23 0 8 9	some potential for incidental take at these sites, no take of unknown sites (see footnote 4)

[1] Estimated from digital maps of public land ownership (DNR 1995d)

[2] Estimates of spotted owl habitat, including old forest and younger forest habitats (Hanson et al. 1993), were based on a supervised classification of Landsat Thematic Mapper (TM) scenes taken July 1991 (WDFW 1994b). Habitat proportions reflect all old growth and large-saw cover, and half of the small-saw cover as estimated by TM.

[3] Based on the WDFW Interagency spotted owl database, July 1995: pair - observations of two owls behaving as a pair; 2 birds - observations of two birds not behaving as a pair; single - repeated observations of a single owl suggesting territorial status; unknown - isolated observations that do not suggest territorial status.

[4] Take can occur at sites occupied by pairs, two birds pair status unknown, and territorial singles only (60 Fed. Reg. 9484 (1995)).

Table 4.4.14: Projections of the proportion of the Olympic Experimental State Forest covered by young and old forest owl habitat based on an exploratory analysis[1] of the outcomes of potential management scenarios under the Unzoned Forest alternative

	percent of OESF in Cover-Type at Different Times (years) in the Future			
Habitat Type[2]	**0**	**30**	**50**	**100**
Young Forest	14	43	58	26
Old Forest	19	18	18	39
All	33	60	75	65

[1]Martin 1995

[2]Habitat definitions based on Hanson et al. 1993.

Figure 4.4.7a-d: Estimates of habitat capability for spotted owls of the Olympic Experimental State Forest areas currently, and under the No Action, Zoned Forest, and Unzoned Forest HCP alternatives

Figures depict major federal and tribal ownership by fine-grained shading and areas that were estimated to provide at least 40 percent potential habitat at the scale of pair ranges (2.7 miles) by coarse hatching. Figure 4.4.7a is based on estimates of current habitat capability derived from analysis of Landsat Thematic Mapper Imagery gathered in July 1991 (WDFW 1994b). Figures 4.4.7b, c, and d are based on projections of No Action, Zoned Forest, and Unzoned Forest alternatives, respectively, 100 years into the future.

Figure a

Figure b

Figure c

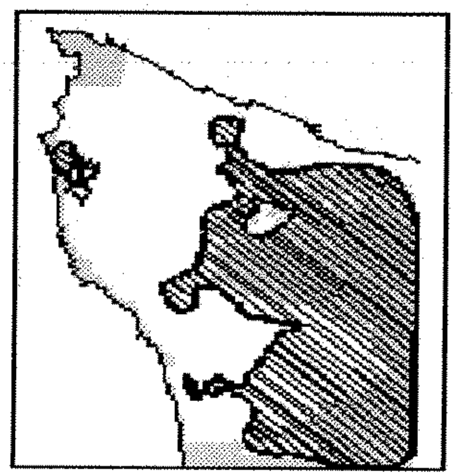


Figure d

Figure 4.4.8: Hexagonal habitat map constructed to represent current conditions. ■ = suitable sites; ▒ = unsuitable sites; ■ = reflecting barriers to movement.

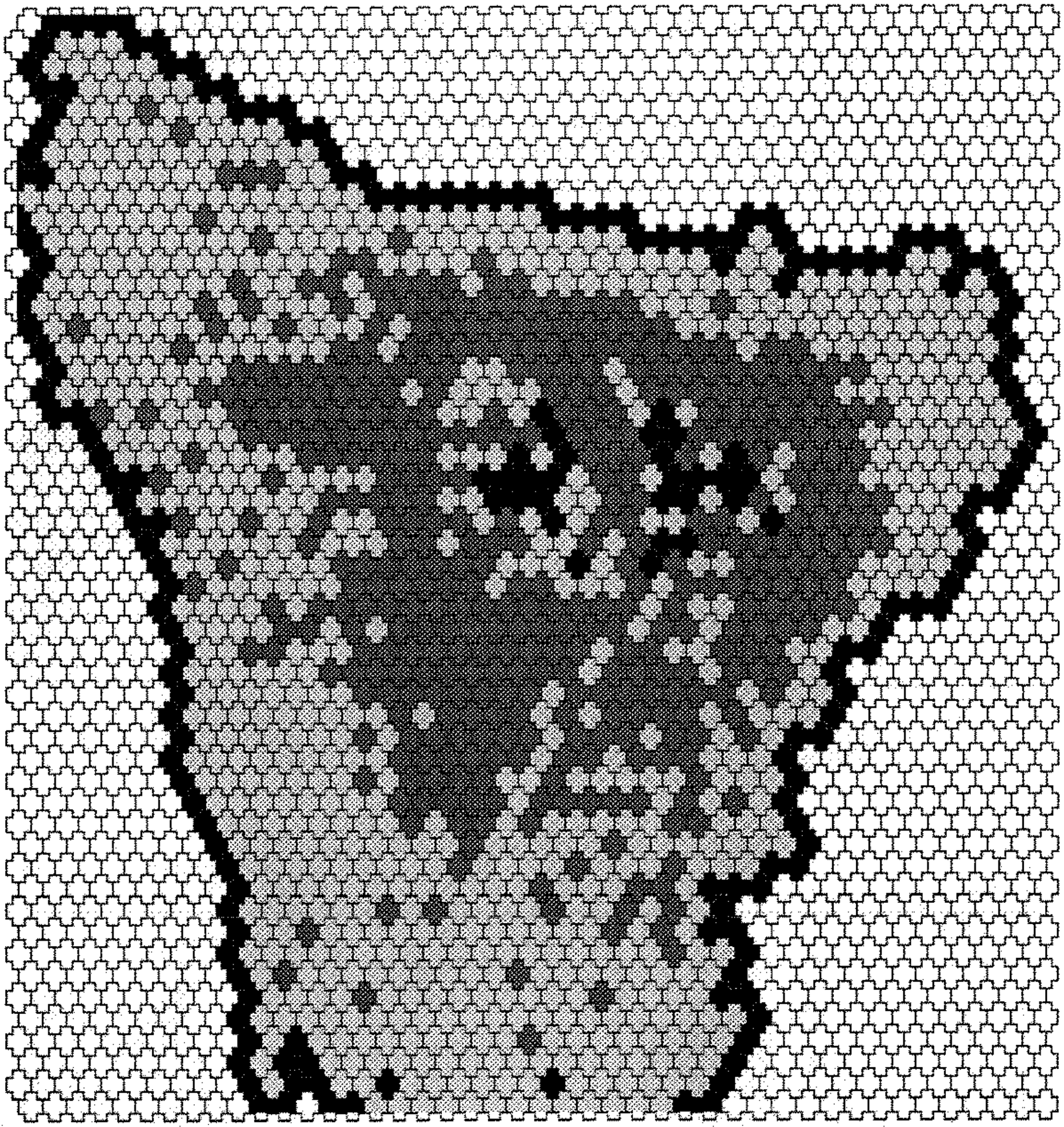


Figure 4.4.9: Histogram of numeric distribution of site scores at year 100 derived from hexagonal habitat map in Figure 4.4.8 (year 2094). ■ = suitable sites; ▩ = unsuitable sites. There were 1239 sites and 470 of these were suitable.

