
WASHINGTON
DEPARTMENT OF NATURAL RESOURCES

Marbled Murrelet Long-Term Conservation Strategy

A report to the Board of Natural Resources

presented by

Kyle Blum

June 2016

Today's Agenda

1. Analytical Framework Review and Updates
2. Calculation Example
3. Outputs by Alternative
4. Dr. Peery's Outputs

Trust Mandate

As manager of state trust lands, DNR has legal fiduciary responsibilities under the State Constitution to:

- Generate revenue and other benefits for each trust, in perpetuity
- Preserve the corpus of the trust
- Exercise reasonable care and skill
- Act prudently to reduce the risk of loss for the trusts
- Maintain undivided loyalty to beneficiaries
- Act impartially with respect to current and future beneficiaries

Evaluation Criteria

1. To the maximum extent practicable, minimize and mitigate the impacts of take.

2. Not appreciably reduce the likelihood of the survival and recovery of the species in the wild.

3. Make a significant contribution to maintaining and protecting marbled murrelet populations in western Washington over the life of the HCP.

Chapter 1

Analytical Framework Review and Updates

Analytical Framework

The methodology agreed upon by DNR and USFWS to provide

objective,

repeatable,

science-based

estimates of impacts and mitigation to marbled murrelet habitat.

Analytical Framework

KEY ELEMENTS

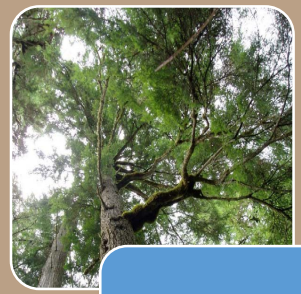
Analytical Framework

Identifying Habitat

P-stage

P-stage 0 (Non-Habitat)

P-stage .36



P-stage .89

P-stage 1 (Occupied Site)

Analytical Framework

Identifying Long-term Forest Cover

Long-term Forest Cover

Existing conservation areas: riparian (blue), steep slopes (brown), owl habitat (light brown) **+** Marbled murrelet-specific areas (orange) layered on top of existing conservation **=** Long-term forest cover (green)

Analytical Framework

Take and Mitigation

Take

- Harvest Take
- Edge Influenced Take
- Other Take

Analytical Framework

Take and Mitigation

Harvest Take

Removal of potential murrelet habitat (acres with P-stage values) through harvesting.

Activities:

Harvest of habitat, new road construction in habitat

Effects:

Loss of nesting habitat, potential loss of chick or egg

Analytical Framework

Take and Mitigation

Harvest Take

Example

Harvested acres x P-stage of area

200,000 x 0.36 = 36,000

(Acres Harvested)

[P-stage of harvested area]

(Harvest Take)

Analytical Framework

Take and Mitigation

Edge Influenced Take

Influence over adjacent murrelet habitat by an abrupt transition between two habitat types.

Activities:

Edge creation due to harvesting

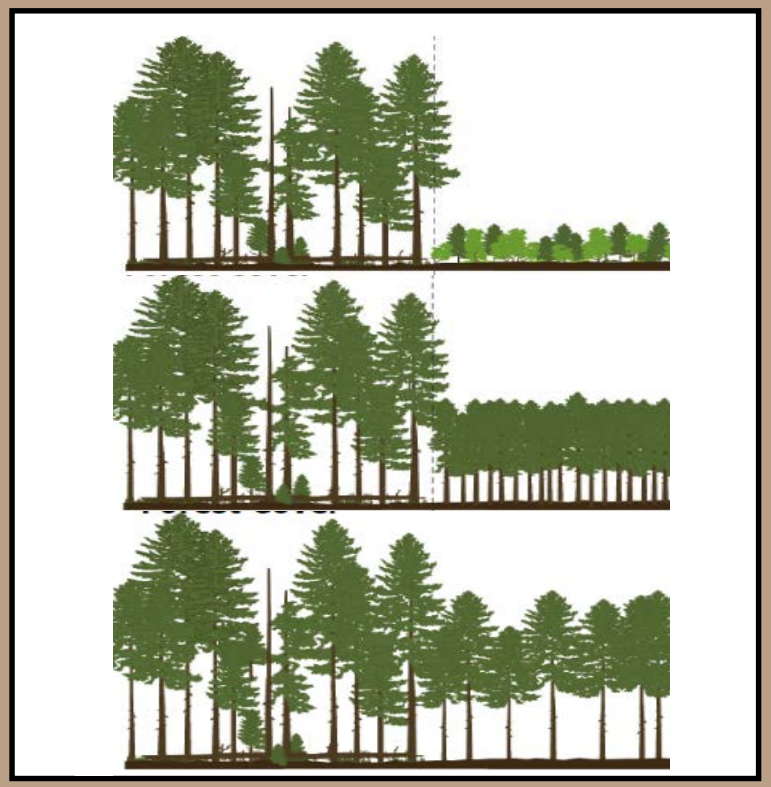
Effects:

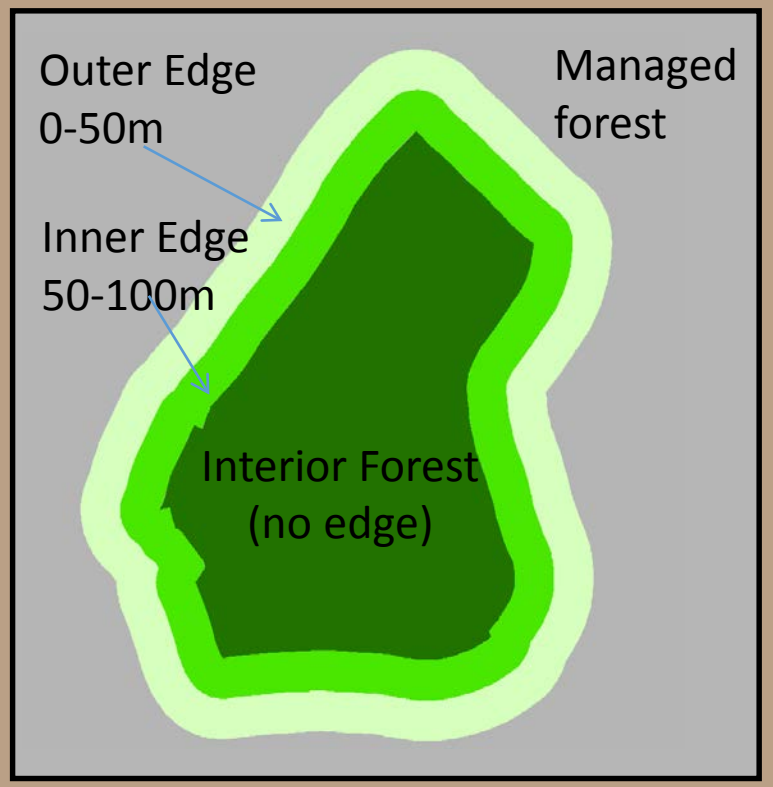
Habitat loss from windthrow and altered microclimate causing loss of platform trees and epiphytes, increased nest predation from edge effects

Analytical Framework

Take and Mitigation

Edge Influenced Take





Analytical Framework

Take and Mitigation

Edge Influenced Take

Example

Forest Inventory Data-Derived Edge Condition x Discount Multiplier = Edge Take

Discount Multipliers:

