

Modeling Habitat Capability for Northern Spotted Owls

Process Documentation for USDA Forest Service Final Spotted Owl EIS

Bruce G. Marcot
USDA Forest Service, PNW Research Station
Spotted Owl RD&A Program
333 SW First Avenue, POB 3890
Portland, Oregon 97208

Martin G. Raphael
USDA Forest Service, PNW Research Lab
Olympia, Washington

16 December 1991

Background

Development of a process for estimating habitat capability for northern spotted owls is a vital step in assessing effects on population viability.

The process used to estimate habitat capability for northern spotted owls for USDA Forest Service's Final Spotted Owl EIS (hereafter "EIS") was outlined at a meeting of the Forest Service's Spotted Owl Research, Development, and Application Technical Group on 17 October 1991 (see Appendix for meeting minutes). We devised the final habitat capability modeling process by following this outline and by testing several approaches. This document summarizes the process developed and used in the EIS.

In this report and in the EIS, "habitat capability" is defined as the potential number of northern spotted owl pairs that a particular geographic location is capable of supporting, given predicted amounts and distribution of spotted owl habitat. Habitat capability is not intended to represent an estimate of current northern spotted owls population size, nor a prediction of expected future populations sizes. Actual present and future population sizes will likely be less than habitat capability estimates. This is because many factors that could depress population sizes, include potential secondary effects of habitat fragmentation, predation, hybridization, fluctuations in prey abundance and availability, catastrophic habitat loss and modification, and other factors, are not quantified and are not explicitly considered in this modeling process. Most of these factors are understood not well enough to be able to quantify their effects at present or especially in the future.

Review of Previous and Current Spotted Owl Habitat Capability Models

We first reviewed existing northern spotted owls habitat capability models to determine if they use currently available information and if they produce estimates of the type needed for the EIS. Specifically, we reviewed:

- o the habitat capability models in the earlier USDA Forest Service spotted owl Final Supplemental EIS (USFS 1988:B1-17 - B1-20);
- o the Interagency Scientific Committee (ISC) report on a conservation strategy for the northern spotted owls (Thomas et al. 1990:320-322);
- o the habitat suitability index model of Laymon et al. (1985);
- o the simulation model being produced by Kevin McKelvey and Barry Noon, Pacific Southwest Research Station, USDA Forest Service (McKelvey and Noon, pers. comm.);
- o the spotted owl dispersal and habitat occupancy simulation model devised by Nancy Warren for the USDA Forest Service northern spotted owl Draft Supplemental EIS (1986:B-12 - B-18);
- o the empirical habitat description models being developed by Wenatchee Research Lab and Wenatchee National Forest, USDA Forest Service, Wenatchee, Washington (R. Everett, pers. comm.); and
- o the analytic models of Doak (1989) and Lande (1988).

Our conclusion from this review was that, whereas each existing model has some desirable characteristics, most were not based on current data on habitat characteristics and use patterns, spotted owl densities, spotted owl demography, and other recent spotted owl studies; or did not provide the simple type of prediction of habitat capability, expressed as number of potential spotted owl pairs, needed for the current EIS project. The McKelvey and Noon simulation model is likely the most realistic -- and most complex -- of existing models. However, it provided far more detail on occupancy patterns than was needed for the EIS; data by which to calibrate and run the model were either not available at all or in the format needed; the model was not available in final form in time for use in the EIS; and the authors of the models, who should run and help interpret the results of this model, were not available for full-time assignment to this project. Thus, we chose to use a simpler procedure for estimating habitat capability.

The types of models needed for the EIS were of the form used in the USDA Forest Service's spotted owl Final Supplemental EIS, and as used in the ISC project (Thomas et al. 1990:320-322). However, the Final Supplemental EIS habitat capability model was based on older data of habitat distribution and habitat associations, and required updating. The ISC model was of the form useful for predicting habitat capability within specific designated spotted owl habitat areas. However, after extensive discussion with one of the ISC

members, it became clear that the habitat capability modeling process was specific to the ISC project and incorporated local expert's opinions on capability of particular Habitat Conservation Areas into the more purely analytic process of estimating habitat capability. This was not a process that could be replicated per se for the current EIS process because those same ISC members were unavailable full-time for the EIS project.

The Laymon et al. (1985) habitat suitability index model did not predict habitat capability in terms of numbers of potential spotted owl pairs. Instead, it produced a composite suitability index that ranged in value between 0 and 1. This was inadequate for assessing potential effects of planning alternatives on future potential populations for the particular needs of this EIS. As well, the analytic models by Doak and Lande predicted persistence times and proportions of the landscape in habitat that would provide for population persistence. These were inappropriate models for habitat capability estimation.

ASSESSING HABITAT CAPABILITY

Estimates of habitat capability were intended to provide a way of assessing how each planning alternative contributes to conservation of northern spotted owl populations. Habitat capability estimates -- particularly for future time periods -- are not intended to be interpreted as precise predictions of actual spotted owl population sizes.

Calculations of present and future habitat capability were intended to be interpreted at the scale of spotted owl populations or states -- that is, physiographic provinces or combinations thereof. Habitat capability was calculated by considering the relative contributions of MPAs, HCAs, and forest matrix areas, summed over a population. The calculations are not intended to provide accurate, unbiased, and precise measurements of actual numbers of spotted owls within each MPA, HCA, or specific forest matrix area.

We devised two approaches to assessing habitat capability for northern spotted owls: a density-based estimator, and a home range-based estimator. Ultimately, the home range-based estimator proved to predict more reasonable values of potential numbers of spotted owl pairs, and was used in the Final EIS. For purposes of documentation of the EIS, we document the home range-based estimator here.

Procedure for Developing A Home Range-Based Estimator of Habitat Capability

The Final EIS described the procedure used to develop the home range-based estimator of habitat capability (USFS 1992:B10 - B-12). This section presents the steps and data used in that process.

1. Proportion of landscape that is habitat

The model is based on empirical relationships depicting that the size of annual pair home range areas are inversely related to the proportion of their home range in suitable habitat (see below for home range data). Thus, the model was used to estimate habitat capability for spotted owls as a function of the overall proportion of the land area in suitable habitat. The appropriate scale for depicting such proportions is roughly the average size of an annual pair home range area of northern spotted owls. Currently available data on annual pair home range sizes (Table 1) suggest that they average approximately 5000 acres.

A grid of 5000-acre rectangles was superimposed over maps of each national forest. The proportion and total acreage of habitat within each 5000-ac grid cell was recorded and tallied by northern spotted owl population (physiographic province or combinations thereof). Acreage on national forest land only was recorded. This information constituted data on proportion of the landscape that is habitat.

2. Distribution of habitat

Distribution of habitat is equally important to discerning capability for northern spotted owl pairs. Distribution was assessed by using the 5000-ac grid cells that correspond to the mean size of the annual home range of northern spotted owl pairs. Distribution of such grid cells across each population (physiographic province or combinations thereof) were assessed by tallying the total acreage of suitable habitat within 10 percent proportion classes of suitable habitat (i.e., the total acreage of suitable habitat within grid cells that consisted of 1-10 percent suitable habitat, total habitat acreage in grid cells of 11-20 percent habitat, etc. up to 100 percent habitat). Later, habitat capability was estimated for each habitat proportion class for each population, and summed over all proportion classes.

No attempt was made to model or analyze effects of distribution of habitat among stands within a home range area or within each 5000-ac grid cell. Empirical information and analyses on effects on owl occupancy of habitat distribution at the within-home range scale are not available.

3. Relationship between annual owl pair home range area and proportion of habitat within the home range

Existing and available data on home range sizes and habitat acreages were used to test correlations and develop empirical regressions for this step in the process. Specifically, the spotted owl scientific literature was thoroughly searched for data on (a) acreage of annual pair 100% minimum convex polygon home range size and (b) acreage of suitable habitat within that same home range area, for northern spotted owls. Much data was available on overall home range size of northern spotted owl pairs. However, not all data on home range included data on amount of suitable habitat within the home range.

All available data on home range sizes of northern spotted owls were collected (Table 1). These data are shown in Table 1 sorted by physiographic province. The same data are also shown in Table 2 sorted by state. The key to the fields of information is in Table 3.

From the overall data base collected on pair home range sizes (Tables 1 and 2), a subset was extracted representing 100% minimum convex polygon annual pair home ranges where total area of suitable habitat within the home range boundary was also reported in the literature. This yielded data on 2 owl pairs in California (Solis 1982), 9 owl pairs in Oregon, and 16 owl pairs in Washington. These data were further categorized by physiographic province: Olympic Peninsula, Washington Cascades West, and Washington Cascades East, in the state of Washington; Oregon Cascades, Oregon Coast Range, and Oregon Klamath provinces in the state of Oregon; and Klamath province in the state of California (Table 1). However, it was clear that not enough data points on both 100% minimum convex polygon annual pair home range size and amount of habitat within the home range were available to analyze relationships at the scale of physiographic province. Thus, the data were combined by state, which approximates combinations of northern spotted owl populations in a north-south cline.

Data on 100% minimum convex polygon home range size were used because (a) the 100% home range size represents the best estimate of the total area within which a spotted owl pair searches to find resources to meet all life needs, and (b) the minimum convex polygon home range estimator was the most widely available data in the literature. Annual pair home ranges were used because habitat capability should be estimated for meeting all life needs (a) over all seasons of the year, including breeding and nonbreeding seasons, and (b) for spotted owl pairs.

The proportion of suitable habitat within each annual pair home range area was calculated by dividing the amount of habitat within the home range by the total 100% minimum convex polygon home range size. Habitat used in these calculations was that defined, quantified, and reported in the literature.