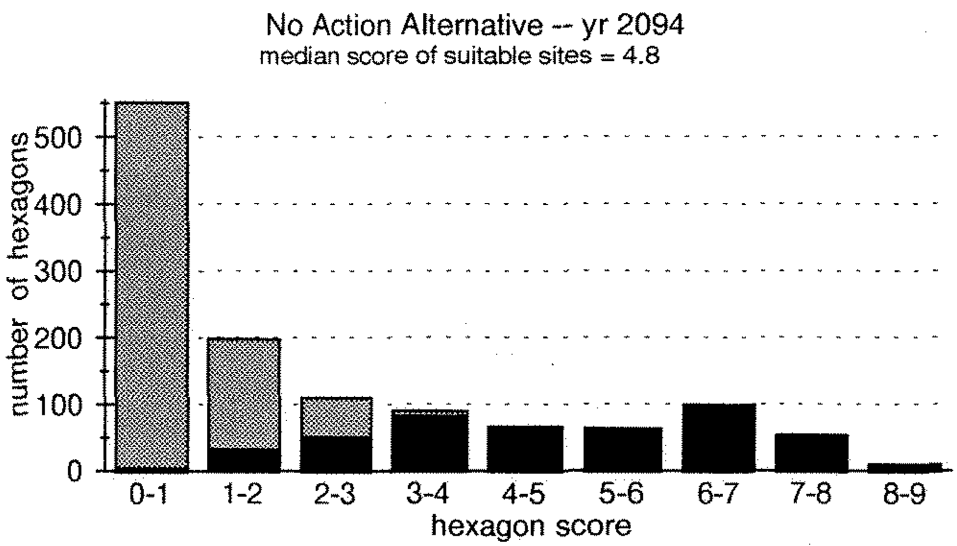


Figure 4.4.10: The numbers of suitable sites projected to result from each of the HCP alternatives for the OESF. Numbers of suitable sites were derived from hexagonal habitat maps in Figures 4.4.11, 4.4.12, and 4.4.13. "Static" is the 1994 hexagonal habitat map (Figure 4.4.8) held constant, and is presented as a base line for comparison.

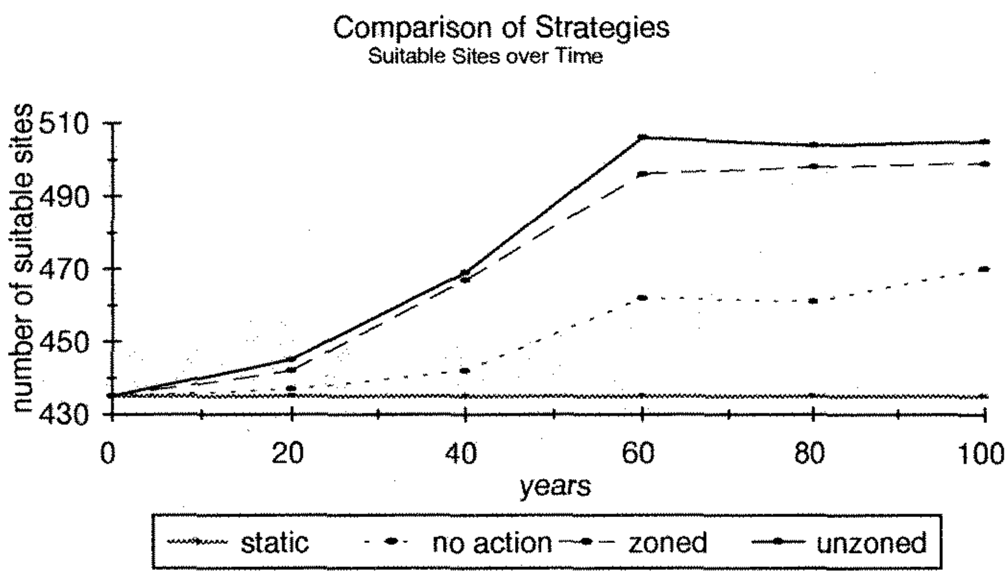


Figure 4.4.11: Time series of hexagonal habitat maps constructed for the No Action alternative for the OESF. ■ = suitable sites; ▒ = unsuitable sites; ■ = movement barriers.

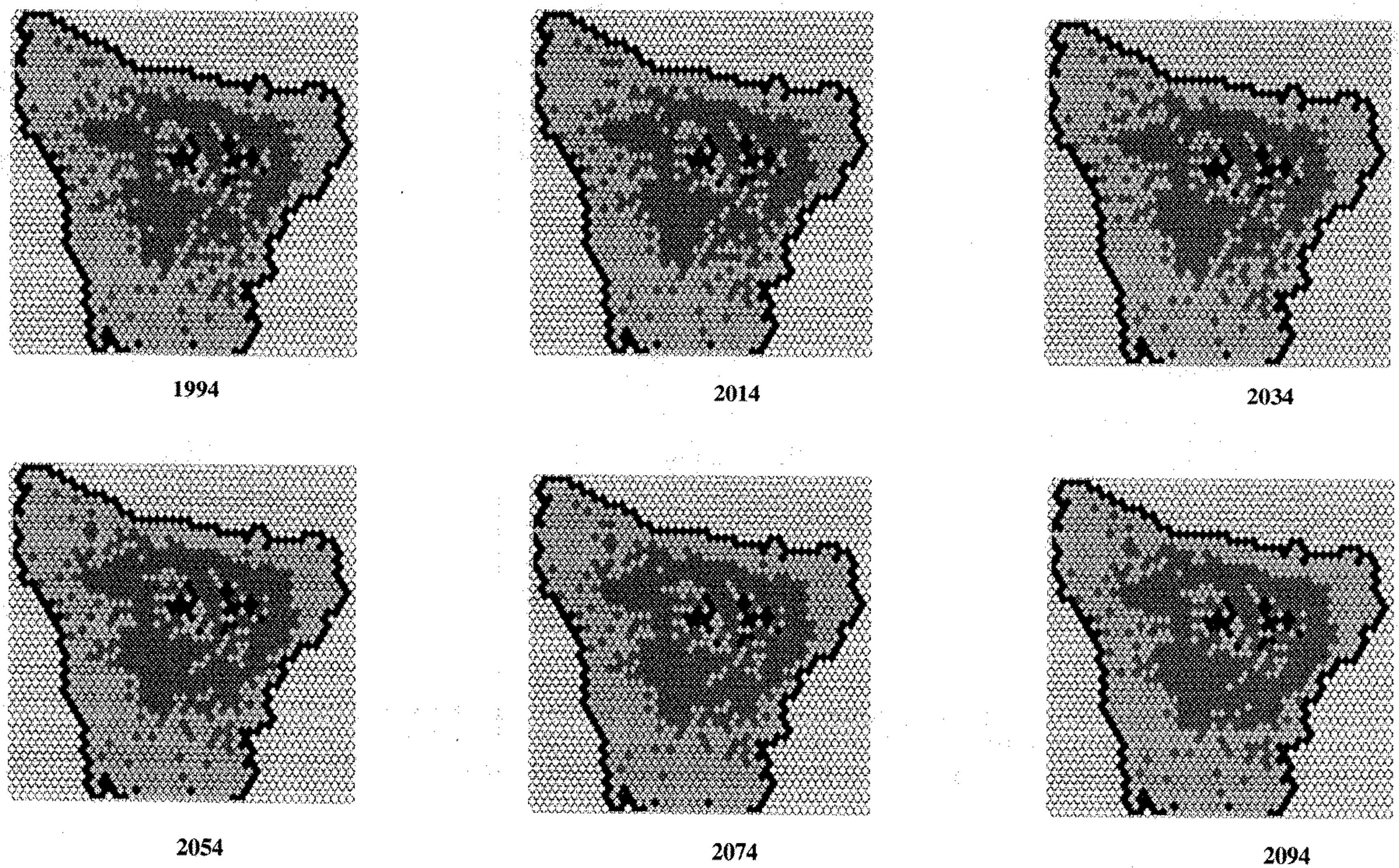


Figure 4.4.12: Time series of hexagonal habitat maps constructed for the Zoned Forest alternative for the OESF. ■ = suitable sites; ▒ = unsuitable sites; ■ = movement barriers.

