Critique of the use of Habitat Fitness Potential

In the Northern Spotted Owl Draft Recovery Plan

Gail S. Olson

Outline of Presentation

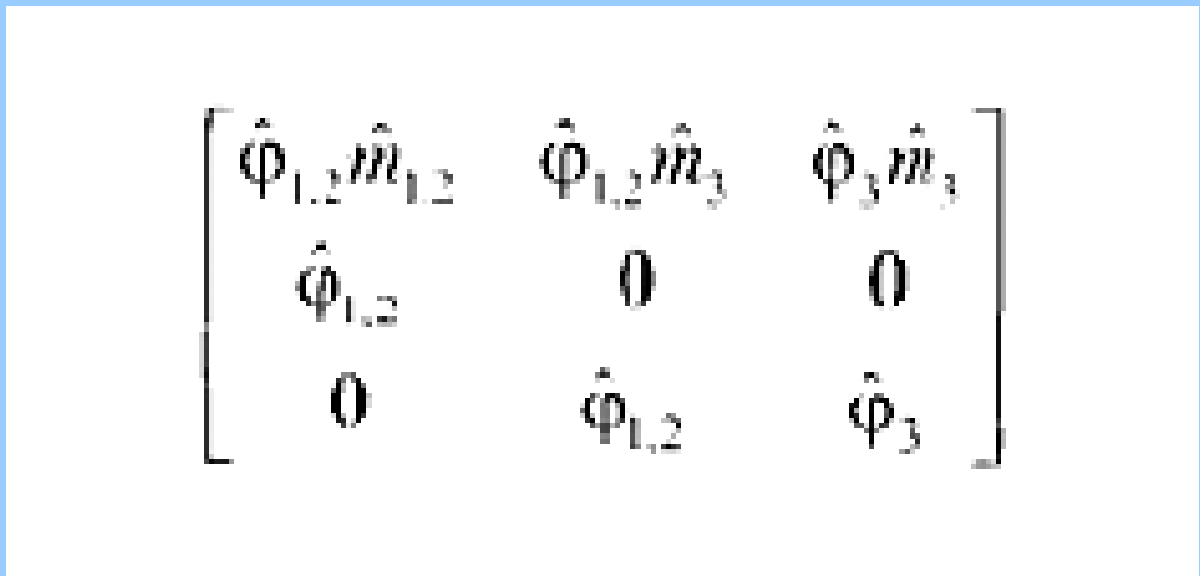
- Definition of Habitat Fitness Potential
- Explain how it was computed in Olson et al. (2004)
- Point out some flaws in the use of Habitat Fitness Potential in the NSO Recovery Plan (hereafter, the Plan)

Habitat fitness potential

- A metric developed by Franklin et al. (2000). From p. 558:
- “the fitness conferred on an individual occupying a territory of certain habitat characteristics”
- “the potential fitness that an individual can achieve if it occupies a particular territory with certain habitat characteristics.”

Estimation of habitat fitness potential

- Estimated from a stage-based Leslie matrix:



- The dominant (positive) eigenvalue from this matrix

Matrix Elements

- φ_a = Survival at age *a* = 1, 2, 3 (3 = >2)
- m_a = Fecundity at age *a* = 1, 2, 3
- Based on females

In Olson et al. (2004):

Owl survey data were used to examine hypothesized relationships between habitat and survival and productivity

