

Marbled Murrelet Long-term Conservation Strategy Analytical Framework



Photo: Nick Hatch, PNWRS

A Report to the Board of Natural Resources
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Marbled Murrelet Long-term Conservation Strategy

Need, Purpose

Need: “ to obtain **long-term certainty** for timber harvest...and to contribute to long-term conservation for the marbled murrelet, **consistent with the 1997 State Trust Lands HCP**”

Purpose: “develop long-term habitat conservation strategy for marbled murrelet ...subject to the fiduciary responsibility to the trust beneficiaries as defined by law and USFWS’ responsibilities under the Endangered Species Act.”



Marbled Murrelet

Long-term Conservation Strategy

Objective 1: Trust Mandate

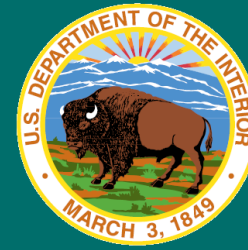
- “Generate revenue and other benefits for each trust by **meeting DNR’s trust responsibilities...**”

Objective 2: Marbled Murrelet Habitat

- “Provide forest conditions...that **minimize and mitigate incidental take of marbled murrelets** resulting from DNR’s forest management activities. In accomplishing this objective, we expect to make a significant contribution to maintaining and protecting marbled murrelet populations.”



Issuance Criteria for HCP



- Taking will be incidental
- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of the taking
- The applicant will ensure that adequate funding for the plan will be provided
- Taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild
- Other measures, as required by the Secretary will be met



Issuance Criteria for HCP

HCP Requirements



- An assessment of impacts likely to result from the proposed taking of one or more federally listed species
- Measures that the permit applicant will undertake to monitor, minimize, and mitigate for such impacts, the funding available to implement such measures, and the procedures to deal with unforeseen or extraordinary circumstances
- Alternative actions to the taking that the applicant analyzed, and the reasons why the applicant did not adopt such alternatives
- Additional measures that the Fish and Wildlife Service may require

Marbled Murrelet Long-term Conservation Strategy Analytical Framework

- Set of assumptions consistent across alternatives for quantifying take and mitigation
- Objective, repeatable, defensible framework that builds on the actual effects to the marbled murrelet
- Result will be a mathematical framework, but will make assumptions explicit



Analysis Area



Analysis Area Marbled Murrelet



55 miles from all
marine waters



Identifying Habitat



Identifying Habitat

Why Identify Marbled Murrelet Habitat?

- Habitat removal considered take under Endangered Species Act
- Identify habitat on our land base beyond what has been surveyed
- Helps identify places to mitigate



Identifying Habitat P-stage

Key stand characteristics
used to calculate p-stage:

- Platforms per acre
- Canopy Layers
- Forest Stand Origin
- Forest Type

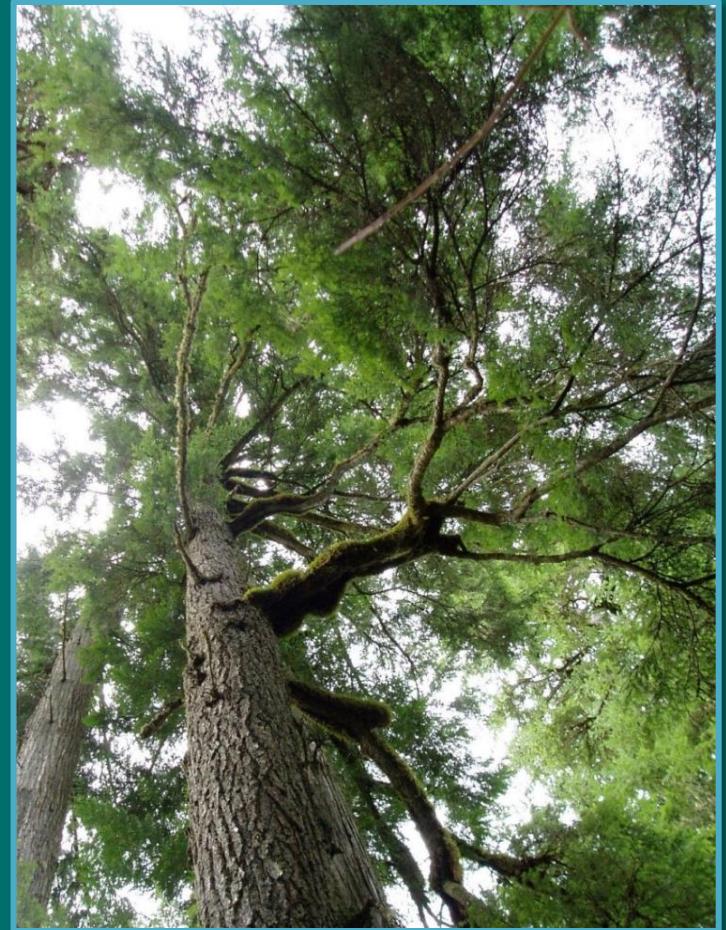
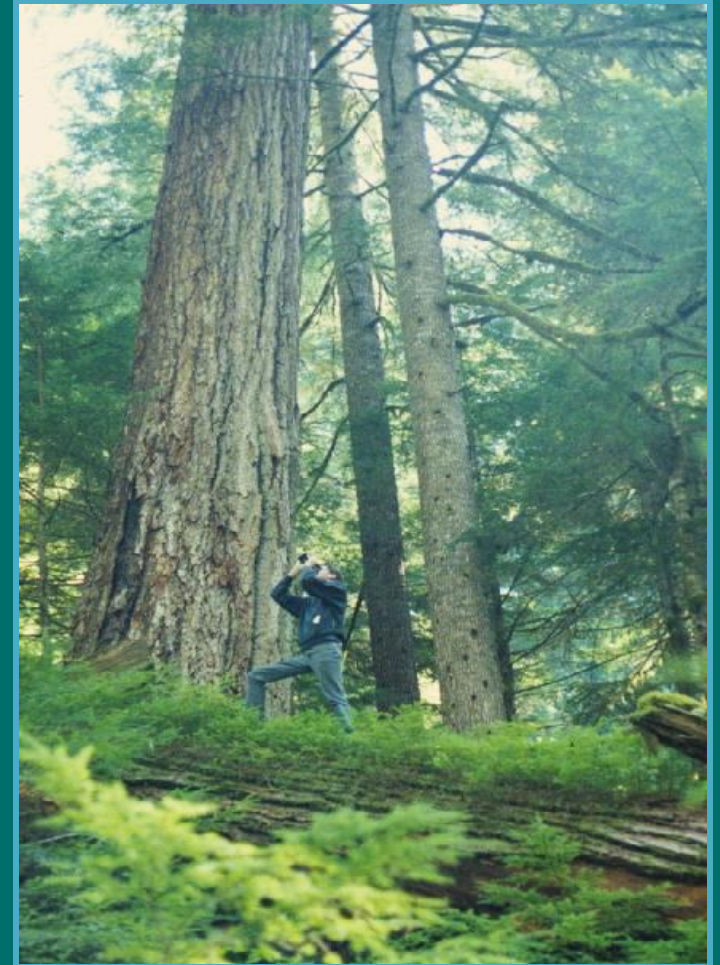