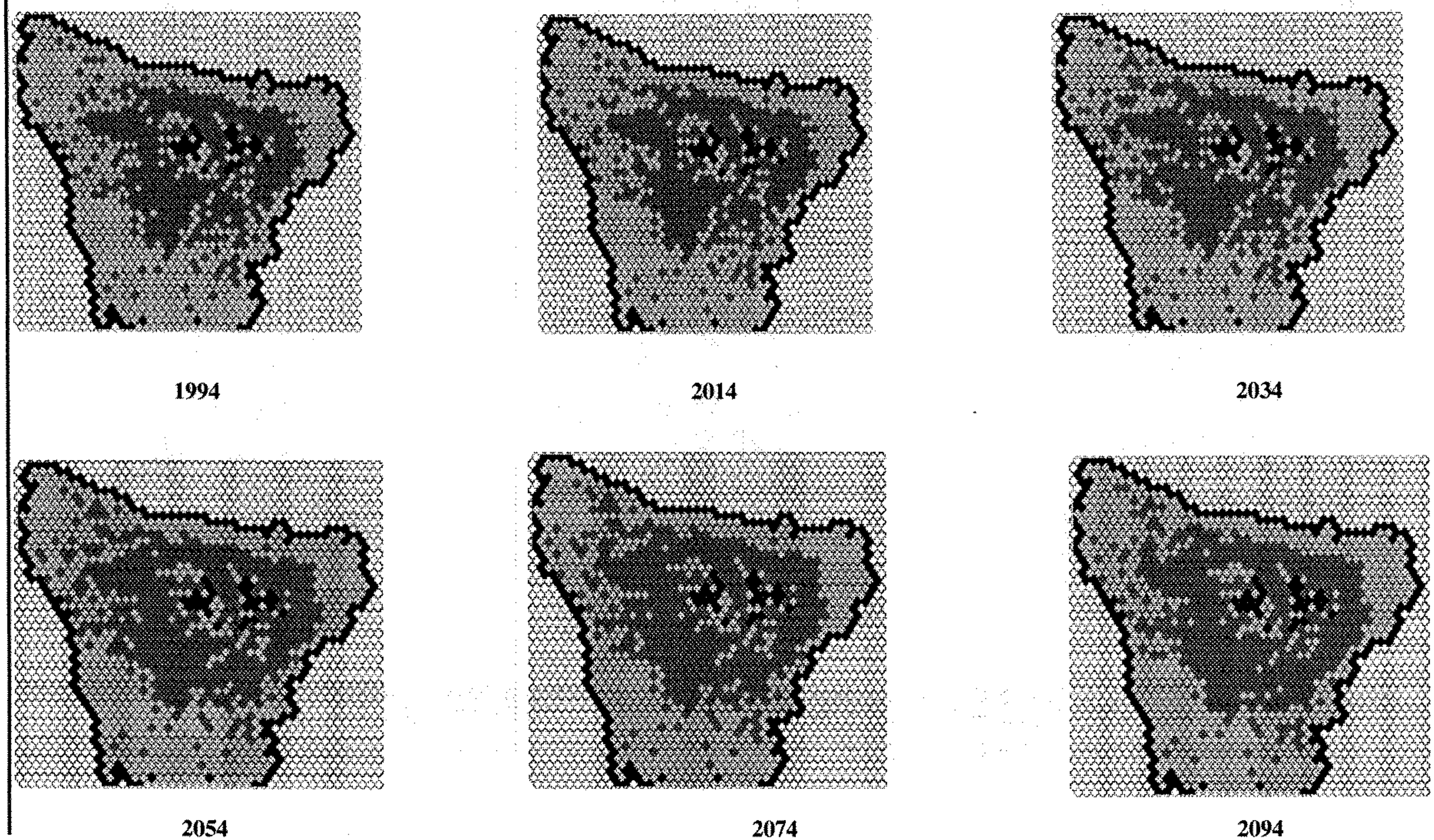


Figure 4.4.13: Time series of hexagonal habitat maps constructed for the Unzoned Forest alternative for the OESF. ■ = suitable sites; ▒ = unsuitable sites; ■ = movement barriers.

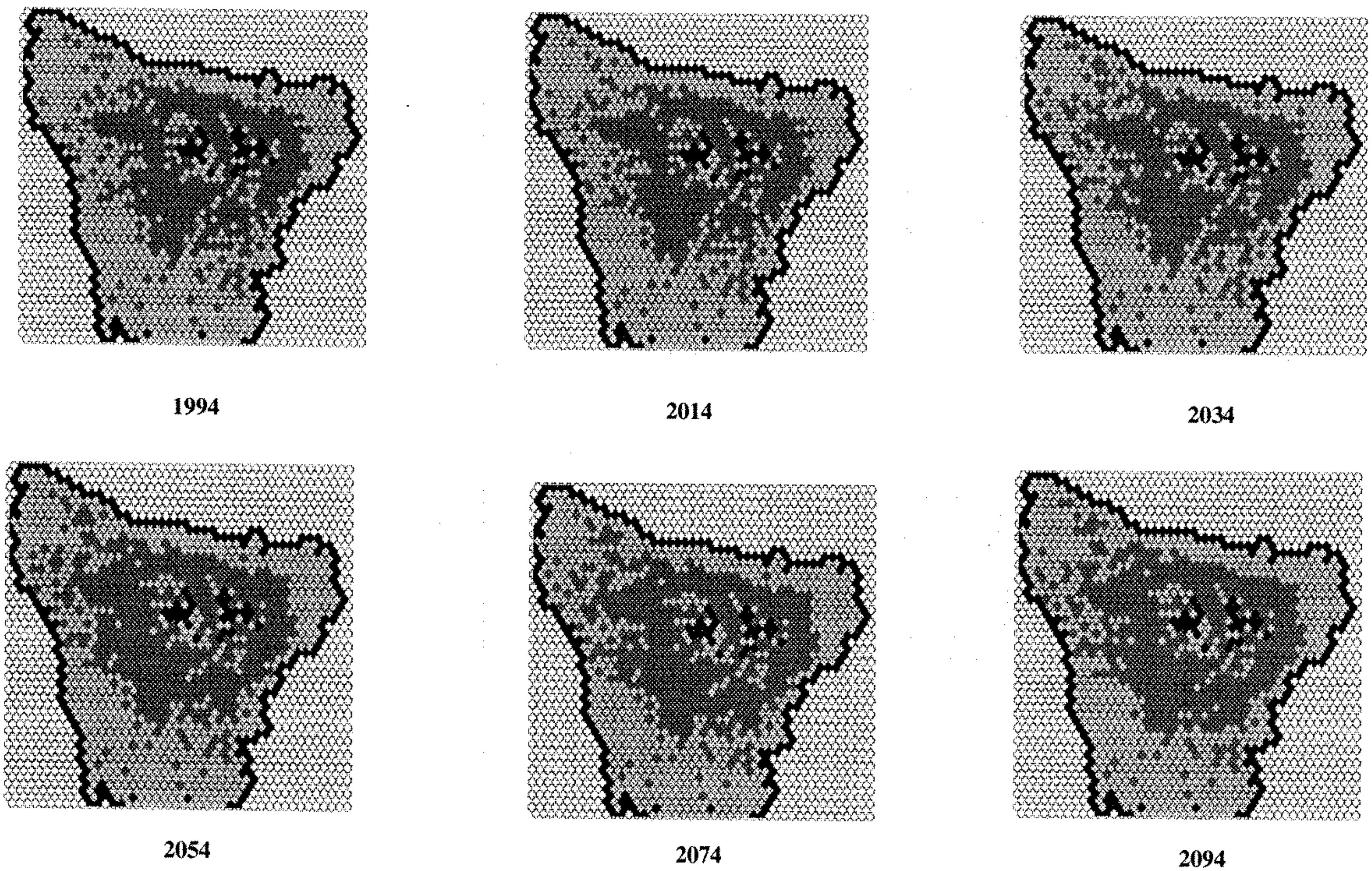
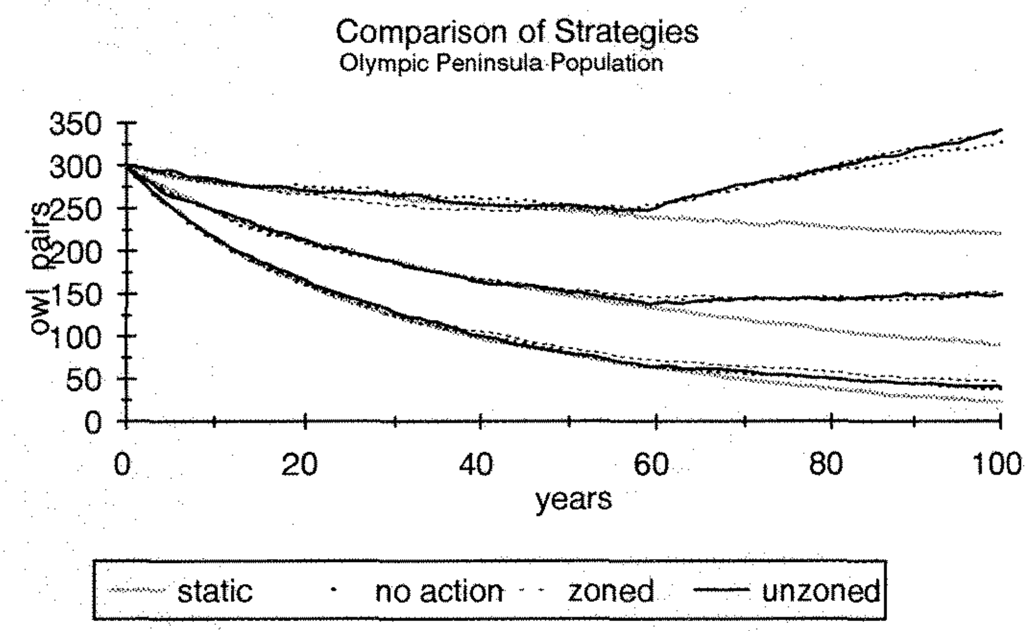