We then plotted scatter diagrams of the 100% minimum convex polygon annual pair home range size as a function of the proportion of the home range that was habitat. Figure 1 displays this scatter for the Washington data, and Figure 2 displays it for the Oregon data. Overall, home range sizes were larger in Washington than in Oregon for a given proportion of suitable habitat within the home ranges.

Linear regression models were then calculated for the home range data by state (Tables 4 and 5).

In Washington, the calculated regression was:

$$\text{Home Range (acres)} = 18,364 - (17,607 * \text{Proportion Habitat})$$

and in Oregon, the calculated regression was:

$$\text{Home Range (acres)} = 8,688 - (7,054 * \text{Proportion Habitat}),$$

where Proportion Habitat ranges from 0 to 1.

Precision of the Washington data regression was represented by the standard error of Y estimation = 6360 ac, and $R^2 = 0.239$ ($0.05 < p < 0.10$, one-tailed test), $n = 16$, $df = 14$ (Table 4). Precision of the Oregon data regression was represented by the standard error of Y estimation = 2346 ac, and $R^2 = 0.269$ ($0.025 < p < 0.01$, one-tailed test), $n = 9$, $df = 7$ (Table 5).

Note: the Oregon regression equation includes all 9 data points from studies in Oregon, but omits the two data points in California from Solis and Gutierrez (1982). Analyses of combining all 11 data points showed that (a) the two data points from Solis and Gutierrez (1982) were statistical outliers in the linear regression model, and (b) with all 11 points combined, the regression coefficient $R^2 = 0.116$ yielded a highly nonsignificant $p \gg 0.05$, $df = 9$, Stnd Err of Y Est = 2723 ac. Thus, the two California data points were removed for purposes of building the regression model.

These linear regressions were graphed over the scatter plot of data in Figures 1 and 2 separately by state. Data scatters and regressions from both states are shown in Figure 3. The regressions were considered useful predictors over the range of home range sizes and proportions of habitat presented in the original data in the literature. For proportions of habitat within home ranges less than those reported, the regression equations were extrapolated linearly to the y-intercept (the thin dotted lines to the left of the regression lines in Fig. 3). For proportions of habitat within home ranges larger than those reported, the linear regressions were extrapolated linearly only to the largest known home range size or to the largest proportion of habitat within the home range as reported in the literature, and thereafter the regression line was truncated at a constant home range size.

These extrapolation rules resulted in the overall curves shown in Figures 3 and 4, and the specific values shown in Table 6. For Oregon, no truncation and leveling of the regression line was necessary. For Washington, the regression line was leveled at approximately 85 percent suitable habitat within the home range. Otherwise, unrealistically tiny home ranges would be predicted. Because specific ecological mechanisms that determine home range size as a function of proportion suitable habitat are poorly understood empirically, we felt that we should not exceed the boundaries of known home range sizes or proportions of habitat in either states' regression until new empirical evidence so warrants.

3. Overlap of home range between adjacent pairs of owls

The main data base on home range size of northern spotted owl pairs (Table 1 and 2) was also used to tabulate reported data on overlap of 100% minimum convex polygon home range between adjacent pairs. Data were too sparse to reliably calculate proportion of annual pair home range that is overlapped by adjacent pairs' home ranges separately for each physiographic province, for each population (physiographic province or combinations thereof), or for each

state. Thus, overlap was calculated for all such reported data subspecies-wide. The average proportion of overlap between a 100% minimum convex polygon annual pair home range and those of adjacent pairs was calculated to be 30.4 percent. Thus, the value of 1.304 was used in the habitat capability calculations to increase the potential number of pair sites in an area resulting from potential overlap among pair home ranges.

4. Correction factor for expected long-term occupancy of sites

The number of potential spotted owl pairs that a habitat is capable of supporting is, in part, a function of the demographic resilience of local populations. Demographic persistence was therefore used as a factor to correct estimates of potential numbers of spotted owl home ranges in an area.

The correction table used by the ISC (Thomas et al. 1990:322 Table Q-3) was developed to represent a correction for demographic persistence of local populations. We also used this correction factor, following the logic presented in Thomas et al. (1990:321). However, we used new, available information that updated Table Q-3. This information was in the form of a table in the same format as Table Q-3 that summarized results of running the demographic persistence model updated with new demographic vital rate data (provided by C. Voss, pers. comm. to M. Raphael) (Table 7). We did not run the demographic persistence model ourselves; rather, we requested new, available information that might update the persistence factors presented in the original ISC report, Table Q-3.

The new table (Table 7) presented data on percent of a population of spotted owls of various sizes (ranging up to 100 pair sites), in areas of various percentages of suitable habitat, that would still persist, on average, over a 100-year time frame. One hundred years represents our interpretation of "long-term" persistence (although the conservation biology literature sometimes calls for up to a millennium for such assessments; for a millennium, the persistence correction values and resulting estimates of habitat capability would be substantially lower).

Figures 5 and 6 display these persistence functions for various initial population sizes. Figure 5 shows persistence functions for populations of 5, 10, 20, 50, 80, and 100 pairs. Figure 6 shows persistence functions for populations of 10, 20, 30, 40, 50, and 60 pairs.

5. Calculations of habitat capability

Finally, calculations of present and future habitat capability from the above analyses and information were made according to the procedure documented in the Final EIS (USFS 1992:B-11 - B-12).

LITERATURE CITED

- Allen, H. L., K. R. Dixon, and K. L. Knutson. 1989. Cooperative administrative study to monitor spotted owl management areas in National Forests in Washington. Final Report. Wash. Dept. Wildlife, Olympia WA. 165 pp.
- Doak, D. 1989. Spotted owls and old growth logging in the Pacific Northwest. Conservation Biology 3(4):1-8.
- Forsman, E. D., and E. C. Meslow. 1985. Old-growth forest retention for spotted owls--how much do they need?. Pages 58-59 in R. J. Gutierrez and A. B. Carey, eds. Ecology and management of the spotted owl in the Pacific Northwest. USDA Forest Service Gen. Tech. Rpt. PNW-185., Portland OR.
- Friesen, C. A., and E. C. Meslow. 1988. Home range size and habitat utilization of northern spotted owls in the Eugene BLM District, Oregon. Progress Report 1 June 1987 - 1 April 1988. Oregon State University, Corvallis OR.
- Gutierrez, R. J., and D. Call. 1988. Home-range size and use by California spotted owls on the Tahoe National Forest. Final Report. Humboldt State University, Arcata CA. 26 pp.
- Hamer, T. E. 1988. Home range size of the northern barred owl and northern spotted owl in western Washington. M.S. Thesis, Department of Biology, Western Washington University. 86 pp.
- Lande, R. 1988. Demographic models of the northern spotted owl (Strix occidentalis caurina). Oecologia 75:601-607.
- Laymon, S. A., H. Salwasser, and R. H. Barrett. 1985. Habitat suitability index models: spotted owl. USDI Fish and Wildlife Service Biological Report 82(10.113). USDI Fish and Wildlife Service, Washington, DC.
- Meslow, E. C., S. K. Albert, M. T. Brown, S. M. Desimone, D. H. Johnson, T. M. Odenbough, F. L. Weekley, and G. S. Miller. 1988a. The ecology of spotted owls in the central Cascades, western Oregon. Progress Report #4 - spotted owl demography and habitat use segments (1 April 1988 - 26 June 1988). Oregon State University, Corvallis OR. 8 pp.
- Meslow, E. C., M. T. Brown, D. H. Johnson, T. M. Odenbaugh, and G. S. Miller. 1988b. The ecology of spotted owls in the central Cascades, western Oregon. Progress Report #3 - spotted owl demography and habitat use segments (1 Jan. 1988 - 31 Mar. 1988). Oregon State University, Corvallis OR. 9 pp.
- Meslow, E. C., G. S. Miller, S. K. Albert, M. T. Brown, S. M. Desimone, D. H. Johnson, T. M. Odenbaugh, and F. L. Weekley. 1988c. The ecology of spotted owls in the central Cascades, western Oregon. Annual Report - spotted owl demography and habitat use segments (1 September 1987 - 15 August 1988).

Oregon State University, Corvallis OR. 45 pp.

Meslow, E. C., K. R. Nickell, and R. E. Hause. 1986. Spotted owls in harvested areas. Adult monitoring project. Final Report. Submitted by Oregon Cooperative Wildlife Research Unit. Oregon State University, Corvallis OR.

Meslow, E. C., and F. F. Wagner. 1987. Spotted owl monitoring: Medford Segment Miller Mountain Study Area. Supplement No. PNW 86-390 to Master Memorandum of Understanding No. PNW 80-87. Progress Report. Submitted by Oregon Cooperative Wildlife Research Unit, Oregon State University, Corvallis.

Meslow, E. C., and F. F. Wagner. 1988. Spotted owl monitoring: Medford segment Miller Mountain Study Area. Annual Report Supplement No. PNW 86-390. Oregon State University, Corvallis OR.

Meslow, E. C., and F. F. Wagner. 1989. Spotted owl monitoring: Medford segment Miller Mountain study area. Progress Report. (9 January 1989). Oregon State University, Corvallis OR.

Reid, J. A., S. P. Horton, and A. B. Carey. 1987. Spotted owl habitat use in the Oregon Coast Range. Progress Report 1987. USDA Forest Service, PNW, Olympic WA. 71 pp.

Solis, D. M., Jr, and R. J. Gutierrez. 1982. Spotted owl habitat use on the Six Rivers National Forest, Humboldt County, California. Cooperative Agreement Final Report.

Thomas, J. W., E. D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Interagency Scientific Committee to address the conservation of the northern spotted owl. USDA FS, USDI BLM, USDI FWS, USDI NPS. US Govt. Printing Office, Portland OR. 427 pp.