Inner edge (51-100 meters)
- Hard Edge: 41.5%
- Soft Edge: 20%
- No Edge: 0%

Outer edge (0-50 meters)
- Hard Edge: 83%
- Soft Edge: 40%
- No Edge: 0%

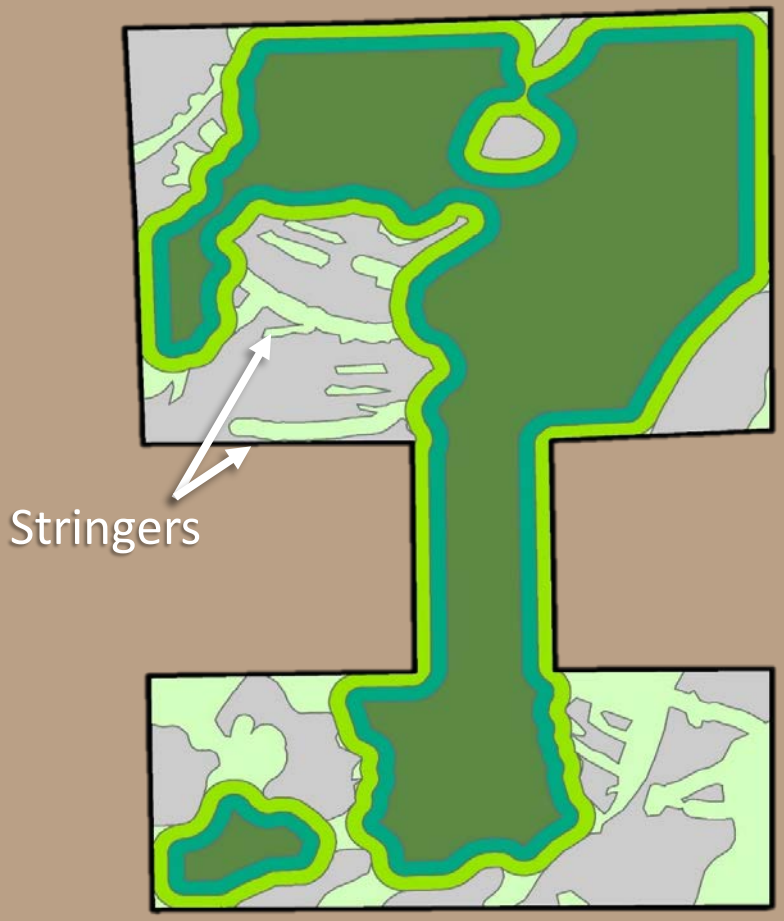
Analytical Framework Updates

1. Stringers
2. Proximity to Occupied Sites
3. Roads as Edges

Analytical Framework Updates

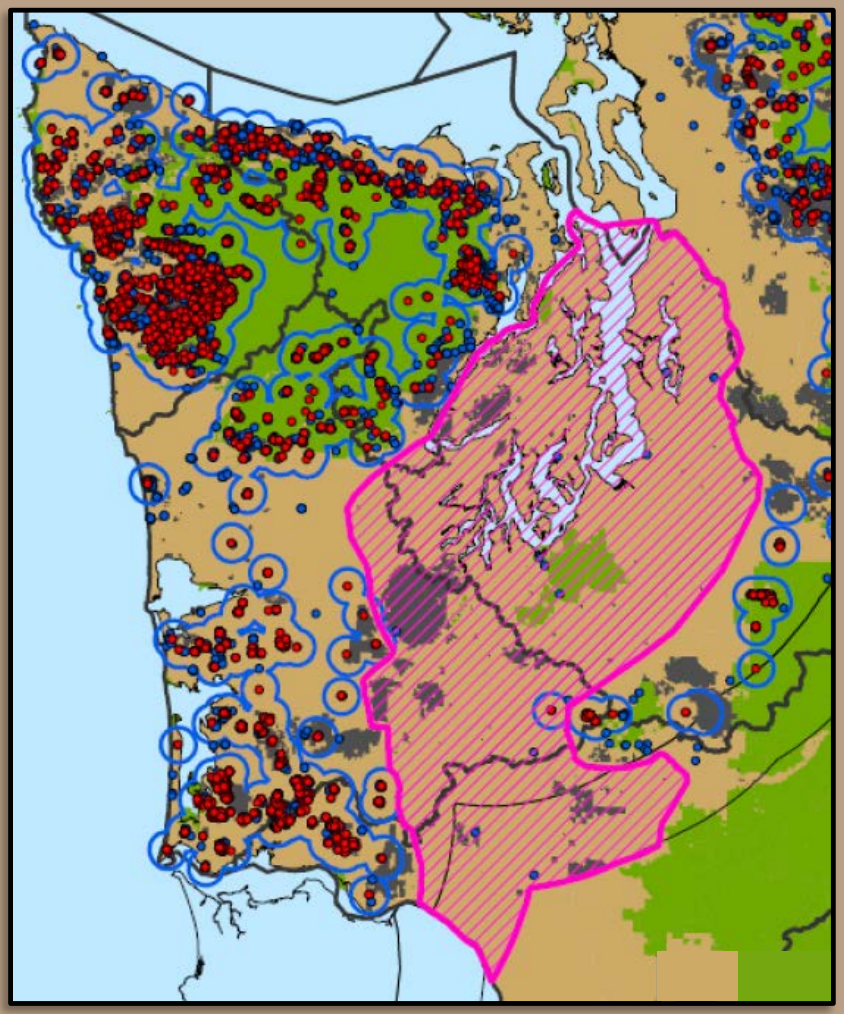
Stringers

Long, relatively narrow (less than 200 meters wide) corridors of LTFC, primarily associated with riparian areas



Analytical Framework Updates

Proximity to Occupied Sites



Analytical Framework Updates

Roads as Edges

Road Edge Factor: **15.5%**

Percentage of habitat in interior or inner-edge LTFC assumed to be within 50 m of a road: **4.8%**