Figure 4.4.14: Projected trajectories of the Olympic Peninsula spotted owl population.

There are three sets of four trajectories representing combinations of each of the three HCP alternatives for the OESF and the static landscape with three sets of assumptions about demographic parameters. For the top set juvenile survivorship equaled 0.53, for the middle set juvenile survivorship equaled 0.47, and for the bottom set it equaled 0.41. Hexagonal habitat maps were changed at years 20, 40, 60, and 80.



4.4.4 Analysis of Consequences to Marbled Murrelet, Other Wildlife and Plant Species in the OESF

4.4.4 Analysis of Consequences to Marbled Murrelet, Other Wildlife and Plant Species in the OESF

Marbled Murrelet Conservation

The conservation strategies for the marbled murrelet in the OESF are the same as the strategies for all other west-side planning units. The analysis of potential environmental consequences related to marbled murrelet conservation strategy is covered for all six west-side planning units, including the OESF, in Section 4.2.2. When the long-term conservation plan is developed, it may or may not propose different strategies for the OESF than for the other five west-side planning units.

Other Wildlife Species

The combined riparian, spotted owl, and marbled murrelet conservation strategies and mitigation measures in the OESF may affect other wildlife and fish species differently in the OESF than in the other planning units. Assessments of potential impacts under the OESF No Action alternative and the two action alternatives for the OESF are included in Sections 4.5.1 and 4.5.2.

Plant Species

The combined effects of the riparian, spotted owl, and marbled murrelet conservation strategies on sensitive plant species in the Olympic Experimental State Forest for the OESF No Action alternative and the two HCP action alternatives for the OESF are also described in Section 4.5.3.

4.5 Other Species and Habitats

4.5 Other Species and Habitats

4.5.1 Section 10A Permit Species

Matrix 4.5.1a: Management strategies for HCP (excluding OESF)

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Other Federally Listed Species			
West-side units, east-side units, and OESF	Other federally listed species protected through meeting requirements of federal and state laws and the development of bald eagle site management plans.	Other federally listed species protected through meeting requirements of federal and state laws and the development of bald eagle site management plans, plus spotted owl, marbled murrelet, and riparian conservation strategies and additional mitigation for: (1) peregrine falcon: site-specific protection with restricted access to lands within .5 mile of active aerie and protection of location information; (2) gray wolf: establish wolf habitat management area and develop plans to limit human disturbance for land within 8 miles of documented sightings; and, (3) grizzly bear: establish grizzly bear habitat management area and develop plans to limit human disturbance for land within 10 miles of documented sightings.	Same as Alternative B.

Matrix 4.5.1b: Management strategies for alternatives related to the OESF planning unit

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Other Federally Listed Species			
Other Federally Listed Species	Other federally listed species protected through meeting requirements of federal and state laws, development of bald eagle site management plans	Landscape-level management, built around riparian, spotted owl, and marbled murrelet conservation, provides primary protection for other federally listed species. Additional mitigation for: (1) bald eagle: continue nest-site-management process; and, (2) peregrine falcon: site-specific protection; restricted access within 0.5 mile of aerie; protect location information.	Same as Alternative 2.

Oregon Silverspot Butterfly (*Speyeria zerene hippolyta*)

The Oregon silverspot butterfly is listed by the federal government as threatened and by the state as endangered. It inhabits salt spray meadows, stabilized dunes, and open fields that support its larval host plant, the western blue violet (*Viola adunca*). Forested edges adjacent to meadows used by the Oregon silverspot are also considered important habitat (WDW 1993d). Such sheltered areas enable the Oregon silverspot to bask, perch, seek nectar, court, and mate despite strong ocean winds that characterize coastal areas (WDW 1993d). Critical habitat has not been designated under the Endangered Species Act (WDW 1993d). A 1991 survey found no Oregon silverspot butterflies in Washington (WDW 1993d). Prior to 1994, a small parcel of land was managed by DNR near a past species sighting on the north end of Long Beach Peninsula. In 1994 this parcel was sold to State Parks.

None of the alternatives offer specific strategies for directly managing habitat of the Oregon silverspot butterfly, such as provisions for maintenance of meadows where the western blue violet might be found. However, it is expected that none of the alternatives would have major effects on the Oregon silverspot butterfly due to its limited distribution in Washington State, its rare potential for occurrence on DNR-managed land, and its minimal use of forests.

ALTERNATIVE A

Current policies may provide adequate protection for the Oregon silverspot butterfly and its habitat (DNR 1992b; see Chapter 2). If salt spray meadows potentially occupied by this species are classified as wetlands, full implementation of Forest Resource Plan (FRP) Policy No. 21, entailing no net loss of wetlands, would provide substantial habitat protection for this species. Buffers designed to maintain the hydrologic function of the wetland may further contribute to Oregon silverspot conservation by providing forested edge habitat and maintaining wetland quality. When fully implemented,[1] this would prevent direct habitat loss and provide future habitat should the species expand its current range.