Photo: Alan Mainwaring, DNR

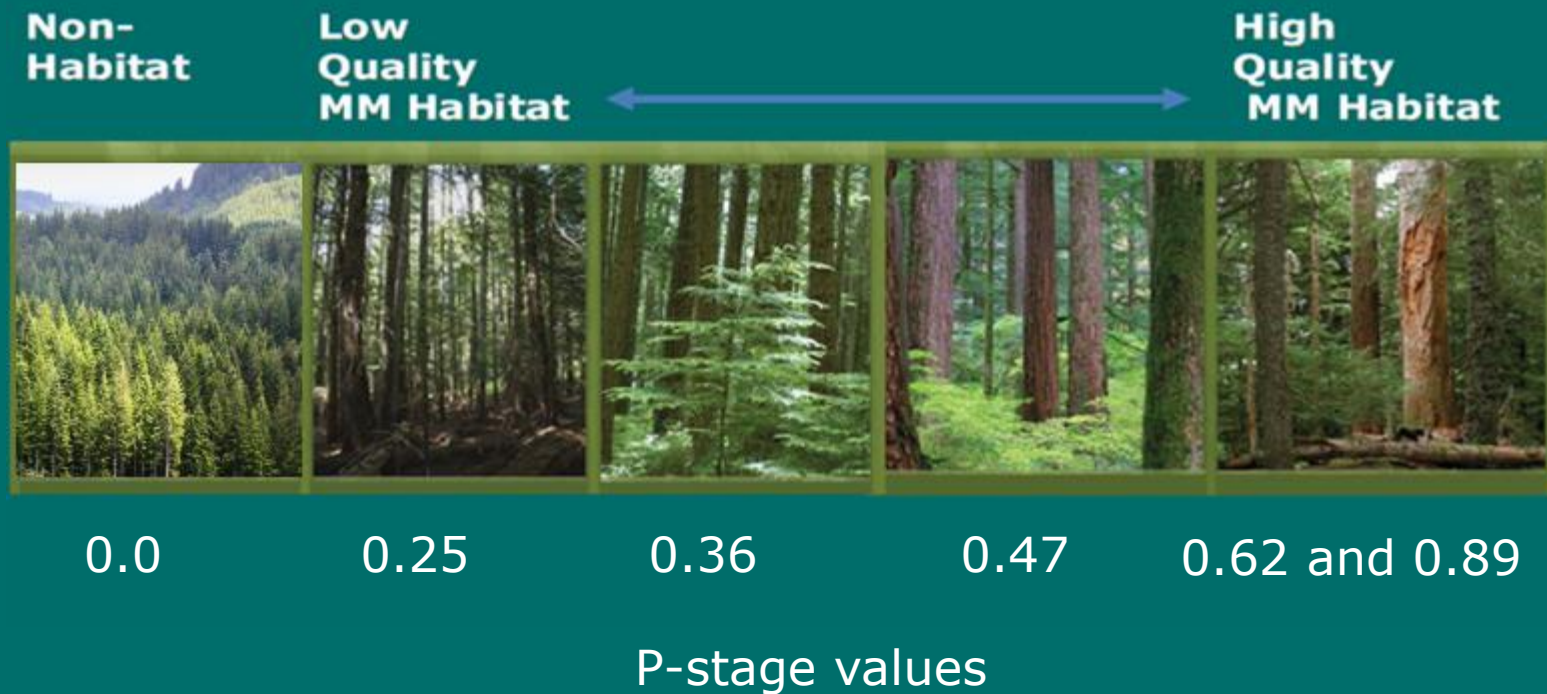
Identifying Habitat P-stage

- Why have we chosen this method over others?
 - Peer reviewed in the Science Team Report
 - Able to project habitat development into the future
 - Summarizes habitat down to the stand level
 - Compatible with DNR's forest inventory data
 - Can be applied across all of the analysis area