Thraillkill, J. A., and E. C. Meslow. 1989. Home range size and habitat utilization of northern spotted owls in the Eugene BLM District, Oregon. Progress Report covering period 1 June 1987 - 1 July 1989. Oregon State University, Corvallis OR.

USFS. 1986. Draft supplement to the environmental impact statement for an amendment to the Pacific northwest regional guide. Spotted owl guidelines. 2 vols. USDA Forest Service, Pacific Northwest Region., Portland OR.

USFS. 1988. Final supplement to the environmental impact statement for an amendment to the Pacific northwest regional guide. Spotted owl guidelines. 2 vols. USDA Forest Service, Pacific Northwest Region, Portland OR.

Table 1. Data on home range sizes of northern spotted owl pairs. Data are sorted by physiographic province. Fields (column headings) are explained in Table 3.

OWLNAME	YEAR	INDIV	SEX	AGE	BREED	LIT	PROV	PROV2	STATE	NPTXYEAR	HABXYEAR	HROVLPR1	HROVLPR2	HROVLPR3	PROXYEAR
HOME RANGE DATA --															
NORTHERN SPOTTED OWL PAIRS															

file HRPARP.wq1

12/91

OWLNAME	YEAR	INDIV	SEX	AGE	BREED	LIT	PROV	PROV2	STATE	NPTXYEAR	HABXYEAR	HROVLPR1	HROVLPR2	HROVLPR3	PROXYEAR
GriffSusan	89	pair	m&f	sub/ad	n	Patonperc89	caca	a	ca	107	11888				
FishWildlife	89	pair	m&f	sub	n	Patonperc89	caca	a	ca	81	13644				
RenoSylvia	89	pair	m&f	ad	y	Patonperc89	caca	a	ca	91	8339				
AceStar	89	pair	m&f	ad	n	Patonperc89	caca	a	ca	145	5880				
LMP	86-87	pair	m&f	ad	unsucc	ReidHor87	cora	c	or	238	9045	2986			0.330
WolfCrP	87-88	pair	m&f	ad	unsucc	FrieMes88	cora	c	or	321	4117	799			0.194
BillLKp	87-88	pair	m&f	ad	y	FrieMes88	cora	c	or	324	5884	1488			0.249
WolfCrP	87-89	pair	m&f	ad	m	ThrMesj89	cora	c	or	546					
PPP	86-87	pair	m&f	ad	unsucc	ReidHor87	cora	c	or	231	5115	2974			0.581
MCPX	86-87	pair	m&f	ad	?	ReidHor87	cora	c	or	326	3238	2430			0.750
CCP	86-87	pair	m&f	ad	y	ReidHor87	cora	c	or	284	2954	1870			0.633
BillLKp	87-89	pair	m&f	ad	m	ThrMesj89	cora	c	or	563					
TurnwaterOly	87-88	pair	m&f	ad	n	Patonperc89	kiam	k	ca	203	3312				
TGFOly	88	pair	m&f	ad	y	Patonperc89	kiam	k	ca	307	7820				
JimTammy	87-88	pair	m&f	ad	n	Patonperc89	kiam	k	ca	311	5700				
JoeMormma	87-88	pair	m&f	ad	y	Patonperc89	kiam	k	ca	271					
JoeKitty	88-89	pair	m&f	ad	n	Patonperc89	kiam	k	ca	401	5096				
OllieJunior	87-88	pair	m&f	sub/ad	n	Patonperc89	kiam	k	ca	294	2055				
OllieFawn	88-89	pair	m&f	ad	unsucc	Patonperc89	kiam	k	ca	367	2836				
TarzanJane	88-89	pair	m&f	ad	n	Patonperc89	kiam	k	ca	371	2813				
BeeCuss	88-89	pair	m&f	ad	y	Patonperc89	kiam	k	ca	322	5402				
BuenoClemenc	87-88	pair	m&f	ad	n	Patonperc89	kiam	k	ca	213	2408				
BuenoHanna	88-89	pair	m&f	sub/ad	n	Patonperc89	kiam	k	ca	324	4883				
BearMedia	88	pair	m&f	ad	unsucc	Patonperc89	kiam	k	ca	122					
AugsyRosa	88-89	pair	m&f	sub/ad	y	Patonperc89	kiam	k	ca	415	2102				
MorrisChel	87-88	pair	m&f	ad	n	Patonperc89	kiam	k	ca	255	2910				
Banditholly	88-89	pair	m&f	ad	n	Patonperc89	kiam	k	ca	443	4594				
Banditholly	87-88	pair	m&f	ad	n	Patonperc89	kiam	k	ca	346	3038				
GandolrWho	88-89	pair	m&f	ad	unsucc	Patonperc89	kiam	k	ca	339	3475				
GandolrWho	87-88	pair	m&f	ad	n	Patonperc89	kiam	k	ca	345	3394				
BearMedia	87-88	pair	m&f	ad	n	Patonperc89	kiam	k	ca	252	2836				
Billy-BDoll	87-88	pair	m&f	ad	y	Patonperc89	kiam	k	ca	353	3243				
SoloMia	88-89	pair	m&f	sub/ad	n	Patonperc89	kiam	k	ca	419	1803				
Billy-BDoll	88-89	pair	m&f	ad	unsucc	Patonperc89	kiam	k	ca	322	2124				
MayoCatalin	80-81	pair	m&f	ad	unsucc	Solis82	kiam	k	ca	415	2126				
LuciaPancha	80-81	pair	m&f	ad	?	Solis82	kiam	k	ca	307	1258				
FredEthel	88-89	pair	m&f	sub/ad	n	Patonperc89	kiam	k	or	196	6195				
FordEmily	88-89	pair	m&f	ad	?	Patonperc89	kiam	k	or	259	5884				
RickRuby	88-89	pair	m&f	ad	n	Patonperc89	kiam	k	or	189	5338				
PatVanna	88-89	pair	m&f	ad	y	Patonperc89	kiam	k	or	234	5325				
MidCrP	87-88	pair	m&f	?	?	MesWag8888	kiam	k	or	550	2785				
GobknobP	88-87	pair	m&f	ad	?	MesWag87	kiam	k	or	936	4500				
AlcoCrP	87-88	pair	m&f	ad	y	MesWag8888	kiam	k	or	868	2500				

0.580
0.292

OWLNAME	YEAR	INDV	SEX	AGE	BREED	LIT	PROV	PROV2	STATE	NPTXYEAR	HRXYEAR	HABXYEAR	HROVLPRI	HROVLPRI2	HROVLPRI3	PROXYEAR
JonesCrp	87-88	pair	m&f	ad	?	MesWag8889	klam	k	or	417	2145					
Shelrockp	86-88	pair	m&f	ad	?	MesWag8889	klam	k	or	1056	4265					
Gobknobp	86-88	pair	m&f	ad	?	MesWag8889	klam	k	or	1471	4890					
MillerMtnP	87-88	pair	m&f	sub	?	MesWag8889	klam	k	or	782	2380					
GobeastP2	87-88	pair	m&f	sub	unsucc	MesWagSp88	klam	k	or	637	3470					
GobeastP1	86	pair	m&f	ad	?	MesWag89	klam	k	or	512	2700					
PORKY1&2	85	pair	m&f	ad		MesWag89	klam	k	or	39	3072					
RUSH1&2	85	pair	m&f	ad		MesWag88	klam	k	or	24	7027					
LBP	88-89	pair	m&f	ad	n	Forsperscomm	dipe	i	wa	590	14238	4579				0.322
LCP	87-89	pair	m&f	ad	n	Forsperscomm	dipe	i	wa	424	6817	4786				0.702
BRP	87-89	pair	m&f	ad	n	Forsperscomm	dipe	i	wa	434	4497	3017				0.671
ECP	87-89	pair	m&f	ad	m	Forsperscomm	dipe	i	wa	436	27309	7680				0.281
BPP	87-89	pair	m&f	sub/ad	n	Forsperscomm	dipe	i	wa	694	20732	8448				0.407
RFP	88-89	pair	m&f	ad	n	Forsperscomm	dipe	i	wa	691	17119	8256				0.482
NRP	87-89	pair	m&f	ad	y	Forsperscomm	dipe	i	wa	766	10801	3195				0.301
FBP	87-89	pair	m&f	ad	n	Forsperscomm	dipe	i	wa	357	9258	622				0.067
SPP	87-89	pair	m&f	ad	y	Forsperscomm	dipe	i	wa	700	4838	2787				0.576
OBP	87-88	pair	m&f	ad	n	Forsperscomm	dipe	i	wa	621	4703					
5ap	75-76	pair	m&f	ad	y	ForMes85	orca	o	or	804	3969	2248				0.566
2ap	75-76	pair	m&f	ad	y	ForMes85	orca	o	or	1505	3945	2092				0.530
1ap	75-76	pair	m&f	ad	n	ForMes85	orca	o	or	1367	10146	3786				0.373
MCP	87-88	pair	m&f	ad		MesetalAp88	orca	o	or	268	2300		571	0.248	166	
MLP	87-88	pair	m&f	ad		MesetalAp88	orca	o	or	256	1907					
FRED1&2	85	pair	m&f	ad		MesWag88	orca	o	or	51	8622					
BCP	87-88	pair	m&f	ad		MesetalAp88	orca	o	or	294	3189		3694			
HCP	87-88	pair	m&f	ad		MesetalAp88	orca	o	or	279	2045					
BRP	87-88	pair	m&f	ad	unsucc	MesetalSp88	orca	o	or	442	4490					
MCP	87-88	pair	m&f	ad	unsucc	MesetalSp88	orca	o	or	443	2594					
MLP	87-88	pair	m&f	ad	n	MesetalSp88	orca	o	or	422	2174					
WSP	87-88	pair	m&f	ad	y	MesetalSp88	orca	o	or	419	1516					
HCP	87-88	pair	m&f	ad	unsucc	MesetalSp88	orca	o	or	437	5056					
BCP	87-88	pair	m&f	ad	?	MesetalSp88	orca	o	or	435	2954					
Fred 1&2	85	pair	m&f	ad	y	MesNick86	orca	o	or	100	2399					
BRP	87-88	pair	m&f	ad		MesetalAp88	orca	o	or	285	4147		539	0.130	494	0.498
WSP	87-88	pair	m&f	ad		MesetalAp88	orca	o	or	282	2267		500	0.221	162	0.316
Humbugp	87	pair	m&f	ad	n	GutCall88C89	sierra	s	ca	492	7141					0.649
WilliamsonP	87	pair	m&f	ad	y	GutCall88C89	sierra	s	ca	565	4611					
EarlyWinters	82-83	pair	m&f	ad	n	Allenperscom	wacae	e	wa	105	8006					
BuckP	82	pair	m&f	ad	n	Allenetal89	wacaw	w	wa	82	3547	1767				0.212
SandyCrp	82-83	pair	m&f	ad	n	Allenetal89	wacaw	w	wa	131	5787	1828				0.673
GoatP	85-86	pair	m&f	ad	n	Allenetal89	wacaw	w	wa	218	2869	1927				0.693
DiobsudP	86-87	pair	m&f	ad	?	Hamer88	wacaw	w	wa	103	8002	3702				0.395
SandyCrp	86-87	pair	m&f	ad	n	Hamer88Allen89	wacaw	w	wa	390	17463	4177				
Alec	84-85	pair	m&f	ad	y	Allenperscom	wacaw	w	wa	201	8205	5859				
Wanlick	83-84	pair	m&f	ad	y	Allenperscom	wacaw	w	wa	71	8602	2472				
Sandy		pair	m&f	ad	n	Allenperscom	wacaw	w	wa		6257					