Forest Resource Plan Policy No. 23 specifically addresses the threatened and endangered status of the species, and states that DNR will comply with federal and state regulations. Washington Forest Practices Rules require completion of an environmental checklist in compliance with SEPA for harvesting timber, road construction, aerial or ground application of pesticides, or site preparation within 0.25 miles of a Washington Department of Fish and Wildlife (WDFW) documented individual occurrence of an Oregon silverspot butterfly (WAC 222-16-080e). This policy should prevent direct harm to the species, provided that WDFW keeps accurate and frequently updated records of

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[1] The "no net loss of wetlands" policy is not fully implemented yet. Until such time, it is reasonable to assume that DNR will, at a minimum, adhere to the Washington Forest Practices Rules regarding wetlands. These rules entail the establishment of average wetland management zones (WMZ) of 50-100 feet around Type A Wetlands, bogs, or fens and 25-50 feet around Type B Wetlands greater than 0.5 acres where 75 trees per acre are left.

Oregon silverspot occurrences. Therefore, the overall risk and impact to the Oregon silverspot butterfly under Alternative A is minimal.

ALTERNATIVE B

Alternative B ultimately provides the same habitat protection for the Oregon silverspot butterfly as Alternative A, because it employs the same wetland strategy and complies with state and federal species-specific endangered and threatened species regulations. However, Alternative B would provide more consistent protection than Alternative A through the detailed guidance it provides for the implementation of the wetlands policy, including specific buffer widths and harvest restrictions. However, it is not likely that the forest management activities of either Alternative A or B will substantially impact the Oregon silverspot butterfly or alter its conservation, due to the limited distribution and rare potential occurrence of this species on DNR-managed lands.

ALTERNATIVE C

If Oregon silverspot butterfly habitats are classified as wetlands, this alternative would provide the most protection for the species, because it would distribute more potential habitat of greater quality across the planning area. Unlike Alternatives A and B, the wetland strategy of Alternative C would retain buffers around smaller bogs (0.1 acres) and wetlands (no minimum if the wetland connects other wetlands or typed water, functioning together like one larger wetland), prohibit harvest through the 50-foot zone bordering nonforested wetlands, and provide more stringent ground-disturbance constraints. The no-harvest zones within the buffers would provide the highest quality protection of potential Oregon silverspot butterfly forested edge habitat. DNR would also continue to comply with the species-specific requirements of the Washington Forest Practices Rules and the Wildlife Code of Washington. Thus, Alternative C provides greater certainty that future Oregon silverspot habitat distribution and quality would be maintained and relatively minimizes potential impact due to forest management activities, compared to Alternatives A and B.

OESF ALTERNATIVES

This species does not occur within the OESF Planning Unit.

Aleutian Canada Goose (*Branta canadensis leucopareia*)

Listed by the both federal government and state as threatened, members of this subspecies of the Canada goose might intermittently occupy sites within the plan area as they migrate between their Alaskan breeding and Oregon and California wintering grounds. Rodrick and Milner (1991) identified habitat used by the geese during migration in and near Willapa Bay and along the lower reaches of the Columbia River. Other potential resting and feeding sites include lakes, large ponds, wetlands, grasslands, meadows, and agricultural fields. Although there is no specific management guidance in any of the alternatives for the management of grasslands or meadows, conservation of the Aleutian Canada goose would be peripheral to DNR's forest management activities due to the rare occurrence of the geese on DNR-managed lands and their lack of association with forested habitats.

ALTERNATIVE A

Under this alternative, general habitat protection would be afforded to the Aleutian Canada goose by compliance with wildlife, wetland, and riparian management zone provisions of DNR's FRP Policies (Nos. 20, 21, and 23) and Washington Forest Practices Rules. Maintaining water quality and protecting lakes and ponds classified as Type 1, 2, 3, or 4 Waters (FRP Policy No. 20) would enhance resting areas, and protecting associated riparian vegetation would maintain foraging opportunities. FRP Policy No. 21, entailing no net loss of wetlands, would also benefit the Aleutian Canada goose by preventing loss of forage and resting areas. Wetland buffers would maintain forage opportunities due the restriction on types of timber harvest activities within them. FRP Policy No. 23, directing DNR to voluntarily participate in the recovery of threatened and endangered species and follow federal and state guidelines for such species, would allow DNR to take further conservation measures should areas managed by DNR become Aleutian Canada goose habitat in the future. Implementation of these policies under Alternative A would likely result in little overall impact to and adequate protection of the Aleutian Canada goose because they distribute resting and foraging areas throughout the planning area. However, the general policy direction offered by Alternative A concerning riparian and wetland management zones would result in inconsistent habitat quality throughout the plan area due to less stringent establishment of the proposed zones.

ALTERNATIVE B

This alternative would result in greater protection for Aleutian Canada goose than Alternative A, primarily due to its more explicit riparian conservation strategy. The greater protection would be the result of larger and less manipulated buffers on ponds and lakes (Type 1 through 4 Waters; see Chapter 2) , including inner riparian management zones (minimum 100 feet) and outer wind buffers where there is a moderate potential for windthrow. These buffers would effectively maintain or increase the amount and quality of resting and foraging areas available to the species. Overall, Alternative B would provide more protection of the Aleutian Canada goose than Alternative A by ensuring a potentially greater amount of higher quality habitat over the planning area through the implementation of specific riparian habitat conservation strategies.

ALTERNATIVE C

Alternative C would provide the most protection for this species and least impact to its habitat of all the alternatives, due to its enhanced wetlands and riparian conservation strategies that further distribute more protected habitat over a broad geographic area. Through its elimination of timber harvest through the 50-foot zone bordering nonforested wetlands, application of buffers to bogs and wetlands of smaller sizes, limitation on harvest of trees within the remainder of the buffer surrounding wetlands, incorporation of an increased buffer for high-risk slope conditions, and more stringent ground-disturbance constraints, the wetland strategy of Alternative C should provide substantial protection of Aleutian Canada goose foraging and resting areas. Overall, the riparian conservation strategy of this alternative, with its increased buffers and restrictions of harvest activities within riparian management zones, would benefit the Aleutian Canada goose by maintaining the quality of aquatic systems, including lakes and ponds it might use for foraging and resting sites along its migratory route. This alternative offers substantially more protection of the species than Alternative A by distributing a greater amount of higher quality habitat throughout the planning area. The enhanced conservation strategies provide more confidence that the species' habitat needs will be met than Alternative B.

OESF ALTERNATIVES

Alternative 1. Under the No Action alternative for the OESF, management and resulting effects would be the same as those described in Alternative A, above.

Alternative 2. The unzoned OESF alternative would result in an increased level of protection compared to the No Action alternative for the Aleutian Canada goose due to two factors: (1) enhanced riparian ecosystem quality derived from 150-foot average inner-core buffers on Type 1 through 3 Waters and 50-foot inner buffers on Type 4 and 5 Waters; and (2) more protection of forage and resting opportunities as a direct result of prohibited harvest within 50 feet of nonforested wetlands. These factors would minimize the impact of forest management activities on Aleutian Canada goose habitat.

Alternative 3. Same as Alternative 2.

Bald Eagle (*Haliaeetus leucocephalus*)

Of the seven states involved in the Pacific Bald Eagle Recovery Plan, Washington State supports the largest breeding and wintering populations of the bald eagle. This species is listed by both the federal government and state as threatened. DNR manages potential bald eagle habitat throughout the plan area, including forested land within one mile of major water bodies such as streams, estuaries, lakes, sloughs, reservoirs, and coastal beaches (Brown 1985; USDI 1986). Most nesting occurs within the San Juan Islands or along the Olympic coastline, but nesting territories are also found along Hood Canal, on the Kitsap Peninsula, within Island County, along the lower reaches of the Columbia River, and in eastern Washington (USDI 1986). Critical wintering areas with communal roost sites occur along the north fork of the Nooksack River, where DNR manages a portion of at least six sites.