Estimated from the “best” model as indicated by lowest AIC_c

Estimation of Matrix Elements

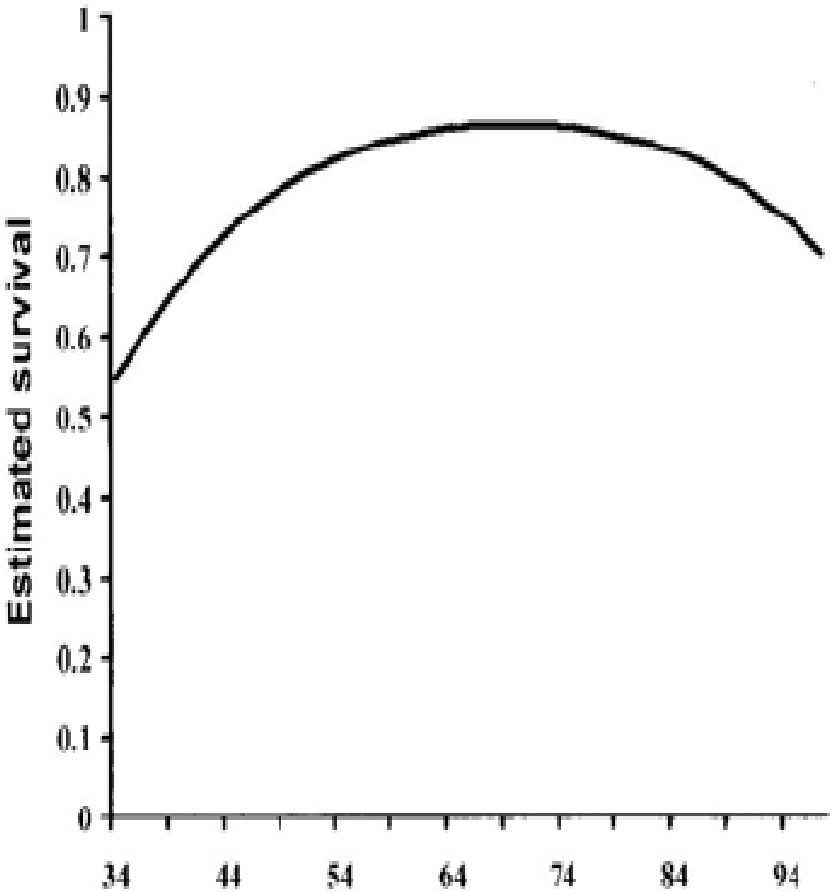
- From Olson et. al (2004):

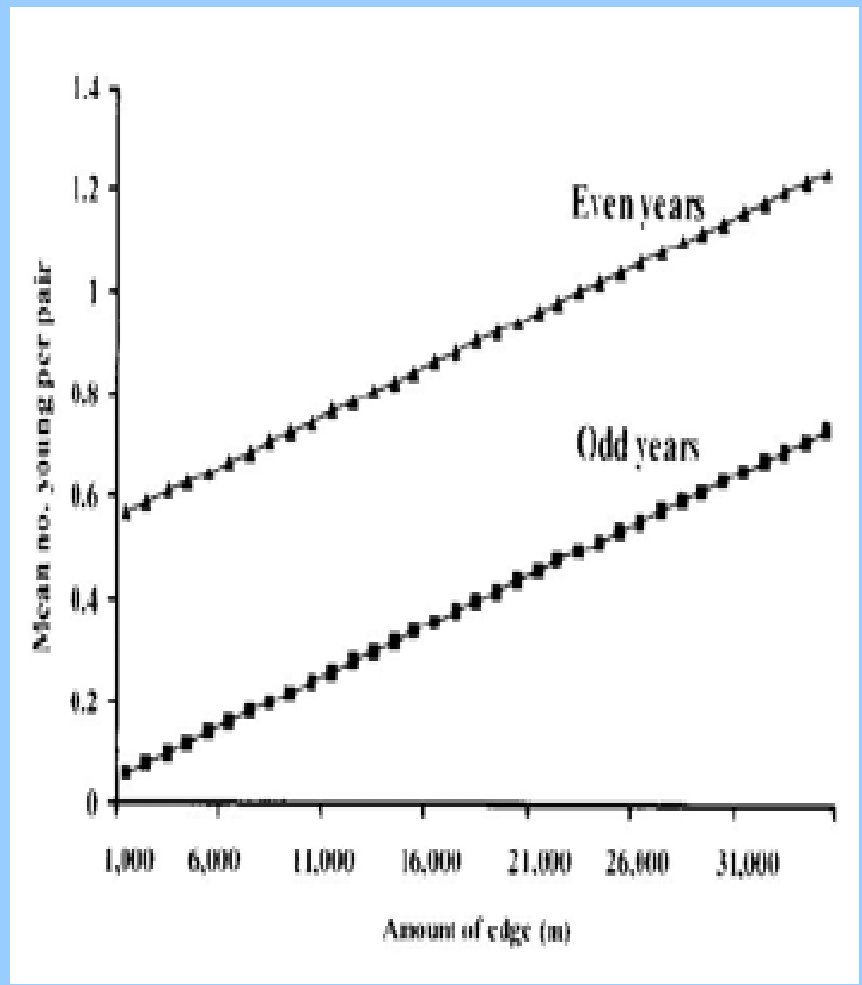
$$\hat{\varphi}_a = \frac{1}{1 + e^{-[\hat{\beta}_0 + [base] + \hat{\beta}_3 (LSMC1500qm)]}}$$