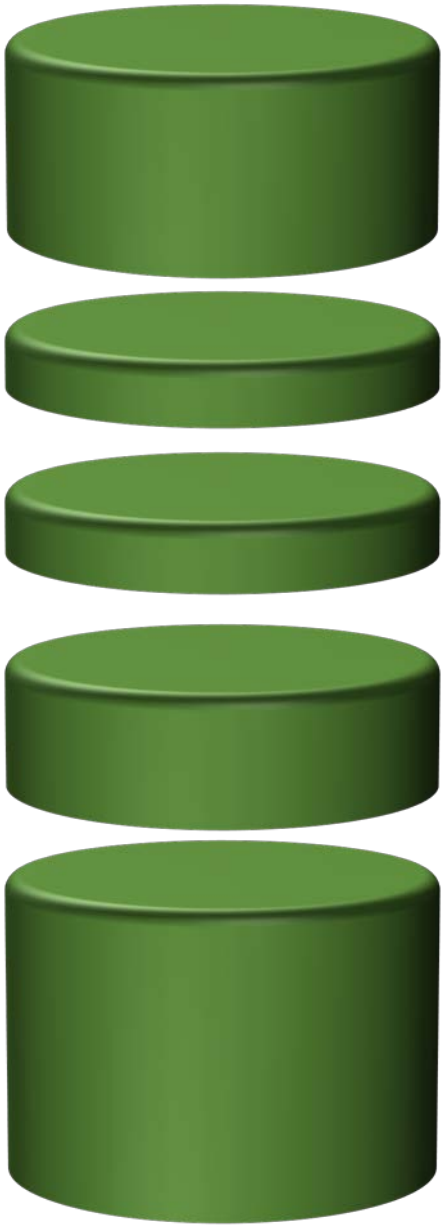
Chapter 2

Applying the Alternative Framework to Alternative F

Alternative F

Management Area: 1,377,479 acres

Alternative F



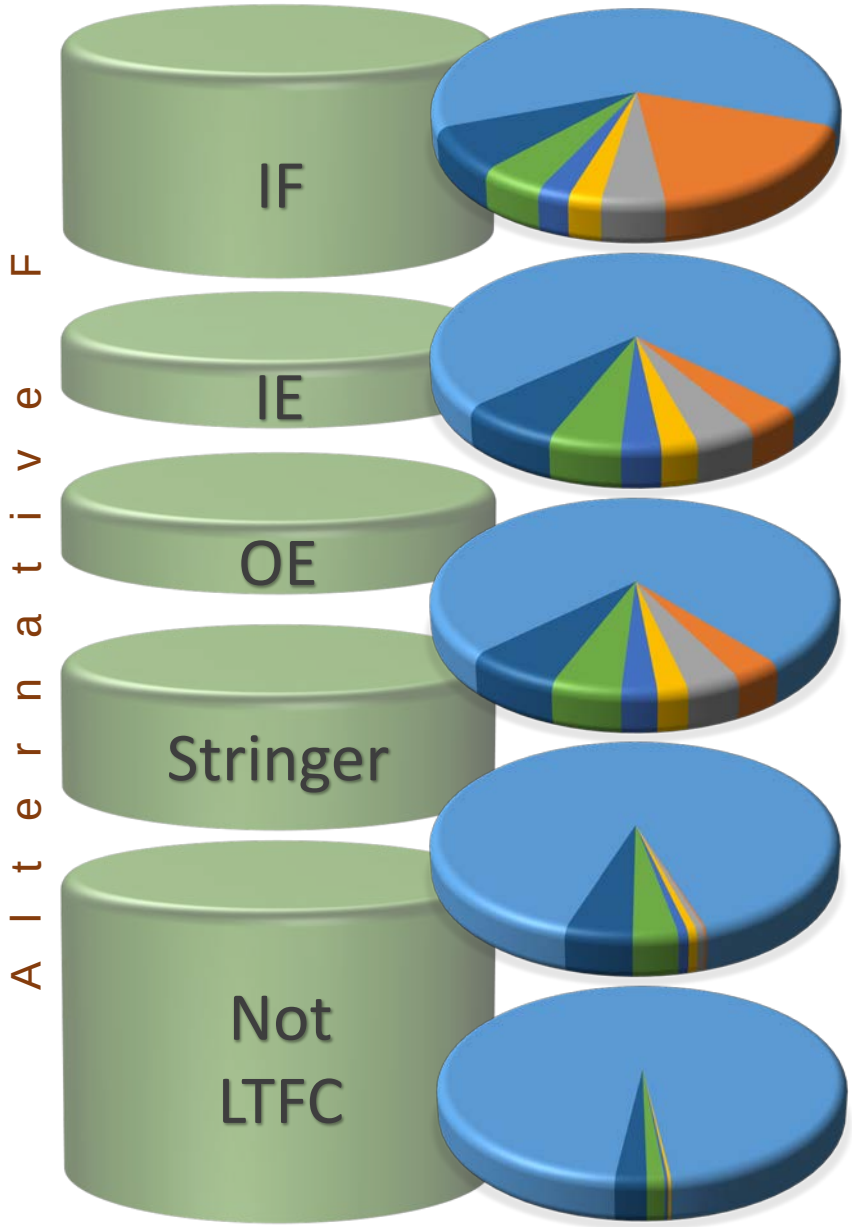
Interior Forest: 311,111 acres

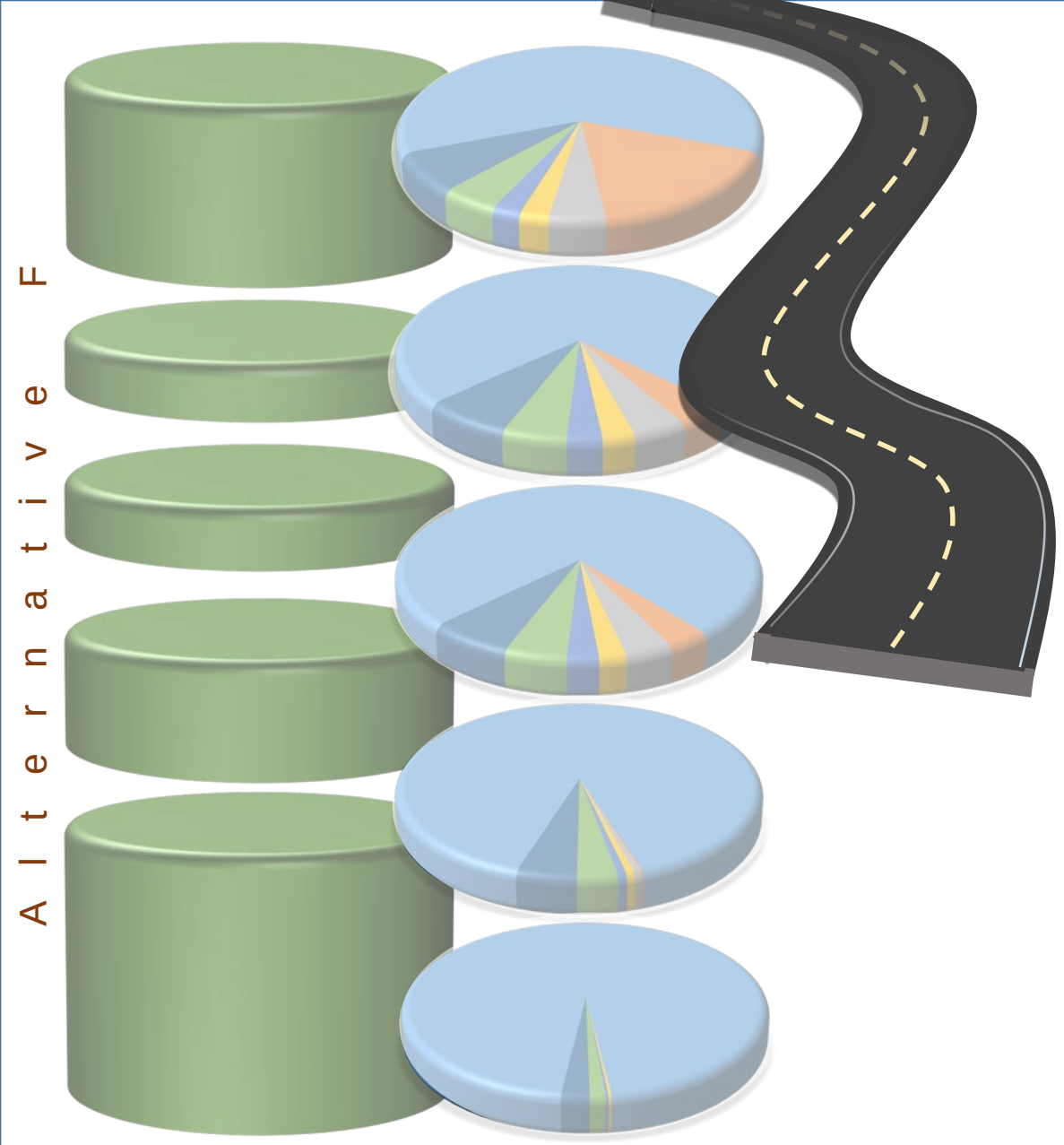
Inner Edge: 82,348 acres

Outer Edge: 93,787 acres

Stringers: 246,288 acres

Not LTFC: 643,946 acres

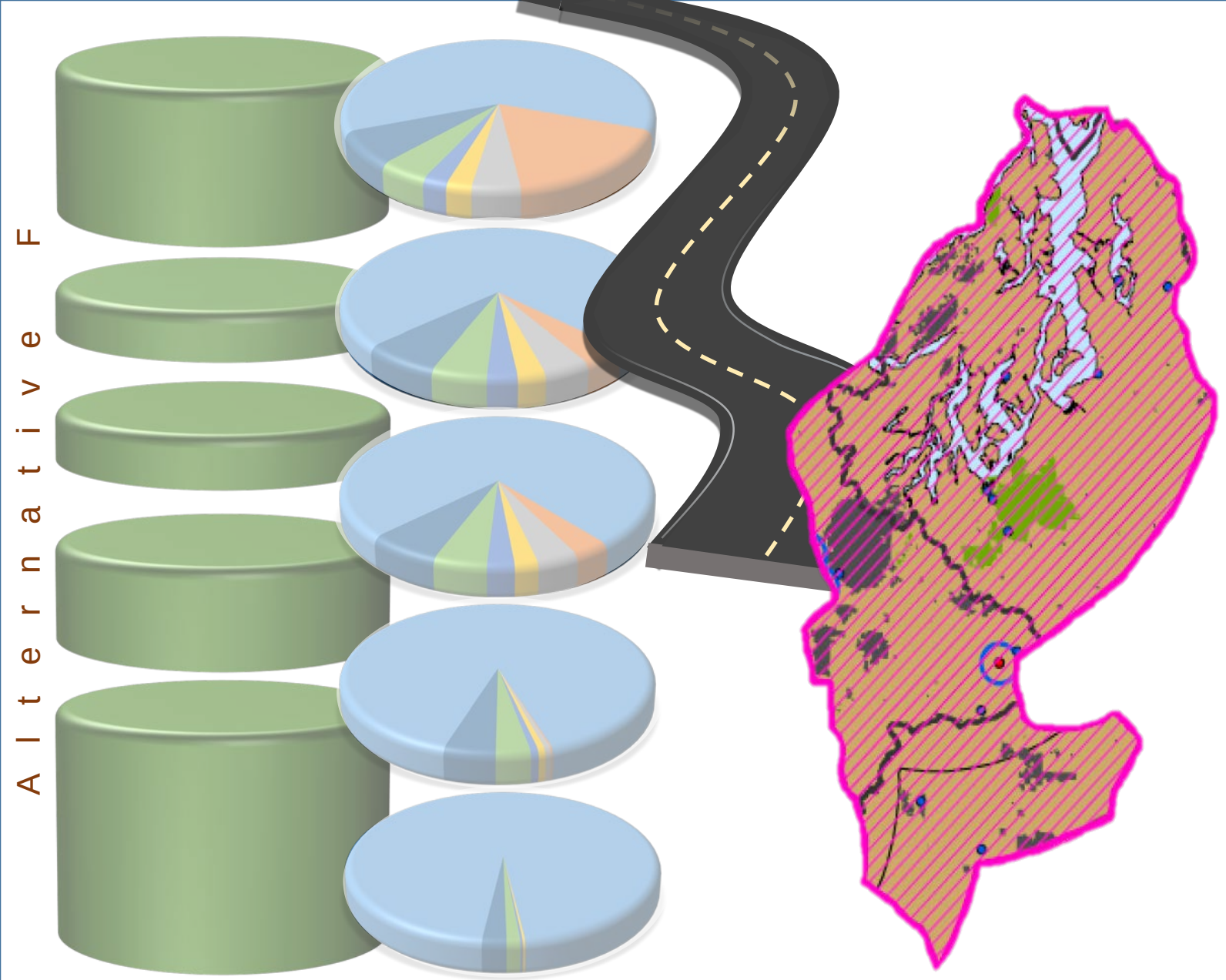

Alternative F
IF
IE
OE
Stringer
Not LTFC
P-Stage
0
0.25
0.36
0.47
0.62
0.89
1



Road Discounts

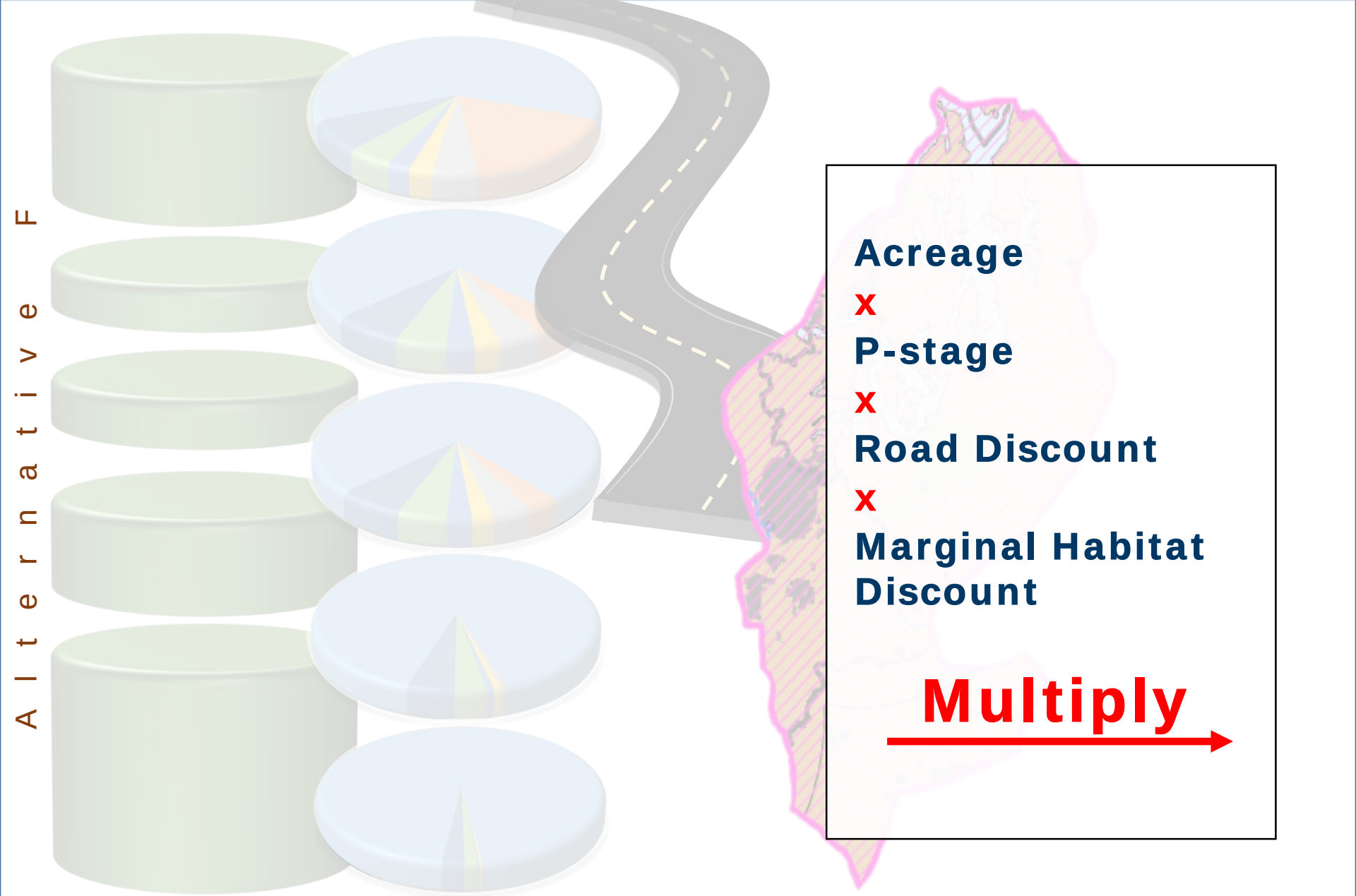
Predation Discount Effect: 15.5%

Habitat Impacted per Decade: 4.8%



Marginal Habitat Discount

75%


Alternative F
Acreage
x
P-stage
x
Road Discount
x
Marginal Habitat Discount
Multiply

Raw Forested P-stage Acres

Combined High and Marginal Landscapes, Decade 0

P-stage	Inner Forest	Inner Edge	Outer Edge	Stringer	Not LTFC	Total
0	191,065	60,904	71,576	221,556	618,506	1,163,607
0.25	23,010	5,914	6,391	11,814	14,402	61,532
0.36	14,569	4,241	4,657	7,866	8,015	39,349
0.47	7,053	2,301	2,364	1,759	1,456	14,933
0.62	7,301	2,115	2,018	1,560	1,288	14,282
0.89	13,909	3,540	3,596	1,368	279	22,692
1	54,203	3,333	3,185	365	0	61,085
Total	**311,111**	**82,348**	**93,787**	**246,288**	**643,946**	**1,377,479**

Adjusted and Discounted P-stage Totals

Combined High and Marginal Landscapes, Decade 0

P-stage	Inner Forest	Inner Edge	Outer Edge	Stringer	Not LTFC	Total
0						0
0.25	5,489	1,400	1,504	2,768	3,297	14,459
0.36	4,948	1,447	1,591	2,776	2,763	13,525
0.47	3,146	1,017	1,046	820	679	6,707
0.62	4,304	1,253	1,194	957	761	8,470
0.89	11,877	3,022	3,070	1,214	248	19,432
1	52,004	3,197	3,055	365	0	58,621
Total	**81,768**	**11,337**	**11,462**	**8,900**	**7,748**	**121,214**

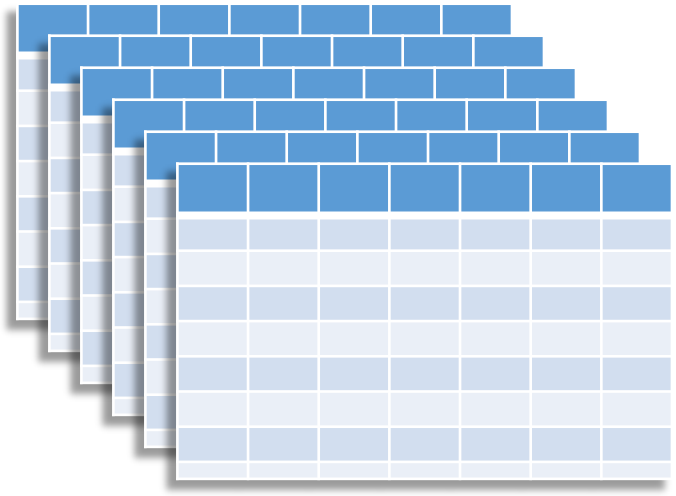
Alternative F

Next Steps:

Alternative F

- Repeat for 5 more decades,

  capturing growth and habitat development over time



- Sum Adjusted totals by decade

+

Adjusted Acres by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0	81,768	11,337	11,462	8,900	7,748	121,214
1	88,426	13,258	13,578	12,679	-	127,941
2	92,330	14,505	14,973	15,256	-	137,063