Table 2. Data on home range sizes of northern spotted owl pairs. Data are sorted by state. Fields (column headings) are explained in Table 3.

OWLNAME	YEAR	INDIV	SEX	AGE	BREED	LIT	PROV	PROV2	STATE	NPTXYEAR	HRXYEAR	HABXYEAR	HROVLPR1	HROVLPR2	HROVLPR3	PROXYEAR
SORTED BY STATE:																
CALIFORNIA + OREGON:																
GriffSusan	89	pair	m&f	sub/ad	n		Patonpercm89	caca	a	ca	107	11668				
FishWildlife	89	pair	m&f	sub	n		Patonpercm89	caca	a	ca	81	13644				
RenoSylvia	89	pair	m&f	ad	y		Patonpercm89	caca	a	ca	91	8339				
AceStar	89	pair	m&f	ad	n		Patonpercm89	caca	a	ca	145	5880				
TurnwaterOly	87-88	pair	m&f	ad	n		Patonpercm89	klam	k	ca	203	3312				
TGfOly	88	pair	m&f	ad	y		Patonpercm89	klam	k	ca	307	7820				0.597
JimTammy	87-88	pair	m&f	ad	n		Patonpercm89	klam	k	ca	311	5700				0.146
JoeMormina	87-88	pair	m&f	ad	y		Patonpercm89	klam	k	ca	271					0.347
JoeKitty	88-89	pair	m&f	ad	n		Patonpercm89	klam	k	ca	401	5096				1625
OllieJunior	87-88	pair	m&f	sub/ad	n		Patonpercm89	klam	k	ca	294	2055				1119
OllieFawn	88-89	pair	m&f	ad	unsucc		Patonpercm89	klam	k	ca	357	2836				1625
TarzanJane	88-89	pair	m&f	ad	n		Patonpercm89	klam	k	ca	371	2813				1398
BeeCuss	88-89	pair	m&f	ad	n		Patonpercm89	klam	k	ca	322	5402				136
BuenoClemenc	87-88	pair	m&f	ad	y		Patonpercm89	klam	k	ca	213	2408				1509
BuenoHanna	88-89	pair	m&f	sub/ad	n		Patonpercm89	klam	k	ca	324	4683				1398
BearMedia	88	pair	m&f	ad	unsucc		Patonpercm89	klam	k	ca	122					748
AugyRosa	88-89	pair	m&f	sub/ad	y		Patonpercm89	klam	k	ca	415	2102				
MorrisChel	87-88	pair	m&f	ad	n		Patonpercm89	klam	k	ca	255	2910				
Banditholly	88-89	pair	m&f	ad	n		Patonpercm89	klam	k	ca	443	4594				
Banditholly	87-88	pair	m&f	ad	n		Patonpercm89	klam	k	ca	339	3475				679
GandolfWho	88-89	pair	m&f	ad	unsucc		Patonpercm89	klam	k	ca	345	3394				0.233
GandolfWho	87-88	pair	m&f	ad	n		Patonpercm89	klam	k	ca	252	2836				0.434
BearMedia	87-88	pair	m&f	ad	y		Patonpercm89	klam	k	ca	363	3243				0.224
BillyBDoll	88-89	pair	m&f	sub/ad	n		Patonpercm89	klam	k	ca	419	1803				0.100
SoloMia	88-89	pair	m&f	ad	unsucc		Patonpercm89	klam	k	ca	322	2124				0.168
BillyBDoll	88-89	pair	m&f	ad	unsucc		Patonpercm89	klam	k	ca	415	2126				0.264
MayoCatalin	80-81	pair	m&f	ad	unsucc		Solis82	klam	k	ca	307	1258				0.321
LuciaParcho	86-87	pair	m&f	ad	?		Solis82	klam	k	ca	307	1258				0.370
LMP	86-87	pair	m&f	ad	unsucc		ReidHor87	cora	c	or	238	9045				0.314
WolfCrP	87-88	pair	m&f	ad	unsucc		ReidHor87	cora	c	or	321	4117				1233
BillixP	87-88	pair	m&f	ad	y		ReidHor87	cora	c	or	324	5984				367
WolfCrP	87-89	pair	m&f	ad	m		ThrMesj89	cora	c	or	546					2986
PPP	86-87	pair	m&f	ad	unsucc		ReidHor87	cora	c	or	231	6115				799
MCPX	86-87	pair	m&f	ad	?		ReidHor87	cora	c	or	326	3238				1488
CCP	86-87	pair	m&f	ad	y		ReidHor87	cora	c	or	284	2954				2974
BillixP	87-89	pair	m&f	ad	m		ThrMesj89	cora	c	or	563					2430
FredEthel	88-89	pair	m&f	sub/ad	n		Patonpercm89	klam	k	or	196	6195				1870
FordEmily	88-89	pair	m&f	ad	?		Patonpercm89	klam	k	or	259	5894				
RickRuby	88-89	pair	m&f	ad	n		Patonpercm89	klam	k	or	169	5338				
PatVanna	88-89	pair	m&f	ad	y		Patonpercm89	klam	k	or	234	5325				
MidCrP	87-88	pair	m&f	?	?		MesWag8988	klam	k	or	550	2785				
GobknobP	86-87	pair	m&f	ad	?		MesWag87	klam	k	or	936	4500				
AlcoCrP	87-88	pair	m&f	ad	y		MesWag8988	klam	k	or	668	2500				
JonesCrP	87-88	pair	m&f	ad	?		MesWag8989	klam	k	or	417	2145				
ShellrockP	86-88	pair	m&f	ad	?		MesWag8989	klam	k	or	1056	4265				
GobknobP	86-88	pair	m&f	ad	?		MesWag8989	klam	k	or	1471	4890				

0.580
0.262
0.330
0.194
0.249
0.561
0.750
0.633

for use in Final EIS, USFS, 1992

Table 3. Descriptions of fields (column headings) for home range data shown in Tables 1 and 2.

SPOTTED OWL HOME RANGE AND HABITAT ACREAGE DATA

OWLNAME\$ - Name or code of owl or owl pair as used in the literature.

YEAR\$ - Year(s) of observation.

INDIV\$ -

indiv = individual spotted owl
pair = spotted owl pair

SEX\$ -

m = male
f = female
m&f = male and female (pair)
? = unknown
blank = no data

AGE\$ -

ad = adult, 3+ years old
sub = subadult, 1-3 years old
im = immature, juvenile, fledgling < 1 year old
? = unknown or unspecified
blank = no data

BREED\$ -

y = yes, was breeding and successful (produced fledglings)
n = no, was not breeding and did not attempt
? = unknown breeding status
unsucc = attempted breeding but did not produce fledglings
m = mixed breeding status for multi-year data

LIT\$ - Literature source (abbreviation of authors' names and year):

Allenetal89 -- Allen et al. 1989
Allenperscom -- H. Allen, pers. comm., 1989
Forsperscomm -- E. Forsman, pers. comm., 1991
ForMes85 -- Forsman and Meslow 1985
FrieMes88 -- Friesen and Meslow 1988
GutCall88C89 -- Gutierrez and Call 1988,
Hamer88 -- Hamer 1988
Hamer88Allen89 -- Hamer 1988, Allen et al. 1989
MesNick86 -- Meslow, Nickell, and Hause 1986
MesWag87 -- Meslow and Wagner 1987

MesWag88 -- Meslow and Wagner 1988
MesWag89 -- Meslow and Wagner 1989
MesWag8889 -- Meslow and Wagner 1988,1989
MesWag8988 -- Meslow and Wagner 1988,1989
MesWagSp88 -- Meslow and Wagner 1988
MesetalAp88 -- Meslow et al. 1988a,1988b,1988c
Patonpercm89 -- P. Paton, pers. comm., 1989
ReidHor87 -- Reid et al. 1987
Solis82 -- Solis and Guteirrez 1982
ThrMesjl89 -- Thrillkill and Meslow 1989

PROV\$ - Physiographic province:

WACAE = Washington Cascades, east of Cascades Crest
WACAW = Washington Cascades, west of Cascades Crest
ORCA = Oregon Cascades (west side)
CORA = Oregon Coast Range
KLAM = Klamath Mountains (Oregon and California)
KLAMORCA = Klamath Mountains and Oregon Cascades
 junction (in southern Oregon)
SIERRA = Sierra Nevada
WOR = Western Oregon (province unspecified)
CACR = California Coast Range (Mendocino)
CACA = California Cascades (Lassen)

PROV2 - Physiographic province:

Same as field PROV\$ above but reduced to a single letter.