$$\hat{m}_a = \left(\frac{1}{2}\right) \cdot \hat{\beta}_0 + [base] + \hat{\beta}_9 (NOEdge)$$

base = base model covariates – not habitat related

Modeled relationships





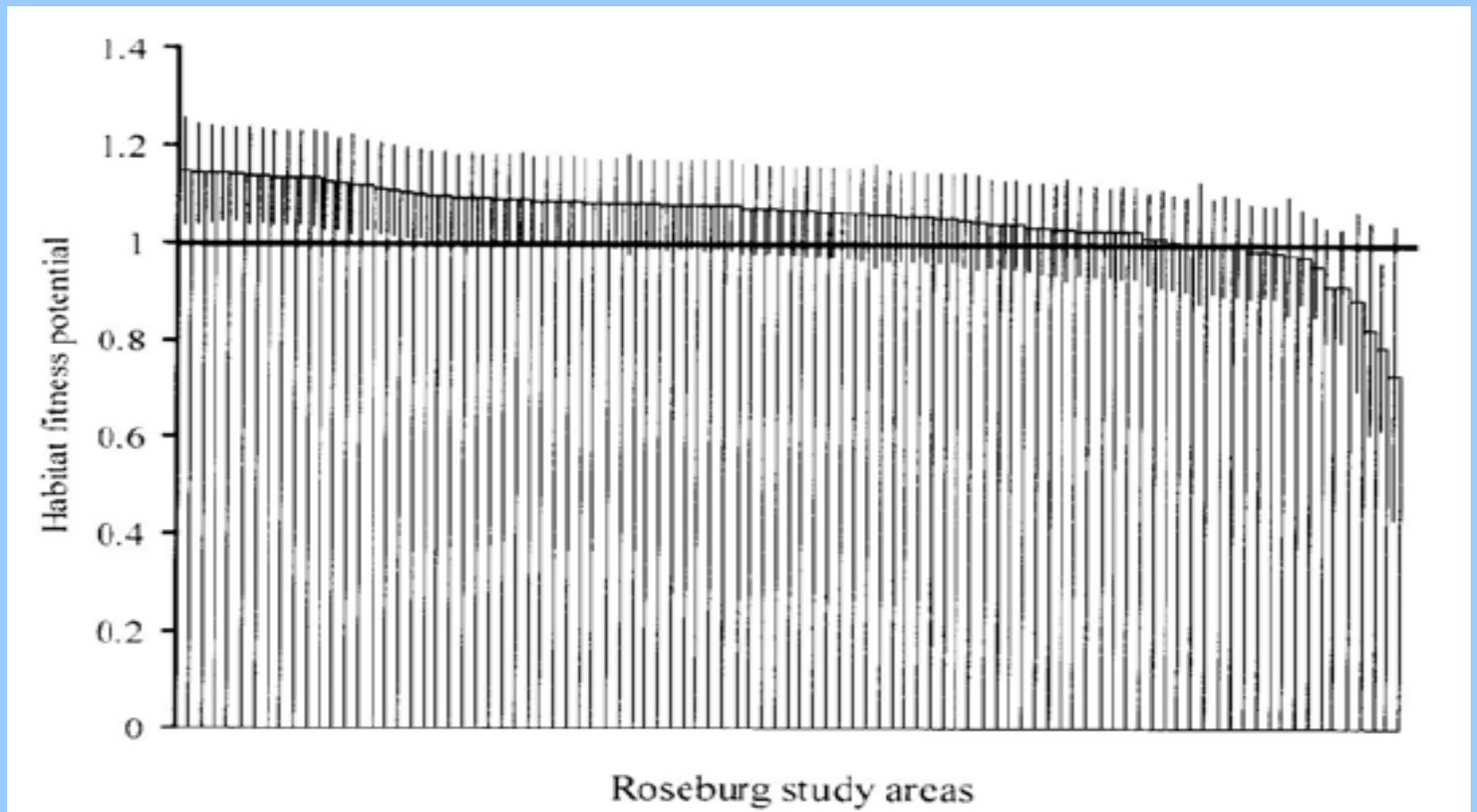
SURVIVAL

PRODUCTIVITY

Territory-specific Habitat Fitness Potential

- Territory-specific habitat values used to estimate φ_a and m_a for each territory in analysis (n=94)
- Average values were used for non-habitat covariates not specified in matrix
- Variance for each value was estimated by applying Delta method to the survival and productivity estimates, and then to the matrix characteristic equation

Territory-specific Estimates



Territory Examples

lambda = 0.99

lambda = 1.024

BLACK= Mid-late seral Forest WHITE = Young forest + nonforest

Misapplication of Habitat Fitness Potential in the NSO Recovery Plan

- Scale of application
- Misinterpretation of λ_H as λ
- Overlooks uncertainty
- Mismatch of habitat definitions
- Faulty derivation of target values

(Not an exhaustive list)