3	97,659	16,360	17,050	19,949	-	151,019
4	104,319	18,665	19,625	26,783	-	169,392
5	109,069	20,123	21,242	31,084	-	181,518

From here,

Calculate Take and Mitigation

Calculating Take

Adjusted Acres by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0	81,768	11,337	11,462	8,900	7,748	121,214
1	88,426	13,258	13,578	12,679	-	127,941
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Calculating Take

Adjusted Acres by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0	~~81,768~~	11,337	11,462	~~8,900~~	7,748	121,214
1	~~88,426~~	13,258	13,578	~~12,679~~	-	127,941
2	~~92,330~~	14,505	14,973	~~15,256~~	-	137,063
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Calculating Take

Calculate Take by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0		11,337	11,462		7,748	121,214
1		13,258	13,578		-	127,941
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3		16,360	17,050		-	151,019
4		18,665	19,625		-	169,392
5		20,123	21,242		-	181,518

Calculate Growth:

13,258
- 11,337
1,921

Apply Edge Discount:

1,921
x 0.14
270

Decade 1
Inner Edge Take

Calculating Take

Calculate Take by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0		11,337	11,462		7,748	121,214
1		13,258	13,578		-	127,941
2		14,505	14,975		-	137,063
3		16,360	17,056		-	151,019
4		18,665	19,625		-	169,392
5		20,123	21,242		-	181,518

Calculate Growth:

13,578
- 11,462
2,116

Apply Edge Discount:

2,116
x 0.28
595

Decade 1
Outer Edge Take

Calculating Take

Take by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0						
1		270	595		7,748	8,613
2		175	393			568
3		261	584			845
4		324	724			1,048
5		205	455			660
Total		**1,236**	**2,752**		**7,748**	**11,735**

Calculating Take

Take by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0						
1		270	595		7,748	8,613
2		175	393			568
3		261	584			845
4		324	724			1,048
5		205	455			660
Total		**1,236**	**2,752**		**7,748**	**11,735**

Calculating Take

Discounting Take by Time

Decade	Take Acres	Decade Discount	Acres of Take *(take acres X decade discount)*
0			
1	8,613	1	8,613
2	568	0.8	454
3	845	0.6	507
4	1,048	0.4	419
5	660	0.2	132
Total	**11,735**		**10,126**

Calculating Mitigation

A very similar process….