STATE\$ - State in which the study was conducted:

ca = California
or = Oregon
wa = Washington

NPTXYEAR - Number of radio telemetry points during year-round
observations, used to calculate home range size.

HRXYEAR - Home range size during year-round observations;
100% minimum convex polygon.

HABXYEAR - Acres of suitable habitat (old-growth or mature
and old-growth forest) within 100% minimum convex polygon.

HROVLPR - No. acres overlap between 100% minimum convex
polygon home ranges of the closest adjacent pair (first pair as
listed in the reports), where known.

HROVLPRO - Proportion of overlap of 100% minimum convex polygon
annual home ranges between adjacent pairs. HROVLPRO is cal-
culated as HROVLPR/HRXYEAR.

HROVLPR2 - No. acres overlap between 100% minimum convex
polygon home ranges of the second closest adjacent pair (second

pair as listed in the reports), where known.

HROVLPR3 - No. acres overlap between 100% minimum convex polygon home ranges of the third closest adjacent pair (third pair as listed in the reports), where known.

PROXYEAR - The proportion of the 100% minimum convex polygon annual pair home range area that consists of suitable habitat as defined and tallied in each report. $PROXYEAR = HABXYEAR / HRXYEAR$

Table 4. Data on home range and habitat amount for northern spotted owl pairs in Washington, showing results of linear regression analysis.

WA data:

HRXYEAR PROXYEAR Regression

9258	0.067	17181
17463	0.212	14631
27309	0.281	13412
10601	0.301	13057
5787	0.316	12802
14238	0.322	12701
6257	0.395	11408
20732	0.407	11189
17119	0.482	9873
3547	0.498	9593
4838	0.576	8221
2969	0.649	6936
4497	0.671	6552
6205	0.673	6512
8602	0.693	6167
6817	0.702	6003

Regression Output:		
Constant		18363.79
Std Err of Y Est		6359.832
R Squared		0.238735
No. of Observations		16
Degrees of Freedom		14
X Coefficient(s)		-17606.6
Std Err of Coef.		8402.74

<-- marginally sig. (p slightly > 0.05)

Table 5. Data on home range and habitat amount for northern spotted owl pairs in Oregon, showing results of linear regression analysis.

HRXYEAR PROXYEAR Regression

Regression with the 2 CA points removed (Solis 82):

Regression Output:	
Constant	8688.113
Std Err of Y Est	2346.405
R Squared	0.268704
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	-7053.86
Std Err of Coef.	4398.325

^

Used THIS regression for HCHRV OSS.WQ1 ... !

Table 6. Data on home range and habitat amount of northern spotted owl pairs in Oregon and Washington, also showing linear regression model predictions and extrapolated values beyond known data ranges. Extrapolation "rules" are explained in the text.

WA & OR COMBINED (excludes the two OR points from Solis82)

** THIS format was used for the FEIS HC model **

STATE	PROXYEAR	OR			WA		
		HRXYEAR	Regressio	Extrap	HRXYEAR	Regressio	Extrap
	0			8688			
OR	0.194	4117	7319	7319			
OR	0.249	5984	6934				
OR	0.330	9045	6359				
OR	0.373	10146	6056				
OR	0.530	3945	4948				
OR	0.566	3969	4693				
OR	0.581	5115	4587				
OR	0.633	2954	4223				
OR	0.750	3238	3394	3394			
	0.8			3045			
	0.85			2692			
	0.9			2340			
	0.95			1987			
OR	1			1634			
	0						18364
WA	0.067				9258	17181	17181
WA	0.212				17463	14631	
WA	0.281				27309	13412	
WA	0.301				10601	13057	
WA	0.316				5787	12802	
WA	0.322				14238	12701	
WA	0.395				6257	11408	
WA	0.407				20732	11189	
WA	0.482				17119	9873	
WA	0.498				3547	9593	
WA	0.576				4838	8221	
WA	0.649				2969	6936	
WA	0.671				4497	6552	
WA	0.673				6205	6512	
WA	0.693				8602	6167	
WA	0.702				6817	6003	6003
	0.750						5151
	0.8						4279
	0.85						3398
	0.9						2969
	0.95						2969
	1						2969

Table 7. Population persistence values (percent of original populations, of various sizes and in areas with various proportions of suitable habitat, remaining after 100 years) used to correct estimates of habitat capability (number of northern spotted owl pair sites). (Source: C. Voss, pers. comm. 1991 to M. Raphael.)

C. Voss' update to Table Q3 ISC persistence correction factors:

(pers. comm. C. Voss to M. Raphael, 11/91)

Total no. pair sites in HCA	(Row to look up)	Percentage of HCA area in suitable (NRF) habitat (30-39)... (continues -->)							
		20	40	50	60	70	80	90	100
0 ^L	1	18	23	29	34	42	49	53	57
5	2	18	23	29	34	42	49	53	57
6	3	17	22	27	34	40	52	57	62
7	4	21	30	37	44	57	61	64	72
8	5	19	29	42	54	59	63	70	75
9	6	30	38	45	51	62	68	74	90
10	7	33	40	54	61	68	78	80	82
11	8	26	39	56	66	71	77	77	82
12	9	37	49	58	66	71	78	82	82
13	10	34	45	62	71	73	77	84	85
14	11	29	52	59	69	73	80	85	86
15	12	42	50	67	70	77	80	86	87
16	13	39	49	64	76	79	82	82	86
17	14	37	56	69	74	78	83	85	89
18	15	36	53	69	75	81	83	87	89
19	16	43	62	71	74	81	84	88	89
20	17	43	59	70	76	80	86	88	90
21	18	41	55	70	79	83	85	88	89
22	19	48	60	72	79	82	85	88	91
23	20	44	58	72	79	83	87	90	91
24	21	44	62	71	77	84	87	90	92
25	22	50	63	71	81	86	88	88	92
26	23	48	61	74	81	84	87	89	90
27	24	46	54	78	81	85	88	90	91
28	25	43	63	74	80	87	87	89	92
29	26	50	55	74	79	86	88	91	91
30	27	50	67	78	82	84	88	90	92
35	28	54	69	80	82	87	88	91	91
40	29	54	71	78	83	87	88	91	93
45	30	59	72	81	85	90	90	91	91
50	31	58	74	82	85	89	90	91	93
55	32	59	73	82	86	88	90	91	93
60	33	61	74	81	86	89	90	91	93
65	34	61	75	83	86	89	91	92	93
70	35	63	75	82	87	90	91	92	92
80	36	63	75	84	87	88	90	92	93
85	37	65	77	84	86	90	92	92	94
90	38	66	77	82	87	89	91	92	93
95	39	68	78	84	87	90	91	92	93
100	40	67	77	88	87	88	90	92	94

Ⓛ This row only for look-up function. Obviously, ϕ pair-sites has no persistence.

FIGURES

Figure 1. Scatter diagram and plot of linear regression of 100% minimum convex polygon annual pair home range of northern spotted owls in Washington.

Figure 2. Scatter diagram and plot of linear regression of 100% minimum convex polygon annual pair home range of northern spotted owls in Oregon.

Figure 3. Scatter diagrams and plots of linear regressions of 100% minimum convex polygon annual pair home range of northern spotted owls in Oregon and in Washington, also showing extrapolations beyond the known data ranges.

Figure 4. Linear regression-based models, with extrapolations, of 100% minimum convex polygon annual pair home range of northern spotted owls in Oregon and Washington.

Figure 5. Selected probability persistence curves representing different starting northern spotted owl population sizes ranging from 5 to 100 pairs. (Source: C. Voss, pers. comm. 1991 to M. Raphael.)

Figure 6. Selected probability persistence curves representing different starting northern spotted owl population sizes ranging from 10 to 60 pairs. (Source: C. Voss, pers. comm. 1991 to M. Raphael.)