Identifying Habitat P-stage

- Associates key stand characteristics with stepwise development of high quality marbled murrelet habitat



Identifying Habitat

Murrelet Habitat Development Stages

- P-stage = 1.00: Occupied Sites

The conservation strategy will assign occupied sites a value equal to 1.

Occupied Site Definition:

Contiguous area of habitat where at least one of the following are found:

- Nest, downy chicks, eggs or egg shells

Or the following behaviors are identified:

- Flying below, through, into or out of the canopy

- Calling from a stationary location

- Circling above a stand within one tree height of the top of the canopy



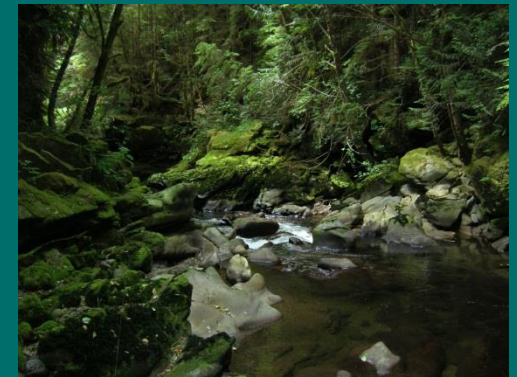
Multi-species HCP Areas of Long-term Forest Cover



Multi-species HCP

1997 Trust Lands Habitat Conservation Plan (HCP)

- Four conservation strategies
 - Marbled Murrelets
 - Northern Spotted Owls
 - Riparian Areas, Wetlands & Salmonids
 - Other Species of Concern & Uncommon Habitats



Multi-species HCP

Areas of Long-term Forest Cover

- Comprised of areas already protected by the multi-species HCP
- Some of those areas currently provide murrelet habitat values or will in the future

The conservation strategy will commit to maintain these lands in long-term forest cover for the benefit of the marbled murrelet, as well as other species covered by the HCP.

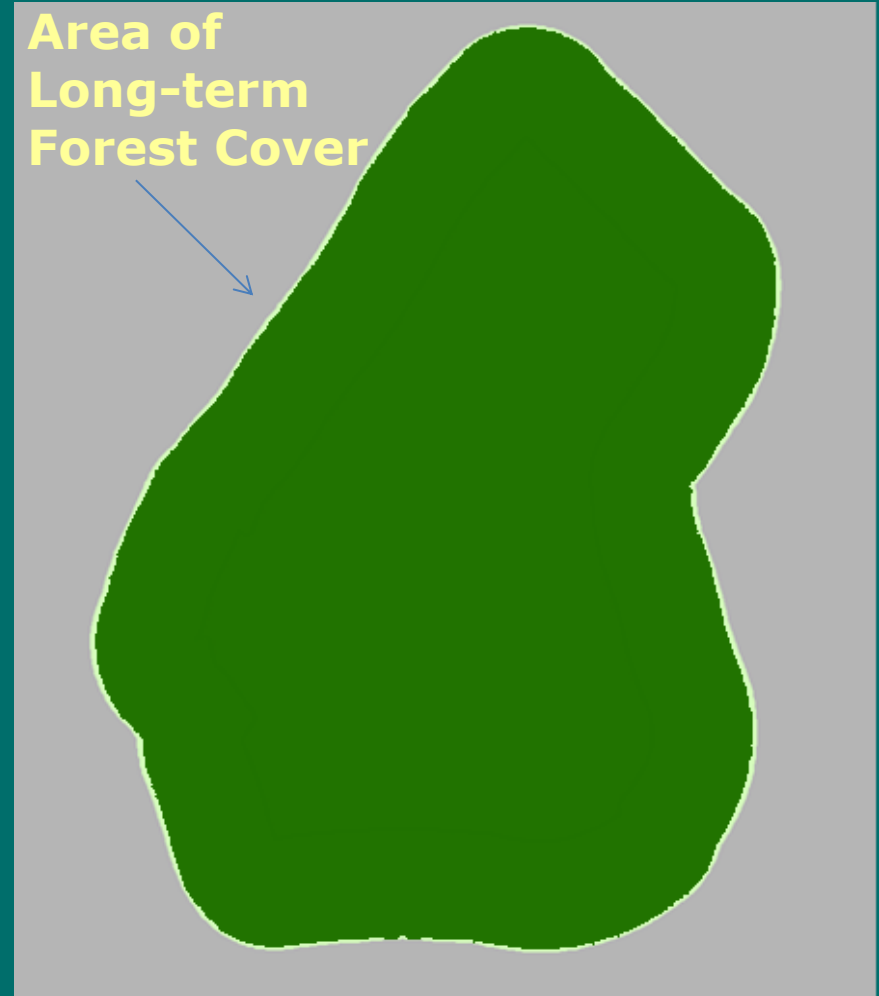


Multi-species HCP

Areas of Long-term Forest Cover

Includes the following categories:

- MM Occupied Sites
- Gene Pool Reserves
- Natural Area Preserves
- Natural Resources Conservation Area
- Northern Spotted Owl Habitat
- Riparian Management Zones
- Slope Stability
- Local Knowledge



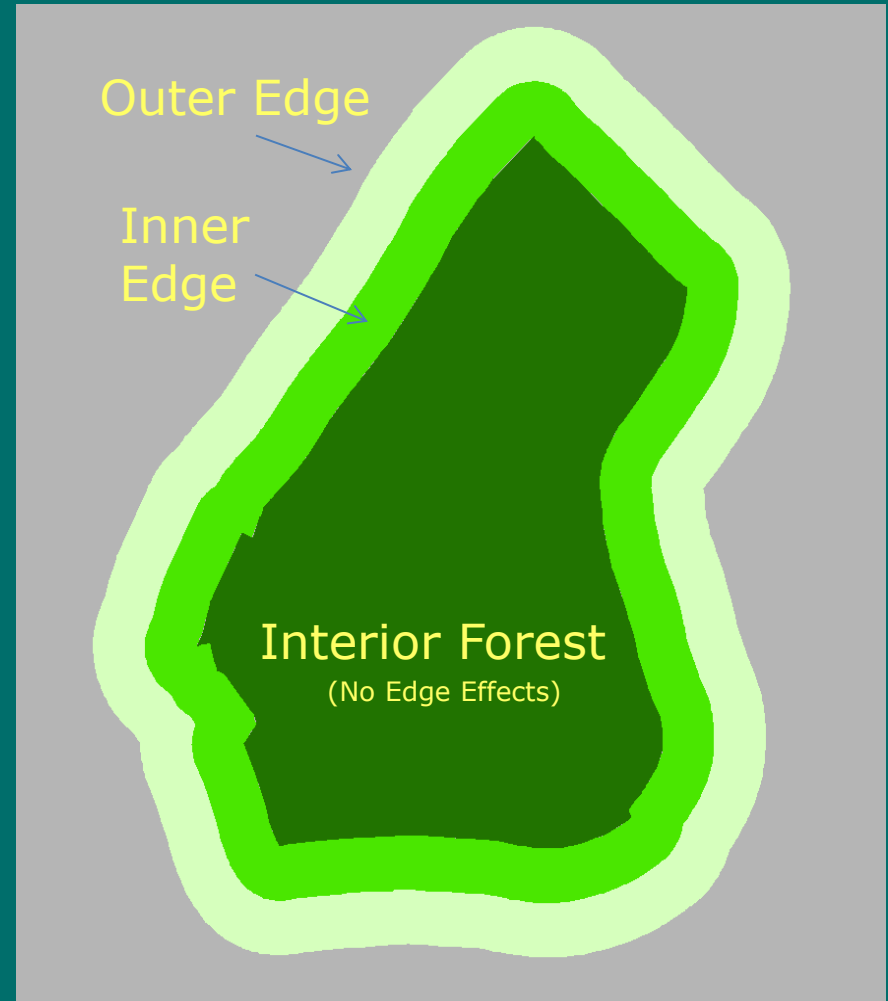
Multi-species HCP Areas of Long-term Forest Cover

Comprised of three parts:

Outer Edge Forest: 0 to 50 meters adjacent to an edge.

Inner Edge Forest: 51 to 100 meters adjacent to an edge.

Interior Forest:
A forested stand greater than 100 meters from an edge.



Identifying Take



Identifying Take Endangered Species Act (ESA)

Under ESA, **'take'** of threatened and endangered species is prohibited (ESA Section 9).

- **'Take'** means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct”
- **'Incidental take'** is a permit issued under Section 10 of the US Endangered Species Act to private, non-federal entities undertaking otherwise lawful projects that might result in the take of an endangered or threatened species

Identifying Take Types of Take

- Harvest
- Edge Influenced
- Disturbance



Harvest Take



Harvest Take

- Removal of potential murrelet habitat (acres with p-stage values) through harvesting. Primarily occurs in stands outside of areas of long-term forest cover.

Activities: Harvest of habitat, new road construction

Effects on MM: Loss of nesting habitat, potential loss of chick or egg



Harvest Take Managed Forest

- **Managed Forest:**
These are acres outside of areas of long-term forest cover that are managed for revenue production for beneficiaries. Some of these acres have p-stage value, those will be considered as incidental take in the conservation strategy.

Managed Forest:



Harvest Take

Calculating Harvest Take Example

$$\text{Probability of occupancy (p-stage)} \times \text{Total acres of harvest take in each p-stage} = \text{Total Acres of Harvest Take}$$

P-stage value	Managed Forest Acres
0.00	100,000
0.25	100,000
0.36	100,000
0.47	100,000
0.62	100,000
0.89	100,000
1.00	100,000
Total P-stage acres:	600,000
Total Acres:	700,000

Total Acres of Harvest Take
0
25,000
36,000
47,000
62,000
89,000
100,000
Total Acres of Harvest Take: 359,000

Edge-Influenced Take



Edge Influenced Take

Take Associated with Edge Influences

“Timber harvesting can create edges that expose the adjacent forest habitat to altered climatic regimes. This can result in edge effects...from the open edge into the interior of the forest” (Van Rooyen et al. 2011).