Calculating Mitigation

(Adjusted Acres by Decade – same table as with Take)

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0	81,768	11,337	11,462	8,900	7,748	121,214
1	88,426	13,258	13,578	12,679	-	127,941
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Calculating Mitigation

(Adjusted Acres by Decade – same table as with Take)

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
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2	92,330	14,505	14,973	~~15,256~~	-	137,063
3	97,659	16,360	17,050	~~19,949~~	-	151,019
4	104,319	18,665	19,625	~~26,783~~	-	169,392
5	109,069	20,123	21,242	~~31,084~~	-	181,518

Calculating Mitigation

Calculate Mitigation by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0	81,768	11,337	11,462		7,748	121,214
1	88,426	13,258	13,578		-	127,941
2		14,505	14,973		-	137,063
3		16,360	17,05[illegible]		-	151,019
4		18,665	19,625		-	169,392
5		20,123	21,242		-	[illegible]

Calculate Growth:

88,426
- *81,768*
*6,659**

Apply Edge Discount:

6,659
x 1
6,659

Decade 1 Interior Forest Mitigation

*rounding

Calculating Mitigation

Calculate Mitigation by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0		11,337	11,462		7,748	121,214
1		13,258	13,578		-	127,941
2		14,505	14,973		-	137,063
3		16,360	17,050		-	151,019
4		18,665	19,625		-	169,392
5		20,123	21,242		-	181,518

Calculate Growth:

13,258
- 11,337
1,921

Apply Edge Discount:

1,921
x 0.86
1,651

Decade 1 Inner Edge Mitigation

Calculating Mitigation

Mitigation by Decade

Decade	Interior Forest	Inner Edge	Outer Edge	Stringers	Not LTFC	Grand Total
0						
1	6,659	1,651	1,521			9,831
2	3,903	1,071	1,003			5,977
3	5,329	1,594	1,493			8,416
4	6,661	1,980	1,850			10,491
5	4,749	1,254	1,162			7,165
Total	**27,301**	**7,550**	**7,029**	**-**	**-**	**41,880**

Calculating Mitigation

Discounted Mitigation by Decade

Decade	Take Acres	Decade Discount	Acres of Take *(take acres X decade discount)*
0			
1	9,831	1	9,831
2	5,977	0.8	4,782
3	8,416	0.6	5,050
4	10,491	0.4	4,196
5	7,165	0.2	1,433
Total	**41,880**		**25,292**

Chapter 3

Outputs by Alternative

Trust Mandate

As manager of state trust lands, DNR has legal fiduciary responsibilities under the State Constitution to:

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Alternative Profiles

Total Acres of Conservation, by Alternative

	Alternative A (no action)	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Existing conservation that provides benefits to marbled murrelets	583,000	583,000	583,000	583,000	583,000	583,000
Marbled murrelet-specific conservation	37,000	10,000	53,000	51,000	57,000	151,000
Total Approximate acres	620,000	593,000	636,000	634,000	640,000	734,000

Alternative Profiles

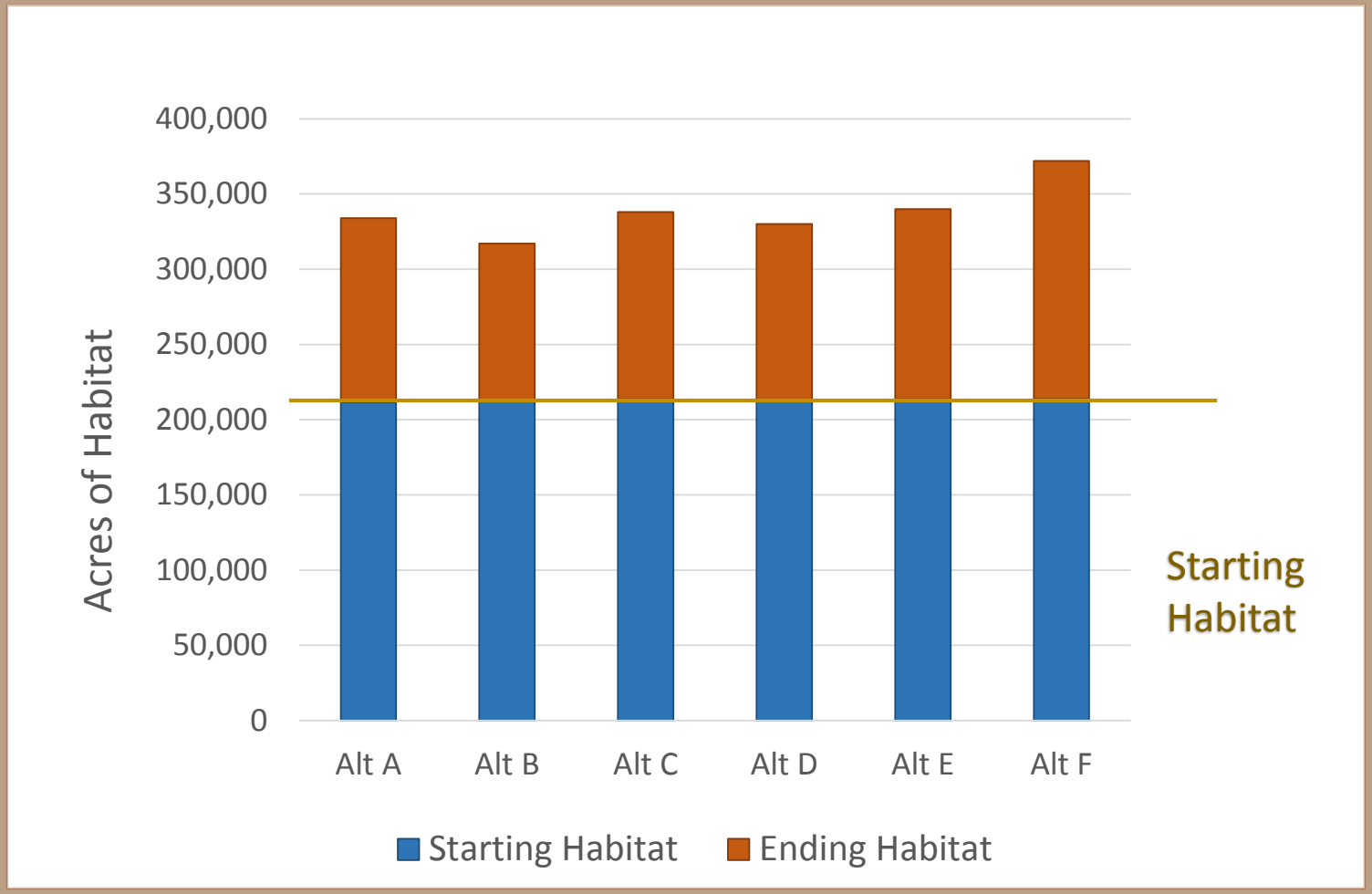
Approximate Acres of Marbled Murrelet-Specific Conservation

Murrelet-specific conservation acres (2016)	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Occupied sites	8,000	10,000	10,000	10,000	10,000	10,000
Occupied site buffers	12,000		13,000	13,000	13,000	16,000
Habitat identified under interim strategy	17,000					
Marbled murrelet management areas						78,000
Emphasis areas			14,000		14,000	
Special habitat areas			9,000	28,000	13,000	
High quality P-stage habitat (>= .47) patches			7,000		7,000	
Existing Northern Spotted Owl Habitat- low quality						47,000
TOTAL	37,000	10,000	53,000	51,000	57,000	151,000

*Note there is a lot of overlap of this habitat with existing conservation. Alternative A has approximately 114,000 acres selected for 'SUITABLE', 'RECLASS', 'POTEN', and 'NEWLYID'. Of that acreage, approximately 98k overlaps with existing conservation, occupied sites, or buffers on those sites.