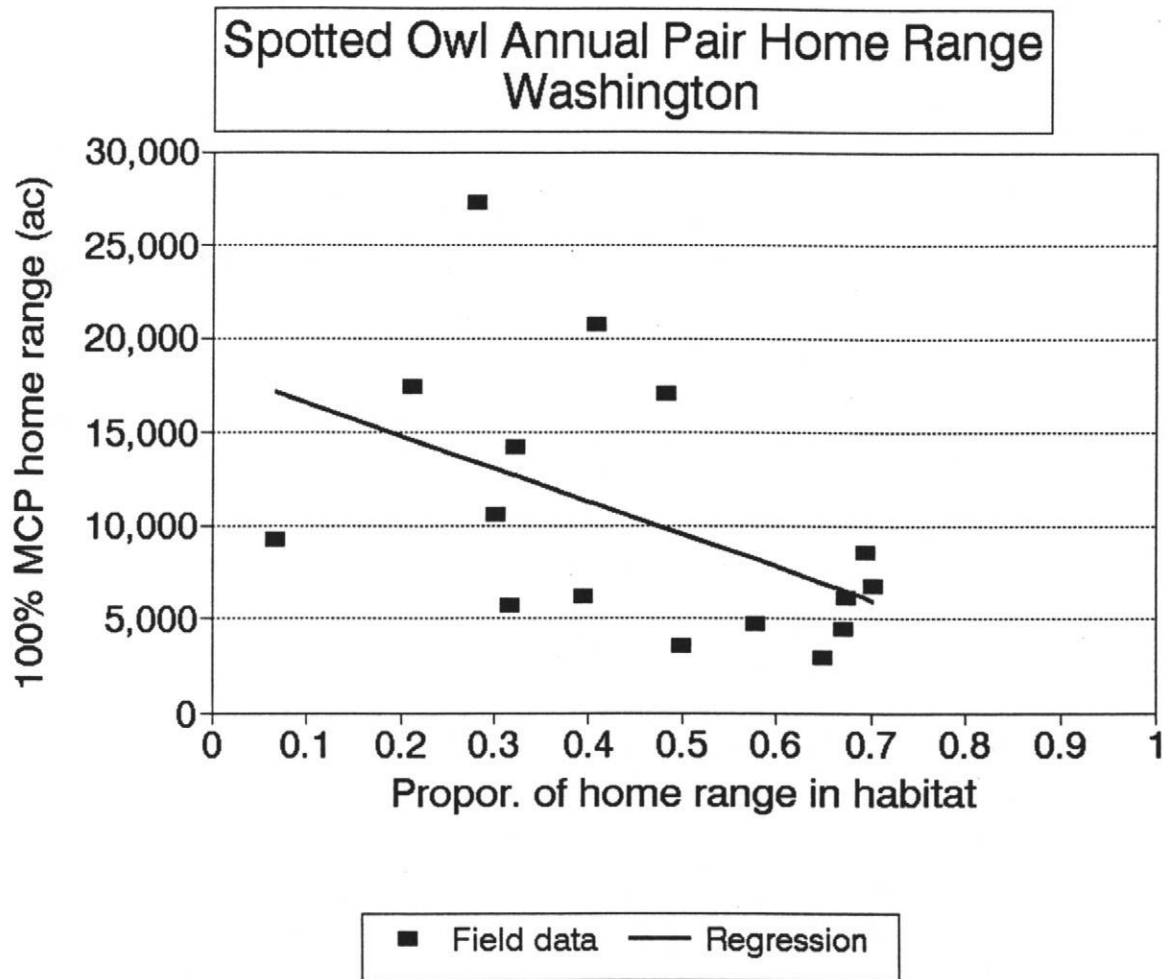


FIGURE 1.

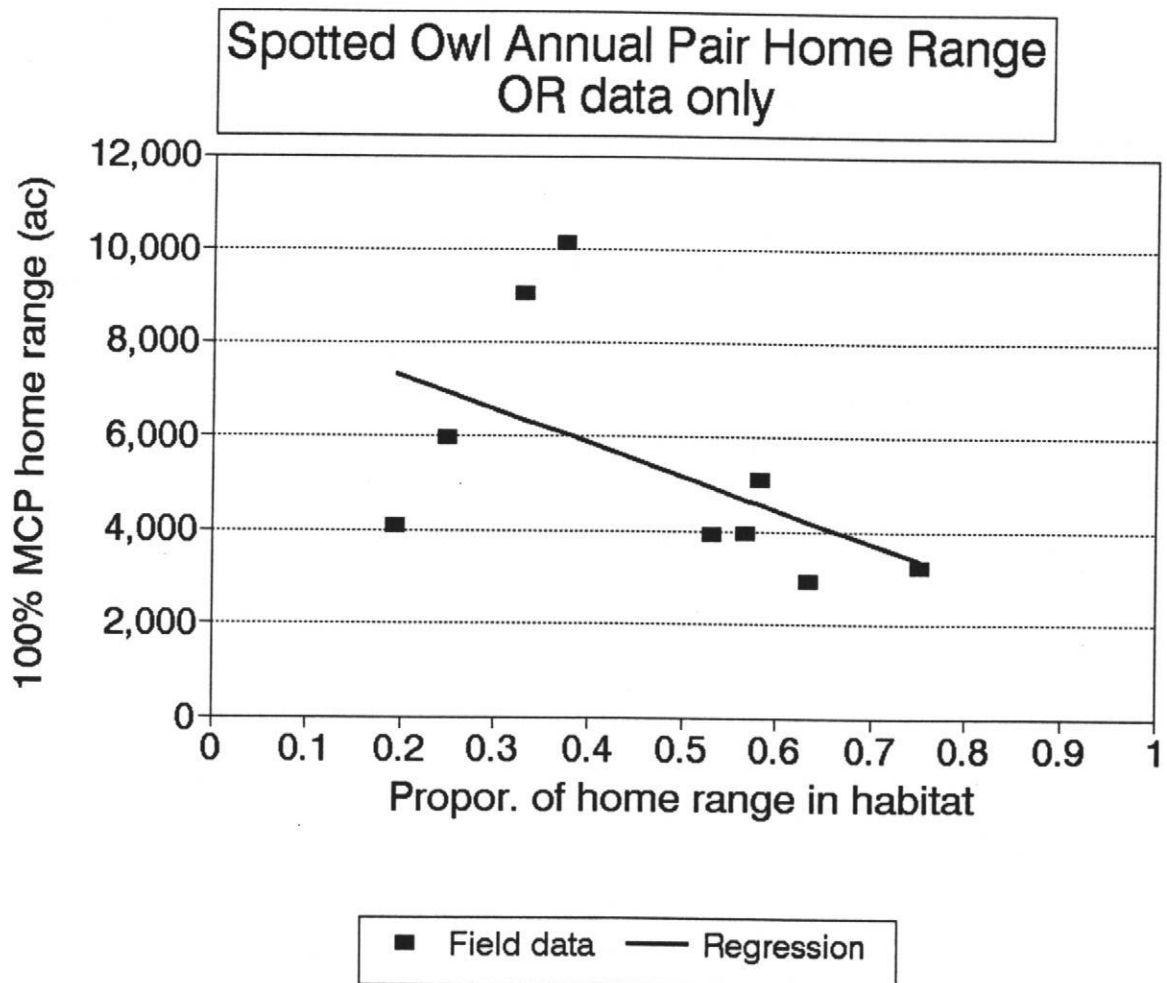


FIGURE 2.

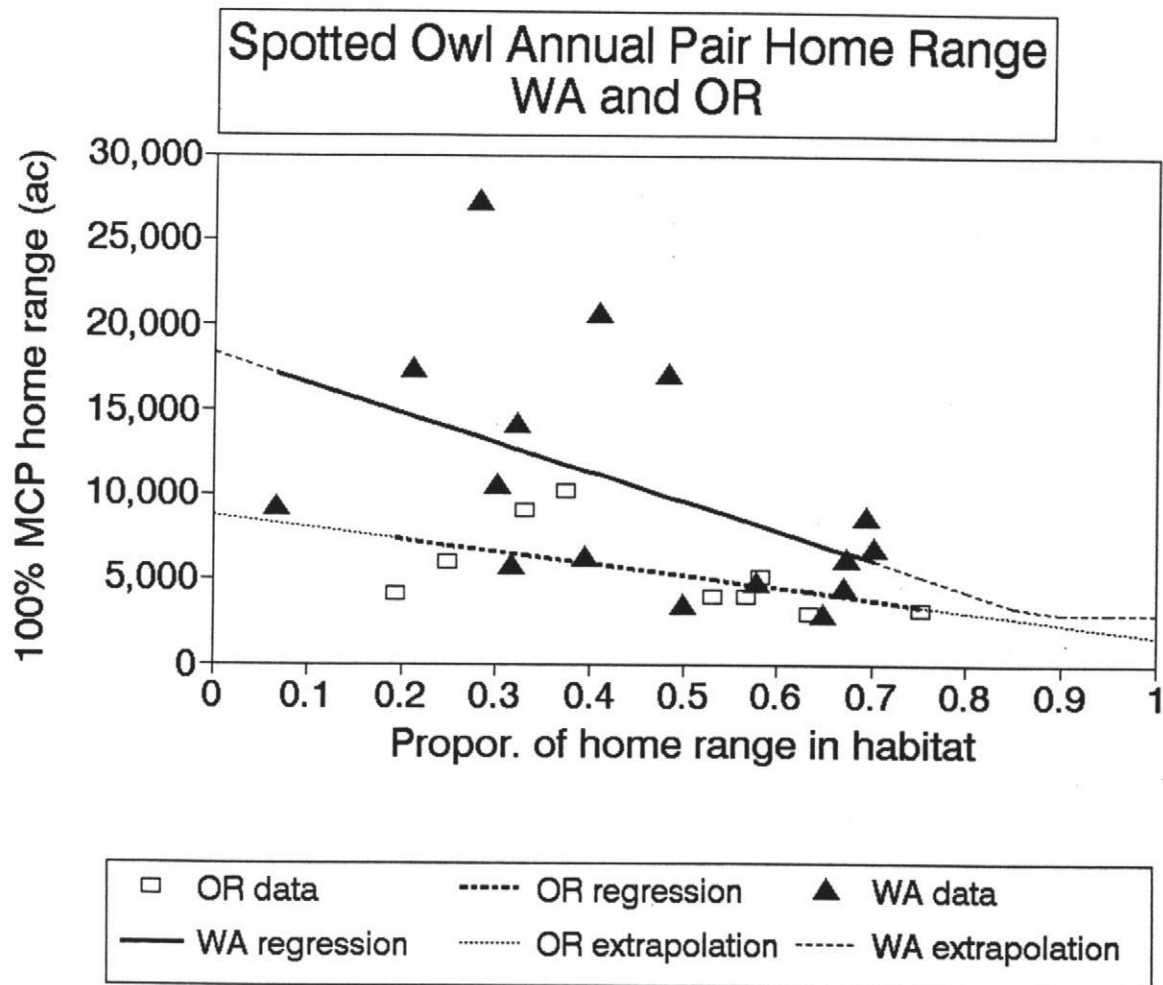


FIGURE 3.