Activities: Edge creation due to harvesting

Effects on MM: Habitat loss, nest predation, altered microclimate and windthrow caused reduced epiphytes and platform trees



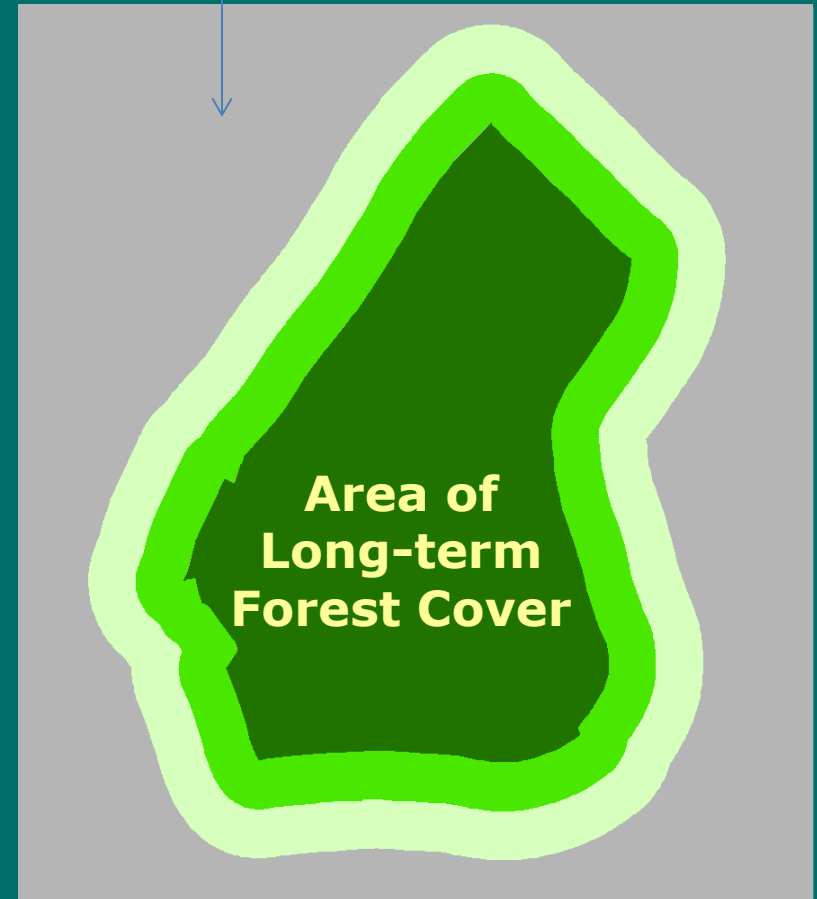
Edge Influenced Take

Edge Dynamics: How they Affect Areas of Long-term Forest Cover

- Creation of Edge:
 - Outer Edge
 - Inner Edge

- Edge Effects Include:
 - Microclimate Changes
 - Increased Predation
 - Increased Windthrow

Managed Forest:

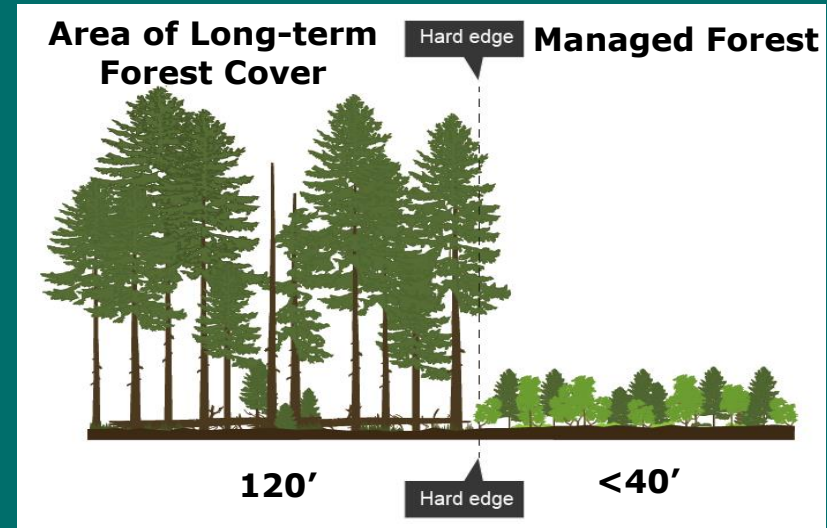


Edge Influenced Take Edge Dynamics: How the Managed Forest Changes Over Time

■ Hard Edge Forests

Key Characteristics:

- Stand height: <40'
- Availability of insects and berries to predators
- Microclimate and windthrow