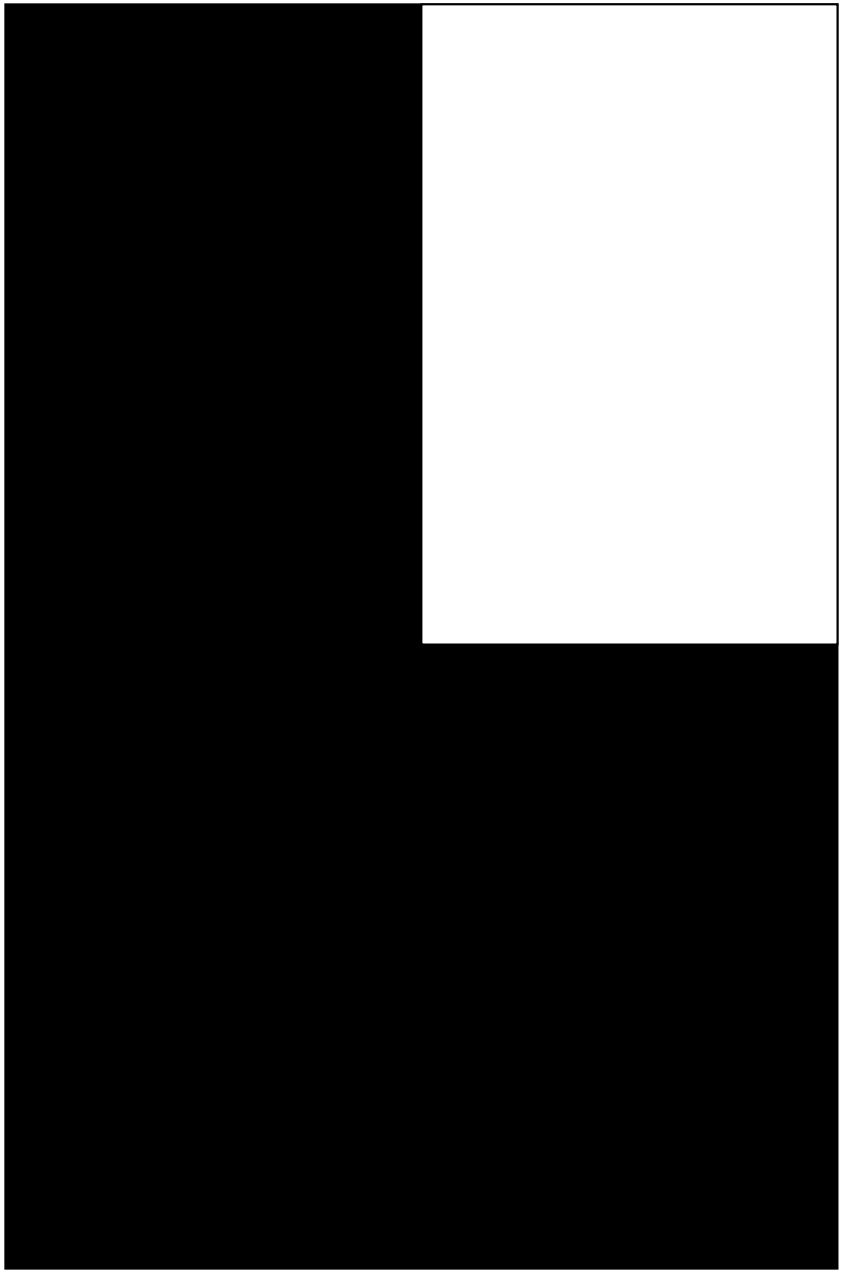
Scale