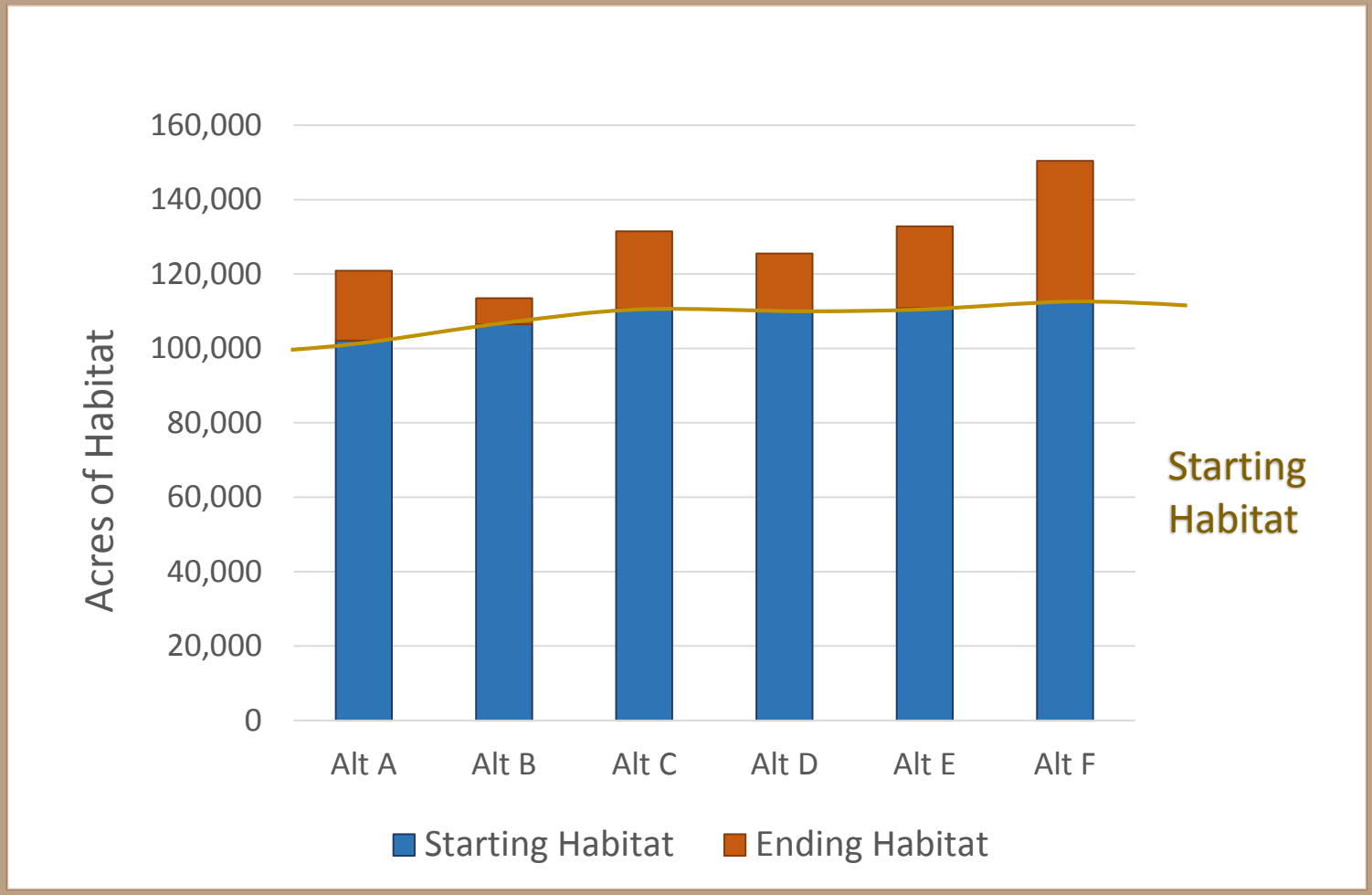
Alternative Outputs

Habitat Growth over Planning Period



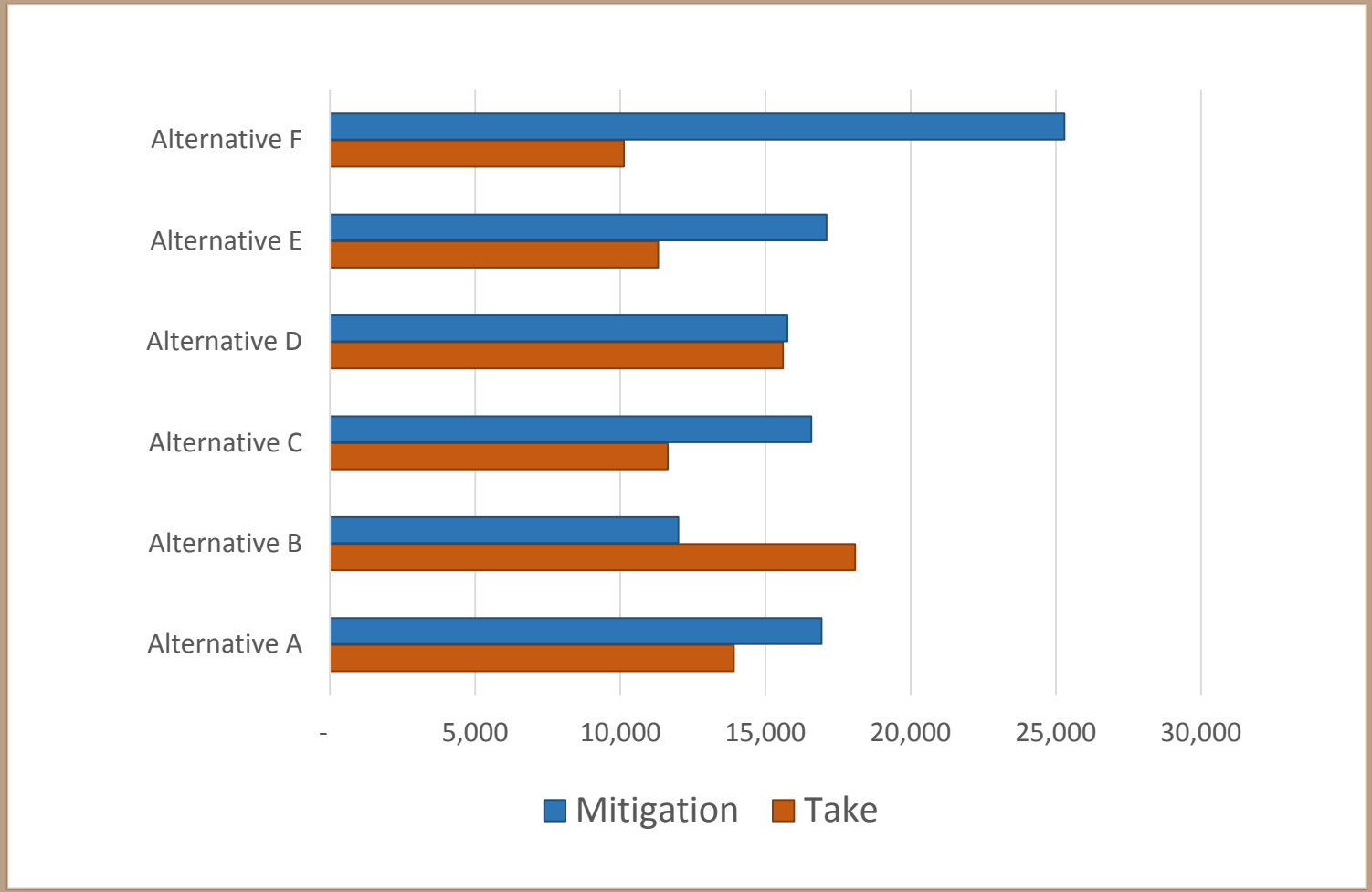
Alternative Outputs

Adjusted Habitat Growth over Planning Period



Alternative Outputs

Take and Mitigation by Alternative



Analytical Framework

Uncertainties

- Surveyed and unoccupied
- Unsurveyed
- Disturbance over a period of 50 years
- Stringers
- Leave Trees
- Modeled Approach
- Occupied sites artificially having a P-stage value of 1
- Others

Chapter 4

Dr. Peery's Outputs

DRAFT - UPDATED ANALYSIS OUTPUT

Modeling the Effects of DNR Forest Management Alternatives on Marbled Murrelets in Washington:
A Population Viability Analysis Approach

Zach Peery and Gavin Jones

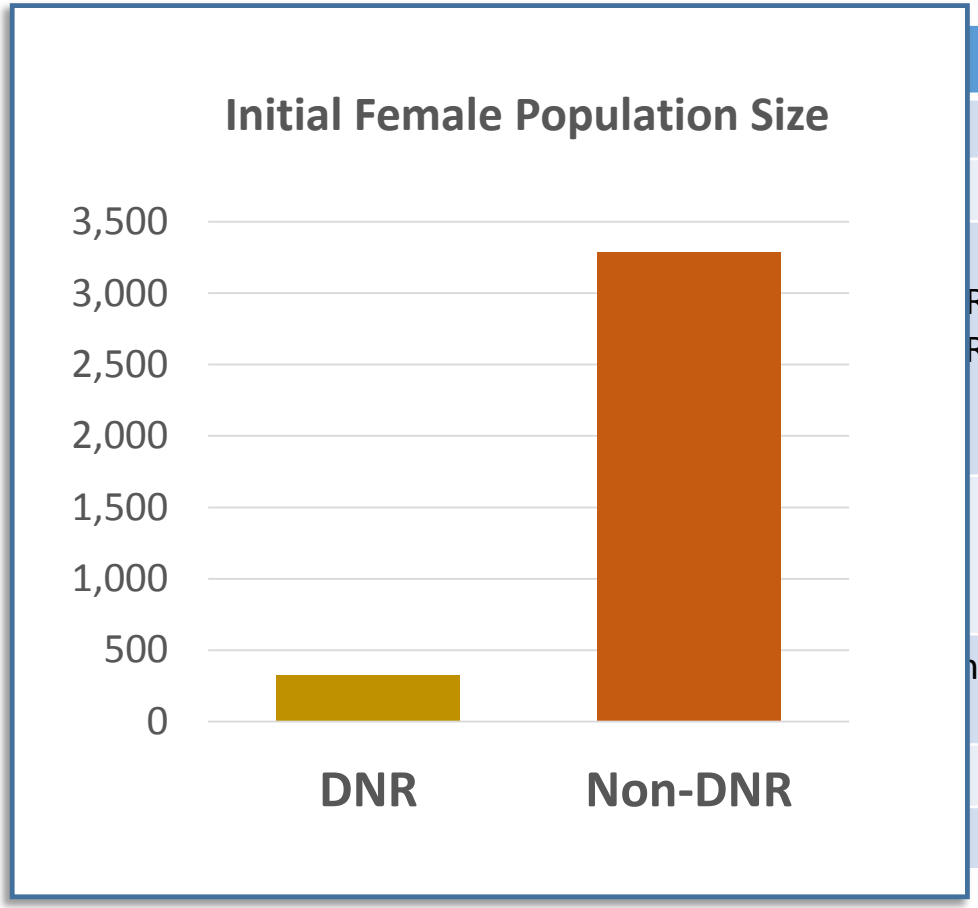
Department of Forest and Wildlife Ecology