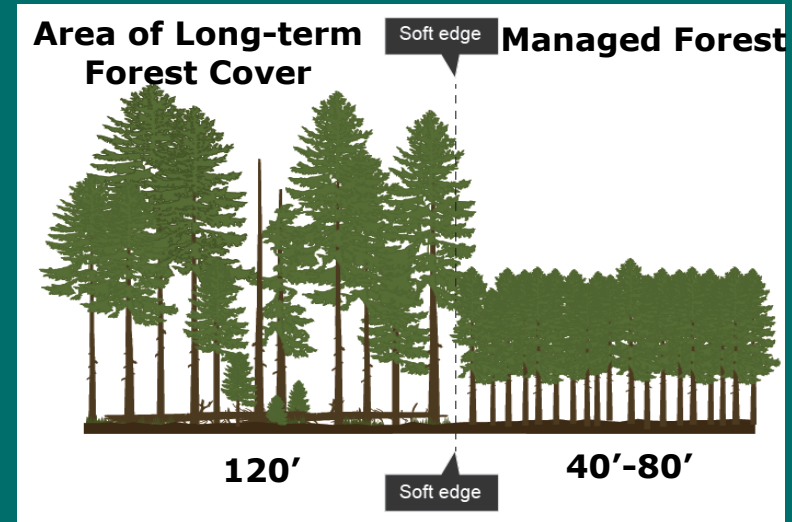
Edge Influenced Take

Edge Dynamics: How the Managed Forest Changes Over Time

- Soft Edge Forests

Key Characteristics:

- Stand height: 40' - 80'
- No understory, therefore minimal to no predation
- Microclimate and windthrow



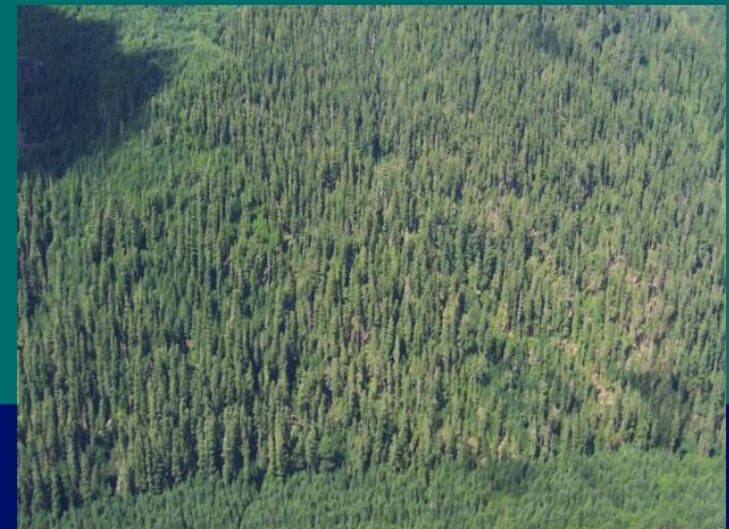
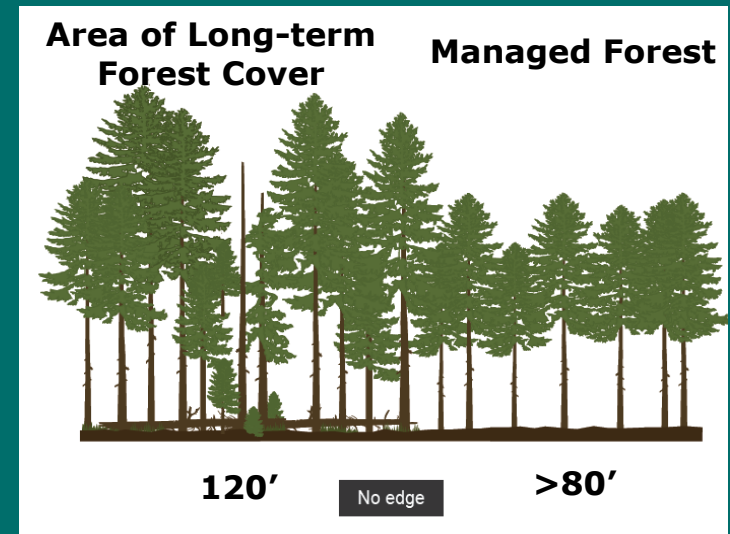
Edge Influenced Take

Edge Dynamics: How the Managed Forest Changes Over Time

- No Edge Forests

Key Characteristics:

- Stand height: $>80'$
- Microclimate and windthrow conditions eliminated as well as predation risk



Edge Influenced Take Edge Forest Types

Conditions of Edge Forests Adjacent to Areas of Long-term Forest Cover

Forest Edge Types	Stand Height	% DNR Managed Lands by Edge Type*
Hard Edge	<40'	26%
Soft Edge	40' – 80'	36%
No Edge	>80'	38%

*Preliminary numbers. Subject to change.



Edge Influenced Take

Calculating Outer Edge Take: Hard Edge Discount

- Microclimate and Windthrow Effect Discount

Platform Tree Density At Edge and Interior Plots of **Hard Edge** Types in Van Rooyen et al. 2011.*

Variable	Hard Edge Forest	
	Edge	Interior
Platform Tree Density	3.76 ± 6.72	15.70 ± 9.29

*See text under “epiphyte habitat” on page 555 (Van Rooyen et al. 2011).