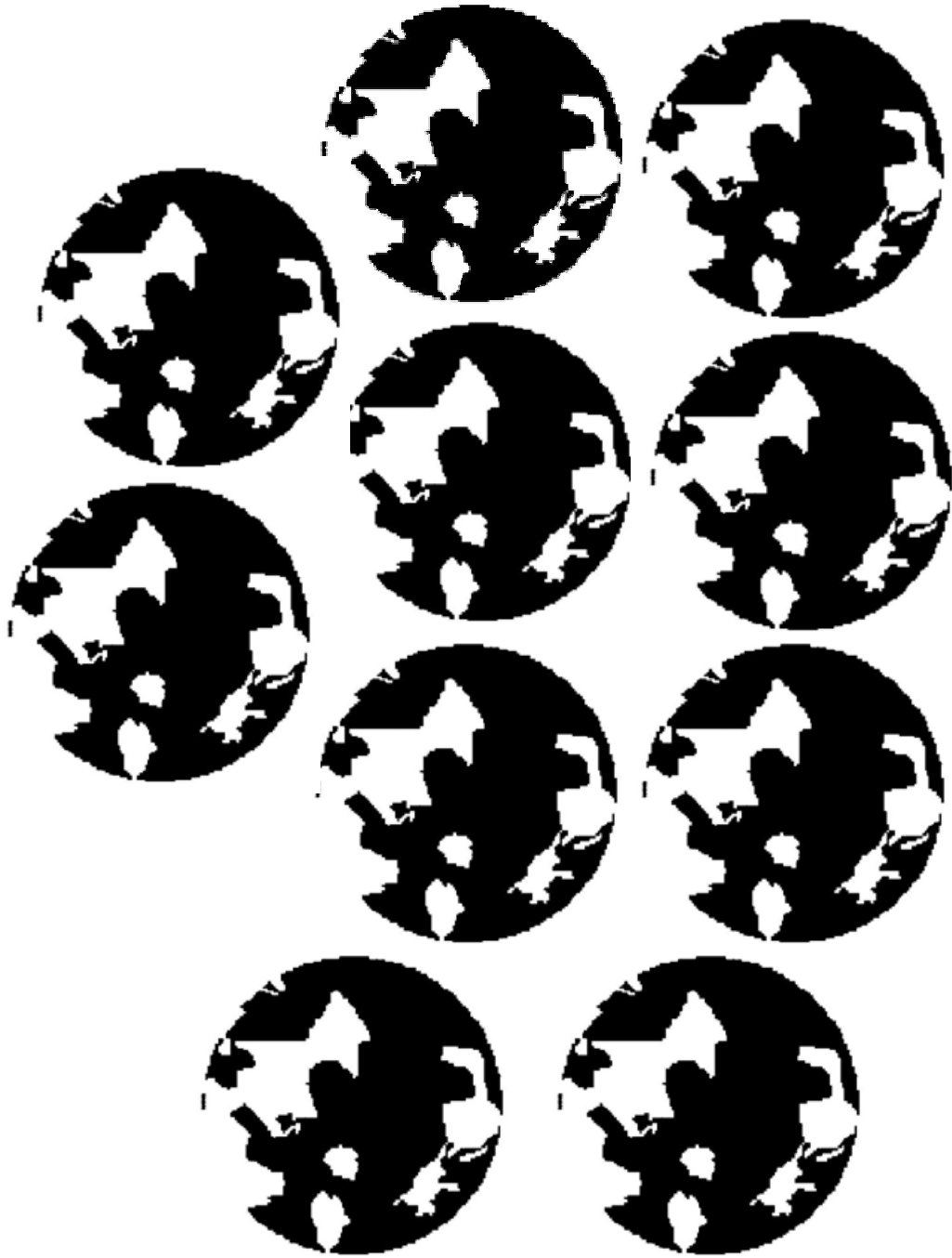
- Research studies:

  Scale was individual owl territories

  (circles 1500m radius)
- Plan:

  Scale is ecological provinces





Misinterpretation of λ_H as λ

- λ_H = Habitat Fitness Potential
- Based on parameters estimated from owls occupying established territories
- Applied to owls on specified territories
- Is NOT an estimate of the population rate of change (λ)
- Does not reflect immigration and emigration
- Does not include recruitment into breeding population

Relationship of λ_H and λ

- Mostly unknown
- Likely λ_H (on average) > λ
- Further research necessary to establish

Uncertainty issues

- Imperfect models

  Habitat covariates explained:

  13.5% of variation in survival

  2.6% of variation in productivity

- Sampling and process variance inherent in all estimates

  These were ignored in the Plan

Habitat Definitions

- Sloppy use of varying habitat definitions

  High-quality habitat, suitable habitat, nesting habitat, roosting habitat, habitat capable …
- “Percent late- and mid-seral forest” =

  “Percent nesting habitat” ?
- Different habitat definitions in primary literature ignored

Faulty derivation of target values

- Based on Figure 5. Olson et al. (2004) p. 1050
- Examples selected for illustrative purposes
- Estimates from only 6 of 94 territories used
- Ignores variance
- Relationship between λ_H and habitat covariate may be computed by formulae

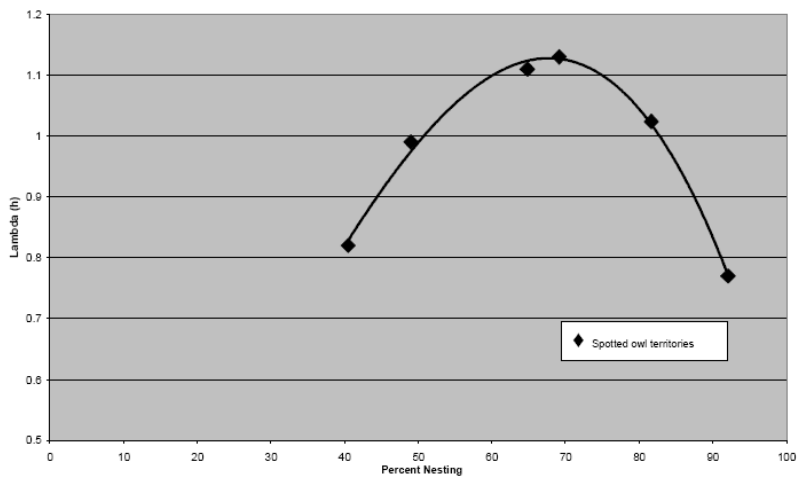


Figure D.3 of the Plan, p. 135

Analysis used unknown (not described in Plan)

Other issues

- Extrapolation of single (and possibly non-representative) study area to entire provinces
- Varying means of measuring habitat
- Selective use of literature

"…we do not recommend that forest managers use our modeling results as a prescription for managing habitat either within the Oregon Coast Range or elsewhere."

Olson et al. (2004), p. 1052