University of Wisconsin-Madison

Refresher: scenarios and parameter inputs

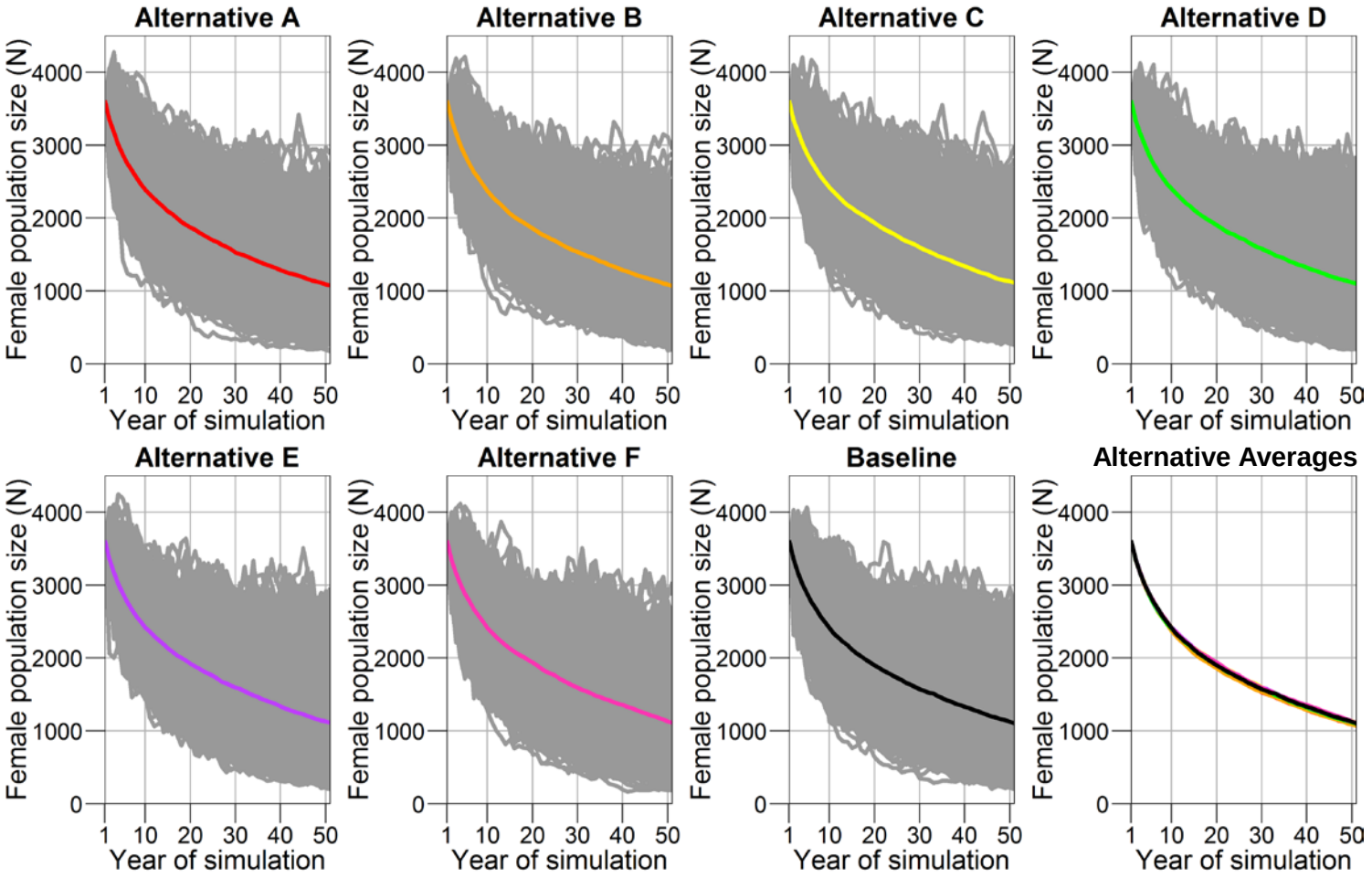
Parameter	Risk	Enhancement
Annual non-juvenile survival rate	0.87	0.90
Annual juvenile survival	0.70 x non-juvenile	
Annual dispersal rate	DNR → non-DNR = 0.91 non-DNR → DNR = 0.09	WA: DNR → non-DNR = 0.91 non-DNR → DNR = 0.09 DNR: 0
Initial female population size	DNR: 325 non-DNR: 3,291	
Initial nesting carrying capacity	40% > Initial number of females of breeding age	
Variance in reproductive rates	0.012	
Variance in survival rates	0.003	

Refresher: scenarios and parameter inputs

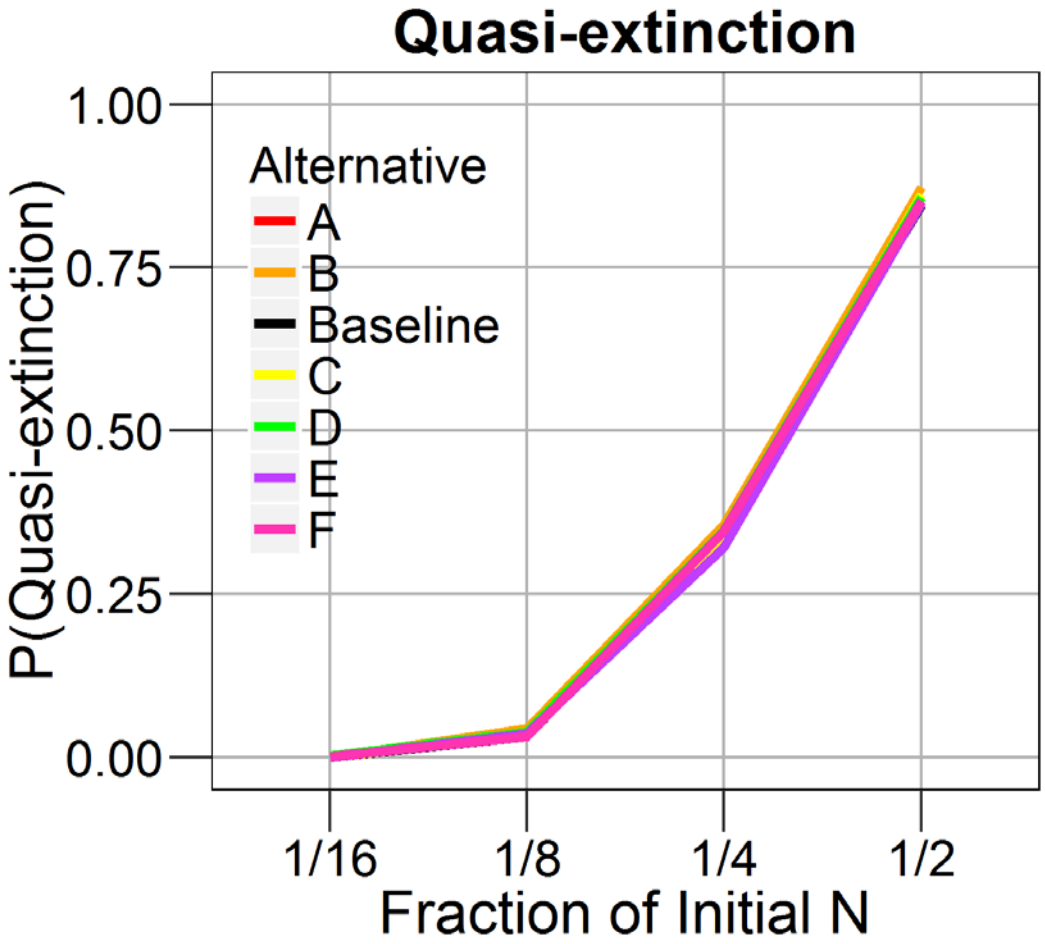


	Enhancement
	0.90
0.70 x non-juvenile	
R = 0.91 R = 0.09	WA: DNR → non-DNR = 0.91 non-DNR → DNR = 0.09 DNR: 0
DNR: 325 **non-DNR: 3,291**	
number of females of breeding age	
0.012	
0.003	