Habitat suitability for bald eagles involves provision of accessible prey and trees for nesting and roosting (Stalmaster 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences nest and territory distribution (Stalmaster 1987; Keister et al. 1987). Nests are most commonly constructed in Douglas-fir or Sitka spruce trees, with average heights of 116 feet and 50 inches dbh (Anthony et al. 1982). Roost trees are usually the most dominant trees of the site and provide unobstructed views of the surrounding landscape (Anthony et al. 1982), although they are often in ravines or draws that offer shelter from inclement weather (Hansen 1978; Keister 1981).

ALTERNATIVE A

Under this alternative, conservation of bald eagles would occur through compliance with FRP Policies (Nos. 20, 21, 22, and 23) that direct DNR to protect riparian areas, achieve no net loss of wetland acreage or function, protect endangered and threatened species, and maintain upland wildlife habitat. These general policy statements provide initial guidance for maintaining the integrity of habitats near water where bald eagles find major prey items (i.e., waterfowl and salmonids) and sites for nesting and roosting (i.e., within riparian management zones and upland habitat). Also, DNR's compliance with the Washington Forest Practices Rules and the Wildlife Code of Washington would protect bald eagle nests (within 0.5 mile, as documented by WDFW, January 1-August 15; 0.25 mile at other times in the year) and communal roost sites (0.25 mile) from timber harvesting, road construction, aerial application of pesticides or site preparation activities (WAC 222-16-080a; WAC 232-12-292). Negative impacts to eagle habitat would still be expected because existing eagles would continue to be the focus of Alternative A. Under Alternative A, there is minimal emphasis on the development of future habitat due to the lack of commitment to specific riparian zone buffers and lack of specific harvest restrictions in riparian buffers for nesting, roosting, and prey habitat, and lack of specific retention of very large trees for nesting and roosting sites.

ALTERNATIVE B

In addition to the established state and agency policies, Alternative B would provide greater conservation for bald eagles and less impact to eagle habitat than Alternative A through its riparian conservation strategy and by requiring retention of very large old trees. Riparian buffers averaging 150 feet, including a 25-foot no-harvest zone next to the stream, would provide essential nest trees and roost sites. The focus of the riparian buffer on protection of salmonid habitat should directly benefit bald eagles, if the conservation strategy results in more abundant salmon, because salmon are primary prey of the species. Likewise, buffers around ponds and lakes that increase the abundance of waterfowl would benefit bald eagles by providing prey. The riparian management zones in the west-side planning units would be managed to provide large woody debris for salmonids, which should benefit bald eagles by maintaining large nest and/or roost trees (116 feet tall and 50-inch dbh) (Anthony et al. 1982) along major watercourses. Nest and roost trees are also addressed by the very large old tree retention policy (two trees per harvested acre, with at least 50 percent in the largest living diameter trees available on the unit before harvest, see Chapter 2). Overall, Alternative B would offer more substantial, widely distributed, and potentially effective protection of the bald eagle through time than Alternative A.

ALTERNATIVE C

In addition to established state and agency policies, Alternative C would provide the greatest conservation of bald eagles and least impact to eagle habitat through its more comprehensive riparian conservation and wetland strategies. Not only would the increased buffer widths and harvest restrictions within wetland and riparian buffers result in more habitat available within the planning area, but they would also maintain or improve the quality of the riparian ecosystem. This increased attention to riparian habitat would benefit bald eagles because salmon and waterfowl are important prey sources for the species. Combined with the old tree retention policy and compliance with the Washington Forest Practice Rules and the Wildlife Code of Washington, the net result of Alternative C would be to increase the effectiveness and/or certainty of protection of bald eagles over Alternatives A and B.

OESF Alternatives

Alternative 1. Under the No Action alternative for the OESF, management and resulting effects would be the same as those described in Alternative A, above.

Alternative 2. The unzoned OESF alternative would result in an increased level of protection for bald eagles and relatively less impact to eagle habitat compared to the No Action alternative due to four factors. First, the development of mature and old-growth forests within riparian zones, especially along Type 1 and 2 Waters, would provide nest and communal roost sites. Second, retention of very large old trees (see Chapter 2) should result in additional nest and communal roost sites dispersed within upland habitats. Third, the principal prey of the bald eagle is fish, and riparian protection would enhance fish populations. The expected result would be a higher bald eagle density on inland habitat, thereby broadening the geographical and ecological distribution of the species on the peninsula. The broadening of the species distribution provides a final benefit: decreased susceptibility to large-scale environmental change, such as natural catastrophic disturbance.

Alternative 3. Same as Alternative 2.

Peregrine Falcon (*Falco peregrinus*)

The peregrine falcon is listed by both the state and federal government as endangered. Although three subspecies occur in Washington State, only *F. p. anatum*, is believed to nest in Washington (along the Pacific coast, the Columbia River Gorge, and in the San Juan Islands) (Allen 1991). Potential peregrine falcon habitat managed by DNR includes land near estuaries and other water bodies where large concentrations of shorebirds, songbirds, and waterfowl accumulate. Nearby cliffs, high escarpments, bridges, and river cutbanks might also be used for nesting (Pacific Coast American Peregrine Falcon Recovery Team 1982; Craig 1986). Conservation of peregrine falcons would be peripheral to DNR's forest management activities because the falcons are rarely associated directly with forests.

Alternative A

Several current policies direct DNR to provide protection for the peregrine falcon, its habitat, and its prey habitat. Under Alternative A, the establishment of riparian management zones along streams and major water bodies (FRP Policy No. 20) and achieving "no net loss of wetlands" (FRP Policy No. 21) would maintain or increase the amount of available prey by addressing prey habitat quality. Compliance with the Washington Forest Practices Rules (WAC 222-16-80f), which mandates a SEPA environmental checklist for timber harvesting, road construction, aerial application of pesticides, or site preparation within 0.5 mile of a known active nest site March 1-July 30; or harvesting, road construction, or aerial application of pesticide within 0.25 mile of the nest at other times, will provide direct protection for known individuals and nests (FRP Policy No. 23). Known sites are those documented by WDFW. The implementation of these policies would provide adequate protection of the species, but would offer little certainty for the protection of future or undetected nest sites.

ALTERNATIVE B

Although DNR's forest management activities are not anticipated to have major impacts on peregrine falcons or their habitat under any of the alternatives, Alternative B would improve habitat conditions over those provided in Alternative A by specifically addressing cliff habitat (potential nest sites) and specifying a detailed west-side riparian conservation strategy (prey habitat). First, protection of cliff habitat would benefit undiscovered and future nest sites. Public access to DNR-managed lands within 0.5 miles of falcon aeries would be restricted where practicable. Secondly, buffers along streams and water bodies and the specific and consistent strategies to achieve the FRP in the riparian conservation strategy of this alternative would prevent potential loss of prey habitat and improve habitat quality compared to Alternative A. These provisions would amplify the benefits of the established state and federal agency peregrine falcon policies and contribute to the conservation of the species.