Spotted Owl Annual Pair Home Range Washington and Oregon

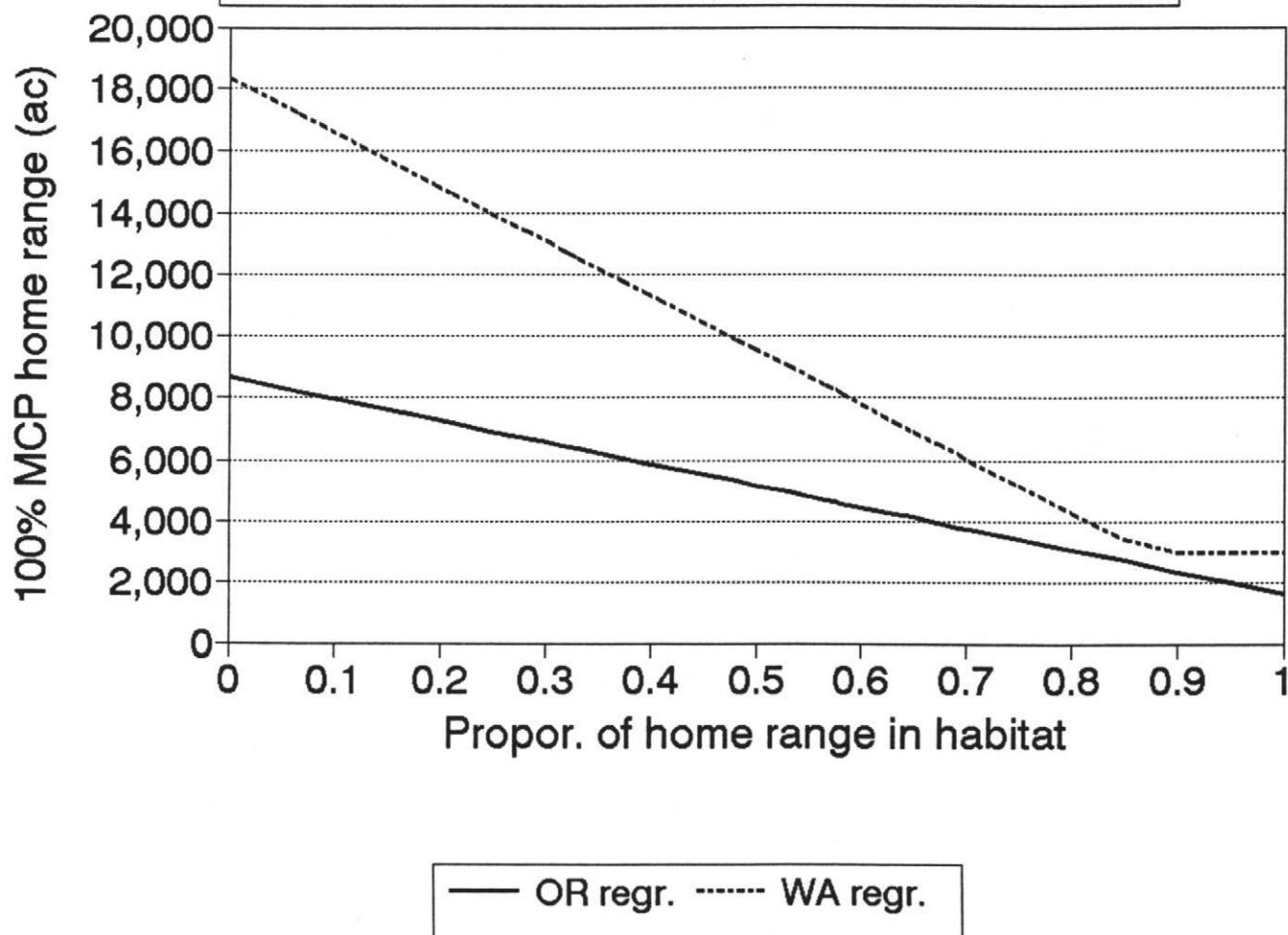


FIGURE 4.

Persistence Probabilities Voss, pers. comm. 11/91

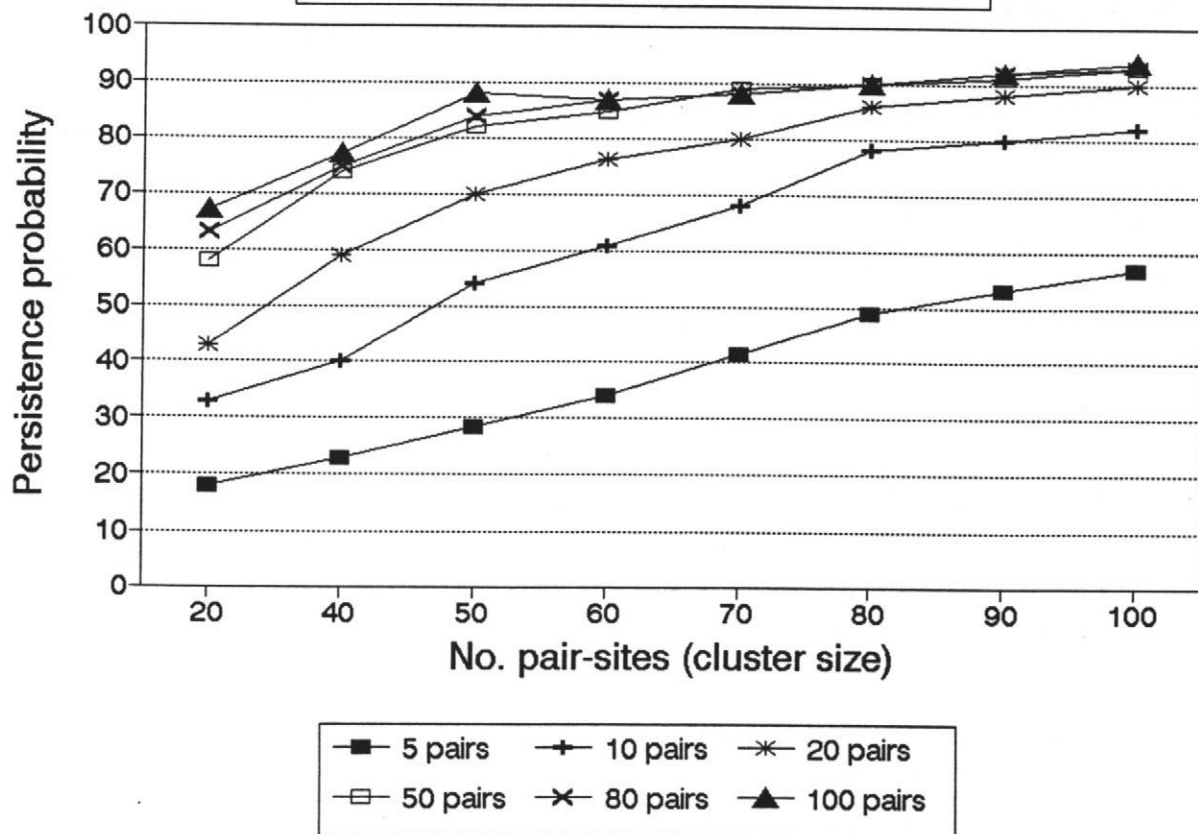


FIGURE 5.

Persistence Probabilities Voss, pers. comm. 11/91

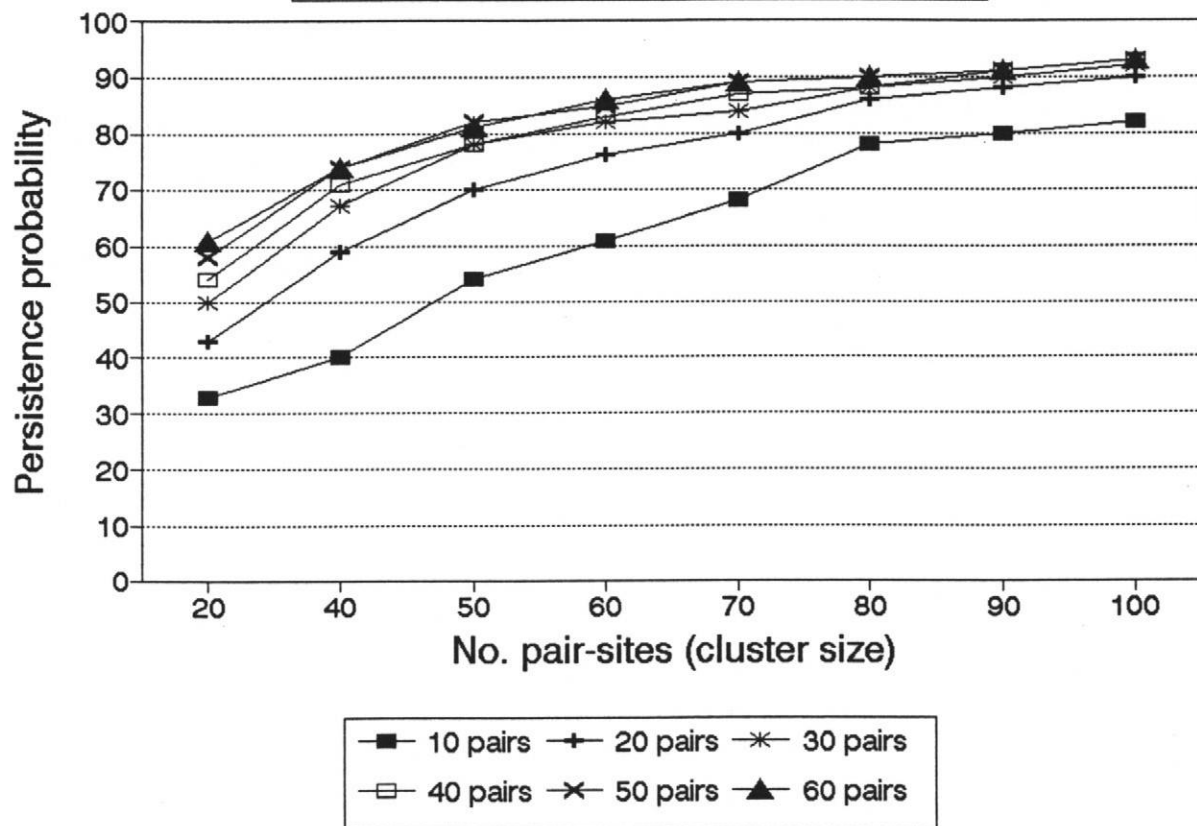


FIGURE 6.