Edge Influenced Take

Calculating Outer Edge Take: Hard Edge Discount

- Microclimate and Windthrow Effect Discount

Platform trees in hard edges were 25% as dense as in interior forests.*

$$3.76/15.70 = 25\%$$

Therefore, **platform abundance is reduced by 75% at hard edges.**

*See text under "epiphyte habitat" on page 555 (Van Rooyen et al. 2011).

Edge Influenced Take

Calculating Outer Edge Take: Hard Edge Discount

- Predation Effect Discount

References	Nest Success at Hard Edges	Nest Success in Interior Forests
McShane et al. 2004	38%	55%

$$38\% / 55\% = 69\%$$

Nests at hard edges are 69% as successful as nests at interior forests.

Edge Influenced Take

Calculating Outer Edge Take: Hard Edge Discount

- Hard Edge Forests Increase Microclimate, Windthrow and Predation Effects on Habitat (Areas of Long-term Forest Cover)

Therefore:

25% (microclimate and windthrow discount) x
69% (predation discount) = 17%

DNR and USFWS estimate that habitat quality at hard edges is reduced by 83% relative to interior forests.

Edge Influenced Take Calculating Outer Edge Take Hard Edge Discount

Forest Edge Type	% DNR Managed Lands*	Outer Edge Effect (% Discount)
Hard Edge	26%	83%

*Preliminary numbers. Subject to change.



Edge Influenced Take

Calculating Outer Edge Take: Soft Edge Discount

- Microclimate and Windthrow Effect Discount

Platform Tree Density At Edge and Interior Plots of **Soft Edge** Types in Van Rooyen et al. 2011.*

Variable	Soft Forest Edge	
	Edge	Interior
Platform Tree Density	16.02 ± 5.14	26.80 ± 6.60

*See text under “epiphyte habitat” on page 555 (Van Rooyen et al. 2011).

Edge Influenced Take

Calculating Outer Edge Take: Soft Edge Discount

- Microclimate and Windthrow Effect Discount

Platform trees in **soft** edges were 60% as dense as in interior forests.*

$$16.02/26.8 = 60\%$$

Therefore, **platform abundance is reduced by 40% at soft edges.**

*See text under "epiphyte habitat" on page 555 (Van Rooyen et al. 2011).

Edge Influenced Take

Calculating Outer Edge Take: Soft Edge Discount

Forest Edge Type	% DNR Managed Lands*	Outer Edge Effect (% Discount)
Hard Edge	26%	83%
Soft Edge	36%	40%

*Preliminary numbers. Subject to change.



Edge Influenced Take

Calculating Outer Edge Take: No Edge

- DNR Managed Lands

At any given point in time, 38% of DNR managed lands are in a no edge condition.



Edge Influenced Take Calculating Outer Edge Take

Example: 100 Acres in "Outer Edge" forest

Forest Edge Type	% DNR Managed Lands*	Outer Edge Effect (% Discount)	Acres of Take (% Land * Edge Effect)
Hard Edge	26%	83%	21.6
Soft Edge	36%	40%	14.4
No Edge	38%	0%	0.0
Total			36.0

Discount Applied to Outer Edge Acres

*Preliminary numbers. Subject to change.



Edge Influenced Take Calculating Outer Edge Example

Probability of occupancy (p-stage) x Total acres of outer edge take in each p-stage = Total Acres of Outer Edge Take

P-stage value	Outer Edge Acres	Predicted Occupied Acres	Outer Edge Discount	Total Acres of Take
0.00	100,000	0	.36	0
0.25	100,000	25,000	.36	9,000
0.36	100,000	36,000	.36	12,960
0.47	100,000	47,000	.36	16,920
0.62	100,000	62,000	.36	22,320
0.89	100,000	89,000	.36	32,040
1.00	100,000	100,000	.36	36,000
Total Acres:	700,000	359,000		129,240

Edge Influenced Take

Calculating Inner Edge Take:

Forest Edge Type	% DNR Managed Lands*	Outer Edge Effect (% Discount)	Inner Edge effect (50-100m) halfway between outer and interior
Hard Edge	26%	83%	41.5%
Soft Edge	36%	40%	20%
No Edge	38%	0%	0%

*Preliminary numbers. Subject to change.



Edge Influenced Take

Calculating Inner Edge Take

Example: 100 Acres in "Inner Edge" forest

Forest Edge Type	% DNR Managed Lands*	Inner Edge effect (50-100m) halfway between outer and interior	Acres of Take (% Land * Edge Effect)
Hard Edge	26%	41.5%	10.8
Soft Edge	36%	20%	7.2
No Edge	38%	0%	0.0
Total			18.0

Discount Applied to Inner Edge Acres

*Preliminary numbers. Subject to change.