ALTERNATIVE C

Alternative C provides greater enhancement of peregrine falcon habitat than the other alternatives through its more comprehensive riparian and wetland conservation strategies. The primary benefit of these strategies is improved confidence that the goals of maintaining hydrologic function of wetlands and quality salmonid habitat will be met. These strategies, such as restriction of harvest activity near and within wetlands, lakes, and ponds classified as Type 1, 2, or 3 Waters, are key to providing abundant habitat for prey of the peregrine falcon. Also, restriction of public access to aeries where practicable and protection of cliff habitat would be implemented, and thus protect nesting falcons. These provisions would amplify the benefits of the established state and federal agency peregrine falcon policies and improve confidence that the habitat needs of the species would be met throughout the plan area.

OESF ALTERNATIVES

Alternative 1. Under the No Action alternative for the OESF, management and resulting effects would be the same as those described in Alternative A.

Alternative 2. The unzoned OESF alternative would provide protection of peregrine falcons through the enhanced riparian conservation strategy that would generally improve wildlife habitat compared to the No Action alternative, and the site-specific conservation of cliff habitat as described in the multispecies strategy on uncommon habitats (see HCP). In addition, DNR would restrict public access within 0.5 mile of any known peregrine falcon aeries. The location of the aeries would be kept confidential between DNR, USFWS, and WDFW.

Alternative 3. Same as Alternative 2.

Columbian White-tailed Deer (*Odocoileus virginianus leucurus*)

Inhabiting riparian forests, meadows, abandoned pastures, and other grasslands less than approximately 10 feet above sea level, the Columbian white-tailed deer is both federally and state-listed as endangered. The deer formerly occupied open forested lands, tidal spruce swamps, and wetlands (Columbian White-Tailed Deer Recovery Team 1983). Currently, they only occur along an 18-mile stretch of the Columbia River near Cathlamet, Washington, on several islands, and near Roseburg, Oregon (Columbian White-Tailed Deer Recovery Team 1983). It is thought that competition with the black-tailed deer for bottomland habitat has prevented Columbian white-tailed deer from expanding their range (Rodrick and Milner 1991).

DNR-managed lands within the deer's range are in the process of being transferred to the U.S. Fish and Wildlife Service as part of the Julia Butler Hansen Columbian White-Tailed Deer National Wildlife Refuge. Parcels on Puget Island are leased to private landowners for dryland agriculture, grazing, and home sites but are not covered by this HCP. Therefore, forest management activities within the plan area are not expected to affect the Columbian white-tailed deer, unless they expand from their current range during the planning period.

ALTERNATIVE A

Conservation of the Columbian white-tailed deer and its habitat would be directed by FRP Policies (Nos. 20, 21, 22, and 23) that mandate general protection for riparian areas through the establishment of riparian management zones, no net loss of wetland acreage or function including wetland buffers, protection of endangered and threatened species, and upland wildlife habitat maintenance. Implementation of these policies under this alternative would minimize impacts to future Columbian white-tailed deer habitat by resulting in maintenance of riparian cover and forage for the deer.

ALTERNATIVE B

This alternative improves upon Alternative A by providing greater protection for potential Columbian white-tailed deer habitat through its more specific riparian conservation strategy. The 25-foot no-harvest zone and average 150-foot riparian buffers along major rivers and water bodies would provide greater confidence that forage and cover resources would be available to Columbian white-tailed deer than the general policy statements of Alternative A. The net result of Alternative B would be less impact to and greater conservation of habitat that could be utilized by Columbian white-tailed deer in the future.

ALTERNATIVE C

This alternative would provide the most confidence that future habitat for this species would be provided within the planning area. Under the enhanced riparian and wetland conservation strategies of Alternative C, DNR would maintain deer cover and browse by applying buffers to smaller bogs and wetlands, prohibiting harvest through the 50-foot zone bordering nonforested wetlands, limiting harvests within forested wetlands and wetland buffers (forage and cover), and maintaining vegetation in riparian management zones (see Chapter 2). Alternative C would provide substantial confidence that future Columbian white-tailed deer habitat needs will be met, compared to Alternative A.

OESF ALTERNATIVES

This species does not occur within the OESF Planning Unit.

Gray Wolf (*Canis lupus*)

The gray wolf is a habitat generalist that may potentially be found throughout the Cascade Range from the northern Washington border south to the Columbia River, and the northeastern third of the state, from the Cascade Range east through the Okanogan Highlands to the Idaho border.[2] This species is listed by both the federal government and state as endangered. Virtually all naturally vegetated lands are considered potential habitat for this species, with the most suitable habitats being those that support dense ungulate populations, such as deer, elk, moose, and mountain goats, in remote areas (Laufer and Jenkins 1989). Wolves typically den under logs or rock outcrops (Thomas 1979). There have been three gray wolf observations within the plan area (one in 1989 and two in 1992; WDFW Natural Heritage GIS data from 1989-93).

A crucial aspect of gray wolf habitat management is minimizing the potential for negative human interactions. Killing of wolves occurs despite legal protection and is positively correlated to road density (Mech 1980; Fuller 1989). Also, gray wolves generally use areas that have less than 0.93 miles of road per square mile (Paquet and Hackman 1995, and references therein). Therefore, road management planning in conjunction with forest management activities can contribute to the recovery of gray wolves.

ALTERNATIVE A

Conservation of the gray wolf would be guided by FRP Policies (Nos. 20, 21, 22, and 23) that mandate general protection for riparian areas, no net loss of wetland acreage or function, protection of endangered and threatened species, and upland wildlife habitat maintenance. A SEPA environmental checklist would be undertaken for harvesting, road construction, or site preparation within one mile of a WDFW-documented den site between March 15 and July 30, or within 0.25 miles at other times (WAC 222-16-80b). No specific consideration is given to wolves or public access in DNR's road strategy in this alternative. Without such consideration, conservation of gray wolves would be minimal under this alternative.

ALTERNATIVE B

The gray wolf might benefit from the improved wildlife and ecosystem conditions afforded by the riparian and spotted owl conservation strategies of Alternative B. Increased shelter (maintenance of debris and mature forest conditions) and provision of prey (along riparian management zones and within harvest units) are benefits of this alternative. In addition, protection of talus slopes, caves, and cliffs might provide important denning and/or shelter opportunities for gray wolves. The spatial arrangement of spotted owl habitat in proximity to federal forests likely would provide wolves with travel opportunities. DNR will continue to participate in cooperative road closures with WDFW and the U.S. Forest Service to restrict vehicular activity to maintain or increase big game security. Additionally, to the extent practicable in appropriate areas, DNR will

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[2] The Olympic Peninsula is no longer considered part of the gray wolf's range. The last wolf was probably shot before 1930 (Scheffer 1949), with most of the animals succumbing to poisoning, trapping, and shooting by settlers before 1920.

schedule management activities, including road construction and use, to occur at times of the year when wolves are least likely to be present.

Although no other proactive consideration is given to wolves or public access in DNR's road strategy in this alternative, there would be a mechanism to protect wolves if they were observed on DNR-managed lands. Site-specific plans would be developed in consultation with WDFW or USFWS to limit human disturbance within eight miles of a Class 1 gray wolf observation (see HCP). Disturbance would be limited in the area until five consecutive years pass without further observations. However, there is no process outlined for detecting such observations. Without at least minimal survey effort, it is unlikely that a Class 1 observation would occur, even if a wolf were present. Nonetheless, Alternative B increases the level of protection of the gray wolf and its habitat through its more comprehensive conservation strategies than Alternative A.

ALTERNATIVE C

The enhanced riparian and northern spotted owl conservation strategies of Alternative C might benefit gray wolf habitat throughout the plan area. Specifically, harvest restrictions within riparian areas and wetlands would maintain cover that might otherwise not be retained. Dense vegetation in these areas might provide cover for the wolves themselves, as well as forage and cover for their prey. It is likely that the relatively reduced disturbance associated with the northern spotted owl strategy of this alternative would benefit the gray wolf.