APPENDIX

Minutes of Spotted Owl Research, Development, and Application Technical Group meeting for devising a northern spotted owl habitat capability model.

NORTHERN SPOTTED OWL HABITAT CAPABILITY MODEL

MEETING 10/17/91

PARTICIPANTS:

Bruce Marcot - PNW/RD&A
Eric Forsman - PNW
Martin Raphael - PNW
Kim Mellen - EIS Team
Marilyn Stoll - EIS Team
Bill Neitro - BLM
Dwayne Dippon - BLM
Richard Holthausen - Recovery Team

Model Objectives:

- No. future pairs throughout range - "macro" scale
- Metapopulation dynamics, population persistence, viability
- Geographic Scales:
 - site - suitable y/n, or grades for life functions
 - home range - reproductive pair, y/n or probability
 - landscape - pair, metapopulation dynamics
- * level of sophistication*
- Potential population vs. likely population

EIS Team Data Available:

- suitable owl habitat - "NRF" (y/n)
- tentatively suitable for timber production - "capable"
 - some currently owl habitat, some not
 - capable of growing trees
 - % that could be suitable owl habitat
- land allocations
 - wilderness
 - owl habitat designated areas
 - land not suitable for timber management (might or might not grow trees)
- current owl locations

- reproductive pair
- pair
- territorial single

BLM and Recovery Team Data

- old-growth/habitat (y/n)
- 20-m cell size

Forest Service Data

- Forest age class area over time
 - not spatially explicit
- resolution varies by forest and layer (5-60 ac?)

COMPONENTS OF NORTHERN SPOTTED OWL HABITAT CAPABILITY MODEL

Input Parameters:

- amount of habitat
- distribution of habitat
 - scale
 - % of area in habitat, OK if on scale of designated area
 - home range or cluster basis?
- Adjust for occupancy as function of:
 - amount habitat
 - distribution habitat
 - arrangement of sites
 - complexity of scale and accuracy
- Model function:
 - habitat needs of reproductive pairs.

Model Needs:

- short-term, pragmatic
- long-term, sophisticated
- broad range of habitat and landscapes

***** ***** *****

ISC

- Known Pairs -current
- Total estimated pairs - current
- Future expected pairs ("pair site")
 - home range size, overlap

- density
- Future adjusted expected pairs
 - based on subpopulation dynamics simulations

***** ***** *****

STEPS

1- Estimating habitat

- amount habitat within bounded areas - current
- for habitat outside bounded areas:
 - 2.1 mile circle, percent habitat (randomly placed circles)

WITHIN BOUNDED AREAS (HCA, SOSA, DCA...)

Pair Sites:

ISC HCA area _____ = Pair sites
 mean Home range size w/ 25% overlap

*Home range size as function of % suitable habitat by phys. prov.

(Pair sites) X (% suitable habitat in HCA) = correction
 * inconsistent? - need for estimate of "pairs"?

OR

Crude Density (pairs/unit area)

use graph of density as function of % habitat in landscape
 * problems associated with packing effects? philopatry?

Questions?

- home range overlap as function of % habitat
- home range size as function of % habitat
- density as function of % habitat

Option:

ISC method but:

- a) use home range as function of habitat
 - create function by province, regression lines (Seavy's graphs) ** "suitable habitat" in Seavy data may not be same definition as on habitat overlays used by EIS team**
- b) constant for overlap - 25% overlap between 2 adjacent pairs

Process for Estimating PAIR SITES in Bounded Areas:

- 1) Calculate % suitable habitat within bounded area

2) Calculate regressions of total home range size as function of percent suitable habitat within home range, by physiographic province (or combination thereof)

3) Calculate quotient: divide total bounded area by adjusted home range size from step 2) regressions

4) Correct 3) for home range overlap: multiply 3) by 1.25

RESULTS = Pair sites

Process for Estimating PAIRS in Bounded Areas

5) Adjust pair sites for expected occupancy: multiply step 4) by appropriate figure in Table Q3, ISC p. 322 (% sites occupied by % suitable habitat)

** Note: In Table Q3, no. pair sites is for future, maximum suitability; but % suitable is for specific time periods ** Clarify with Barry Noon *

RESULT = Pairs (adjusted pairs)

Process for Estimation of "adjusted pairs" with Density Data

- 7-8 density study areas + other study areas (p. 190, Table H4, ISC):

Coos Bay BLM	Willow Creek (NF)
Wenatchee NF (Cle Elum)	Roseburg BLM
HJ Andrews	Medford BLM
Eugene BLM	Siuslaw NF
Olympic NF	

ESTIMATE crude density (pairs/area) as function of % landscape in habitat
... update table H4 in ISC

Estimate ADJUSTED PAIRS: apply crude densities from updated table H4 to HCA acres, for the appropriate category of % habitat, by physiographic province

Interpret 2 approaches:

Eric: use density-based estimate over home range-based estimate -- best for CURRENT density

Holt: also evaluate both approaches for FUTURE density

OUTSIDE BOUNDED AREAS

Process to Estimate PAIR SITES:

Complications:

- might be difficult to assess low % suitable

1)- Use GIS with grid on map overlays to derive distribution ... frequency distribution - no. sample grids as function of % suitable habitat classes - grids scale to avg. home range size, 5,000 acre hex's or squares (need cutoff rule for % grid outside HCA's to include)

- for FUTURE apply %'s for specific times (assume % if distributed well and 0 if distributed badly)

2)- check regression of total home range size as function of % suitable habitat ... see if any points fall <20% suitable habitat. Cutoff of % suitable habitat below which owl occupancy = 0

3)- Estimate expected home range size for each % habitat class

4)- Divide home range size into total acreage of each % habitat class (include suitable and unsuitable habitat)

5)- Multiply by 1.25; sum over all % classes

RESULT = Pair Sites (outside bounded areas)

OR

Default to use forest-wide average of % habitat

OR

for future, need to correct for occupancy as function of % spatial distribution - possibly calculate max and min occupancy

** Calculate years 0 and 150 only - discuss intervening years based on FORPLAN acres over time **

Possibly adjust for spatial distribution - use table Q3 (ISC):

- Calculate high and low estimates:
 - high - use number sites in HCA where correction factor asymptotes (25-30 pairs)
 - Low - use same as above but for 1-pair correction data (occupancy rate)

Show (footnote) overall expected occupancy rate of pairs in HCA 3's, but don't show HCA-specific occupancy rates (many = 0)

Estimate for FUTURE adjusted pairs outside Bounded Areas

1) For SUITED TM land outside bounded areas:

- calculate (total habitat acres in suit. TM lands)/(total suit TM)
 - * if < 20% then assume no significant contribution to population (adjusted pairs = 0)
 - * if > 20% then use low and high estimates based on adjustment factors as with bounded areas estimates BUT forest-wide average of % suitable habitat (assumption)

2) For UNSUITED TM land outside bounded areas:

- overlay unsuitable TM map onto "capable" map - overall % of unsuitable TM acres in "forestable condition"
- then treat intersection by using 5000 acres grids to determine frequency class distribution of size of individual unsuitable TM acres (same procedure as above)

DECISION:

For current year (0), grid entire forest without clustering into bounded areas - use low and high estimates based on ISC table of correction factors

for 1-pair and multi-pair areas, for a given % suitable habitat per grid category OR use empirical data as lower bound, or at least as cross-check

Question: - Account for wildernesses adjacent to (contributing to) HCA capability? If so, then don't double-count as unsuitable TM

TASKS:

- 1) - Summarize land classification and designated habitat area terminology and ensure that all classes are duly accounted for in this process - EIS Team
- 2) - Reality-check estimate of year 0 pairs with inventory and monitoring data - EIS Team
- 3) - Compile table of density of owls by physiographic province and proportion suitable habitat
 - ERIC - Roseburg, Olympic, Siuslaw, Wenatchee, HJ Andrews, Medford, Eugene study areas
 - EIS Team - Willow Creek (Al Franklin), Coos Bay (M.Brown and Cindy Zabel)

- request crude density and boundary of study area - then use GIS to calculate % suitable habitat within boundary
- 4) - Regression of home range size on % suitable habitat - FRED SEAVEY
 - recalculate for age and breeding status (use annual pair home range data) - BRUCE to work with FRED
- 5) - Clarify with Noon Table Q3 - MARTY
- 6) - Compile meeting notes - BRUCE and KIM
- 7) - Formulate all GIS queries - EIS team working with JOHN STEFFENSON