Edge Influenced Take

Calculating Inner Edge Example

Probability of occupancy (p-stage) x Total acres of inner edge take in each p-stage = Total Acres of Inner Edge Take

P-stage value	Inner Edge Acres	Predicted Occupied Acres	Inner Edge Discount	Total Acres of Take
0.00	100,000	0	.18	0
0.25	100,000	25,000	.18	4,500
0.36	100,000	36,000	.18	6,480
0.47	100,000	47,000	.18	8,460
0.62	100,000	62,000	.18	11,160
0.89	100,000	89,000	.18	16,020
1.00	100,000	100,000	.18	18,000
Total Acres:	700,000	359,000		64,620

Edge Influenced Take

Inner and Outer Edge Summary

- Inner Edge (51-100 meters)
 - Hard Edge: 41.5% (predation, microclimate, wind)
 - Soft Edge: 20% (microclimate, wind)
 - No Edge: 0% (n/a)
- Outer Edge (0-50 meters)
 - Hard Edge: 83% (predation, microclimate, wind)
 - Soft Edge: 40% (microclimate, wind)
 - No Edge: 0% (n/a)



Disturbance Take



Disturbance Take

- Effects to murrelets may occur from actions that generate loud noises and activity in close proximity to nesting murrelets, resulting in a potential disruption of murrelet breeding and nesting behaviors



Activities: Non-timber Resources, such as collecting western greens, Christmas greens, mushrooms, Christmas trees, sand and gravel sales, electronic site maintenance, recreational site use and maintenance, road use and maintenance.

Effects on MM: Adults flushing, aborted feedings and therefore a likelihood of injury to chicks from fewer feedings.

Disturbance Take Three Types

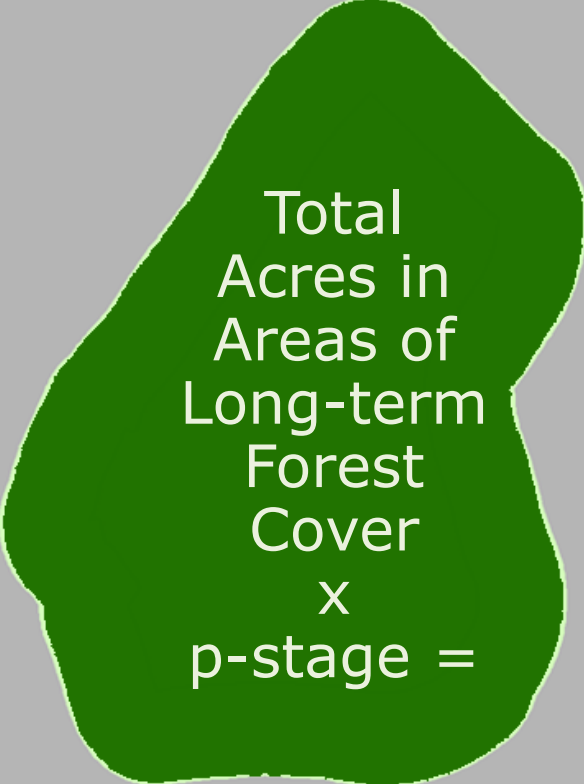
- Visual and noise
- Aircraft
- Impulsive noise



Mitigation



Mitigation

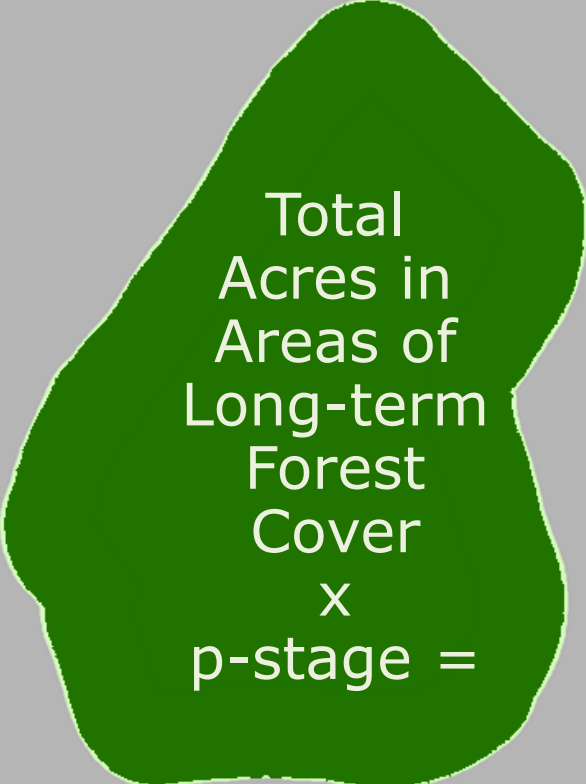


Total
Acres in
Areas of
Long-term
Forest
Cover
x
p-stage =

Year: 2067

Future
Occupied
Acres

-



Total
Acres in
Areas of
Long-term
Forest
Cover
x
p-stage =

Year: 2016

Baseline
Occupied
Acres

=

Mitigation
Credit

Mitigation

Calculating Mitigation Credit

Discounting Future Habitat

Decades	Occupied Acres	Diff. Btwn Decades	Value	Acres of Mitigation Credit
0	1000			
1	2000	1000	1.00	1000
2	3000	1000	0.80	800
3	4000	1000	0.60	600
4	5000	1000	0.40	400
5	6000	1000	0.20	200
Total Mitigation Credit				3000



Next Steps

December

- Updates to Analytical Framework
 - Disturbance Take
 - Baseline Acres
 - Biological Consequences

- Alternatives



Thank you



References

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VanRooyen, J.M. Malt, D.B. Lank,. 2011. Relating Microclimate to Epiphyte Availability: Edge Effects on Nesting Habitat Availability for the Marbled Murrelet, Northwest Scientific Association.