Although no proactive consideration is given to wolves or public access in DNR's road strategy in this alternative, there would be a mechanism to protect wolves if they are observed on DNR-managed lands. Site-specific plans would be developed in consultation with WDFW or USFWS to limit human disturbance within eight miles of a Class 1 gray wolf observation (see HCP). Disturbance would be limited in the area until five consecutive years pass without further observations. However, there is no process outlined for detecting such observations. Without at least minimal survey effort, it is unlikely that a Class 1 observation would occur, even if a wolf were present. Nonetheless, implementation of the enhanced conservation strategies of Alternative C would offer more protection of gray wolves, habitat for their prey, denning habitat, and potential connectivity with federal lands than Alternative A.

OESF ALTERNATIVES

This species does not occur within the OESF Planning Unit.

Grizzly Bear (*Ursus arctos*)

The grizzly bear is listed as federally threatened and state endangered in Washington. Potentially found throughout the Cascade Range from the Canadian border south into Yakima County and northeast to the Idaho border, grizzly bears occupy virtually all habitat types. Special habitats include wet meadows, swamps, bogs, streams, forested land, alpine meadows, and park lands (Brown 1985). The dispersion of habitats may also be critical, so that grizzly bears have access to a wide variety of vegetative and animal food sources (Servheen 1993). Steep sites where deep snows accumulate and persist through mid-winter warm periods have potential to be used by grizzlies for denning (Servheen 1993). Importantly, grizzly bear habitats are often relatively isolated from human disturbance and involve an aspect of cover. Although 90 percent of the radio relocations of bears (46 radio-collared bears) within the Yellowstone ecosystem were in forests that were too dense to permit observations of the bears, only 1 percent of the relocations in dense forests were farther than 1 kilometer (0.62 miles) from an opening (Blanchard 1978). One of the most important aspects of grizzly bear habitat management is road density, because grizzly bears tend to avoid habitat near roads, and roads expose grizzly bears to direct human-related mortality (Servheen 1993; Paquet and Hackman 1995 and references therein). There was one grizzly bear observation in 1990 within the plan area (WDFW Natural Heritage GIS data from 1990-93). Overall, approximately 190 square miles of plan area are within the 9,565 square miles of the North Cascades Grizzly Bear Recovery Zone. DNR-managed lands in the planning area are thought to potentially provide lower-elevation spring habitat for grizzly bears. The plan area may contribute significant attributes that raise its relative importance to the recovery zone.

A substantial amount of post-emergence habitat occurs in low-elevation areas at the edge of the recovery zone. As of 1993, there were 104 Class I and Class II sightings in the Washington Cascades (Almack 1993). The locations of the North Cascades grizzly bear observations are widely distributed throughout the ecosystem. Locations and timing of locations indicate at least some of the grizzly bears in the local population are resident to the Washington Cascades, including reproductive females. The Service believes that higher open-road densities and minimal hiding cover could result in mortality and harassment of bears during a tenuous period in a natural-recovery process.

ALTERNATIVE A

Conservation of the grizzly bear is guided by FRP Policies (Nos. 20, 21, 22, and 23) that mandate general protection for riparian areas, no net loss of wetland acreage or function, endangered and threatened species protection, and upland wildlife habitat maintenance. When fully implemented, these policies might provide foraging, travel, resting, and hiding opportunities for grizzly bears through the improved function of the riparian ecosystems, including wetlands. A SEPA environmental checklist would be undertaken for harvesting, road construction, or site preparation within one mile of a WDFW documented den site between October 1 and May 30, or within 0.25 miles at other times (WAC 222-16-80b). However, no proactive mitigation for identifying potential den sites is included, such as a map-based strategy displaying potential snow accumulation and persistence to indicate areas where preventative caution may be needed to avoid inadvertent harm to the species. Given that much of the area managed by DNR in the recovery zone is considered likely to be lower-elevation spring habitat, this omission may not pose substantial risk to the species. However, unrestricted seasonal activities near primary habitats would increase disturbance to grizzly bears. Most importantly, no specific consideration would be given to grizzly bears or public access in DNR's road strategy under this alternative. Conservation of grizzly bears and their habitat would be governed by Section 9 of the ESA.

ALTERNATIVE B

Improved wildlife habitat conditions afforded by the west-side riparian and northern spotted owl conservation strategies under this alternative might benefit grizzly bears. Increased hiding, resting, and travel cover (maintenance of debris and mature forest conditions) might improve access to prey/forage habitat (within harvest units and along west-side riparian areas). The specific buffer distances and harvest restrictions applied to riparian management zones, wind buffers, and wetland buffers would result in higher riparian ecosystem quality than Alternative A, perhaps increasing their value to grizzly bears as travel corridors and hiding cover. In addition, protection of talus slopes, caves, and cliffs might provide important shelter opportunities for grizzly bears. The spatial arrangement of spotted owl habitat in proximity to federal forests might provide grizzly bears with further travel opportunities which might facilitate access to diverse foraging opportunities.

Because no proactive provisions to limit access or reduce road density are incorporated in this alternative, the benefits of increased habitat suitability in this alternative over Alternative A may not be fully realized. High active road densities, where present, could decrease the probability that grizzly bears would occupy DNR-managed lands in those areas where this occurs. Harvesting and road construction near primary habitats such as avalanche chutes and meadows where no visual screening is left could negate the value of the habitats. Similarly, unrestricted seasonal activities near primary habitats could also increase disturbance to present but undetected grizzly bears.

However, there would be mechanisms to protect bears if they were observed on DNR-managed lands including adherence to established state policies. A SEPA environmental checklist would be undertaken for harvesting, road construction, or site preparation within one mile of a WDFW documented den site between October 1 and May 30, or within 0.25 miles at other times (WAC 222-16-80b, see Alternative A). Additionally, site-specific plans would be developed in consultation with WDFW or USFWS to limit human disturbance within 10 miles of a Class 1 grizzly bear observation until five consecutive years pass without a grizzly bear Class 1 observation in the area. Without at least minimal survey effort, there is the potential that a Class 1 observation would not occur, even if a grizzly bear was present. Overall, Alternative B's site-specific plans would provide the potential for increased protection for grizzly bears and their habitat over Alternative A.

ALTERNATIVE C

The more comprehensive riparian and northern spotted owl conservation strategies of Alternative C would enhance grizzly bear habitat throughout the plan area. Specifically, harvest restrictions within riparian management zones and wetland buffers would provide hiding cover that might otherwise not be maintained. Dense vegetative cover provides security near forage areas for bears. Enhanced salmonid strategies could directly benefit grizzlies by providing habitat conditions that would aid salmonid recovery, thereby increasing the food supply available for pre-hibernation fattening. The relatively lessened disturbance associated with the northern spotted owl strategy of this alternative would likely benefit the grizzly bear over Alternatives A and B.

Concerns about road densities, seasonal activities in areas with undetected bears, and lack of use surveys are the same as Alternative B. Established state policies would also similarly provide mechanisms to protect bears if they were observed on DNR-managed lands (see Alternative B). In this alternative, greater conservation of the grizzly bear and its habitat is suggested compared to Alternatives A and B, and more confidence of effective conservation is suggested by this alternative than Alternative B, due to the combined effect of the conservation strategies that could improve ecosystem function and therefore grizzly bear habitat. However, as with the other alternatives, the realized value of this alternative may be marginal due to the lack of consideration for grizzly bears in road management strategies outside of areas of known sitings.

OESF ALTERNATIVES

This species does not occur within the OESF Planning Unit.