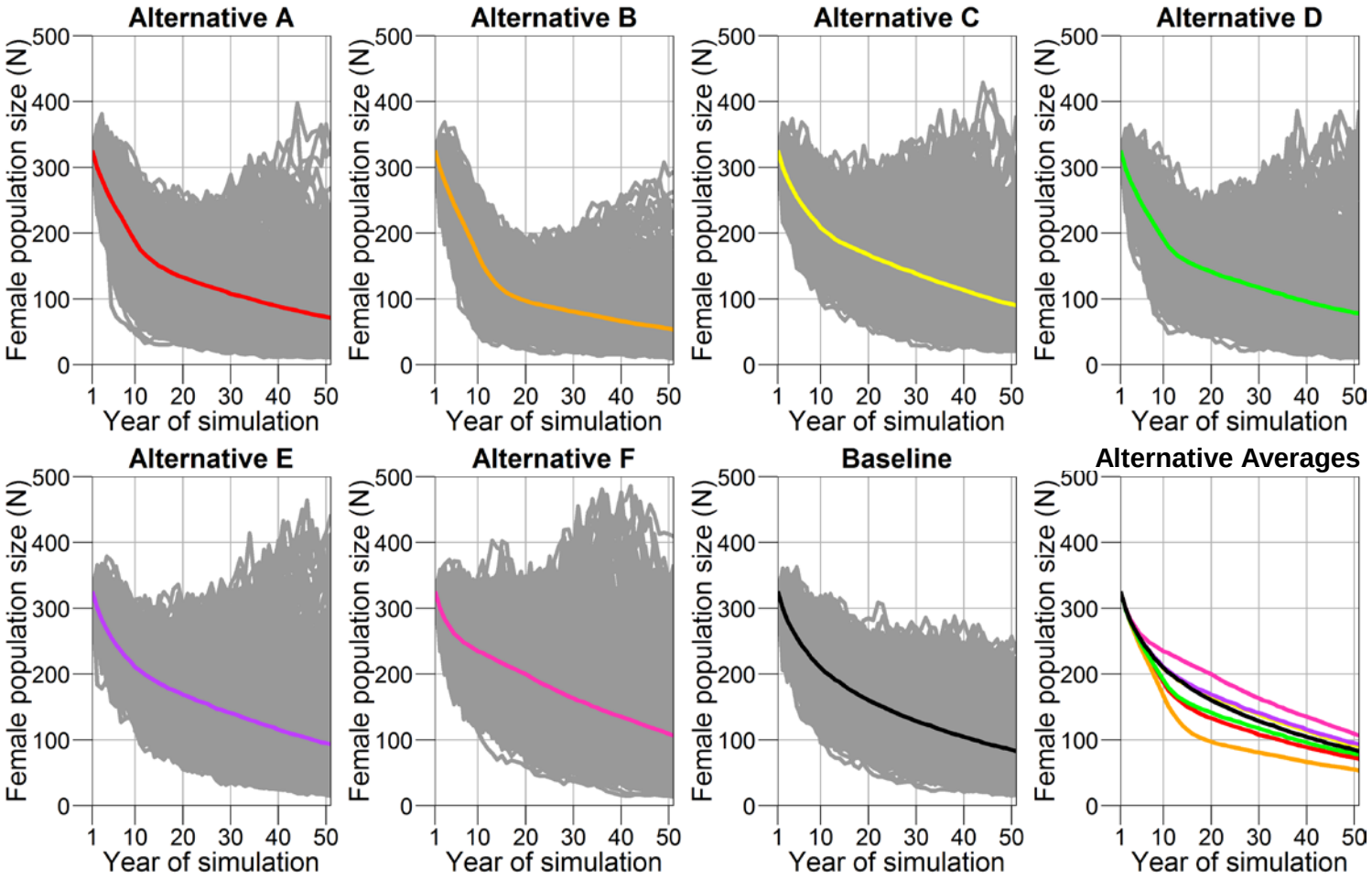
Risk - WA


Alternative A
Alternative B
Alternative C
Alternative D
Alternative E
Alternative F
Baseline
Alternative Averages
Female population size (N)
0
1000
2000
3000
4000
1
10
20
30
40
50
Year of simulation

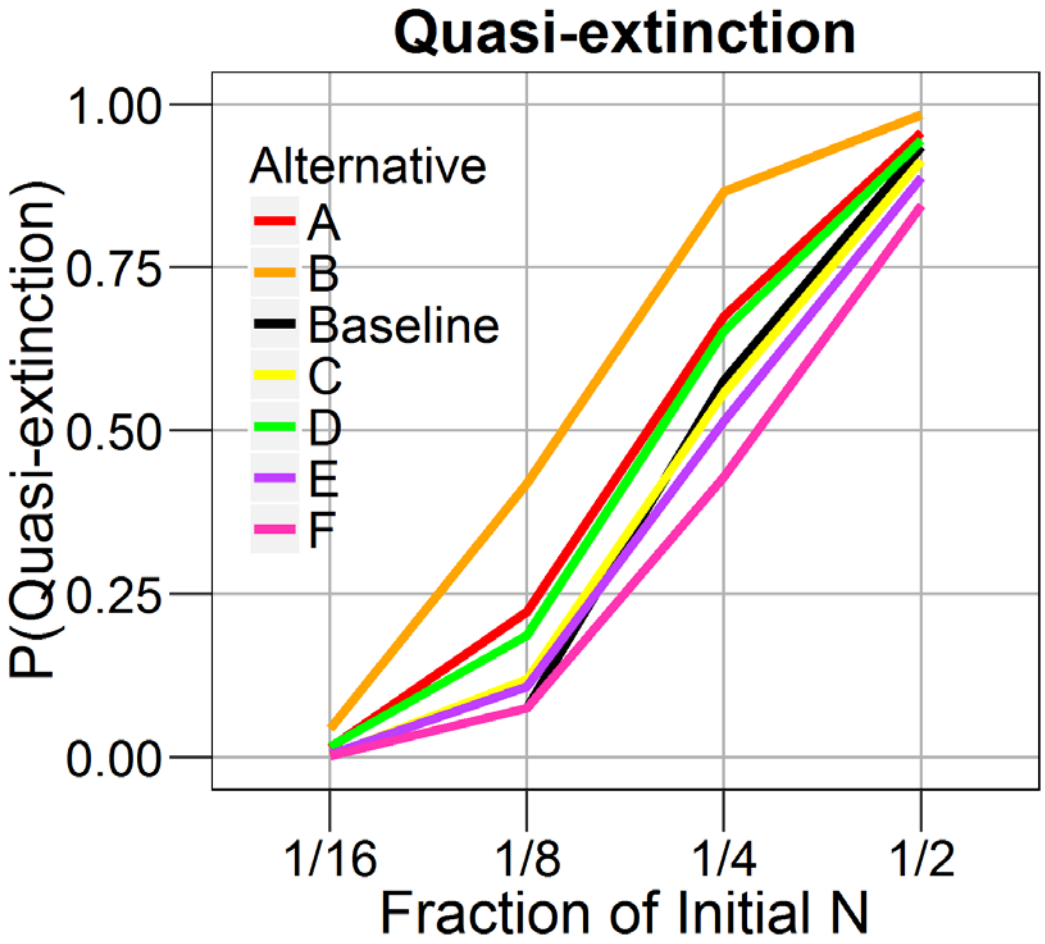
Risk - WA


Quasi-extinction
1.00
0.75
0.50
0.25
0.00
P(Quasi-extinction)
Alternative
A
B
Baseline
C
D
E
F
1/16
1/8
1/4
1/2
Fraction of Initial N

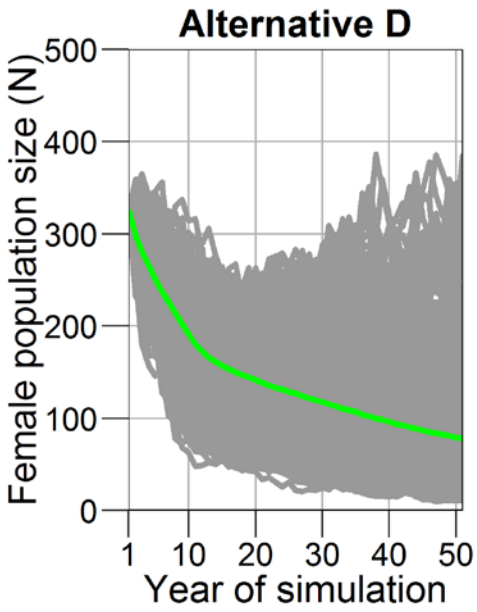
Risk - DNR

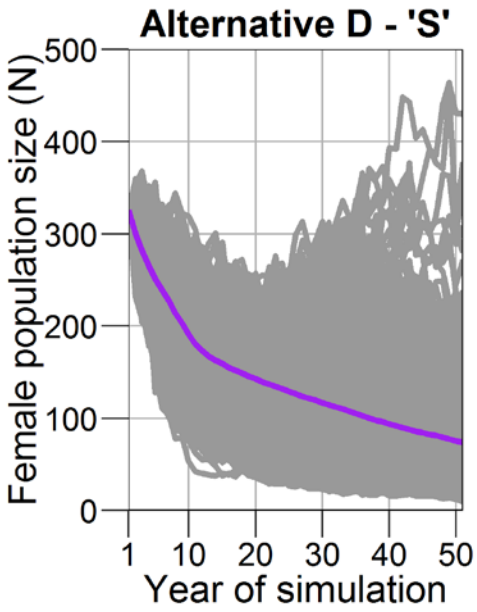

Alternative A
Alternative B
Alternative C
Alternative D
Alternative E
Alternative F
Baseline
Alternative Averages
Female population size (N)
Year of simulation
0
100
200
300
400
500
1
10
20
30
40
50

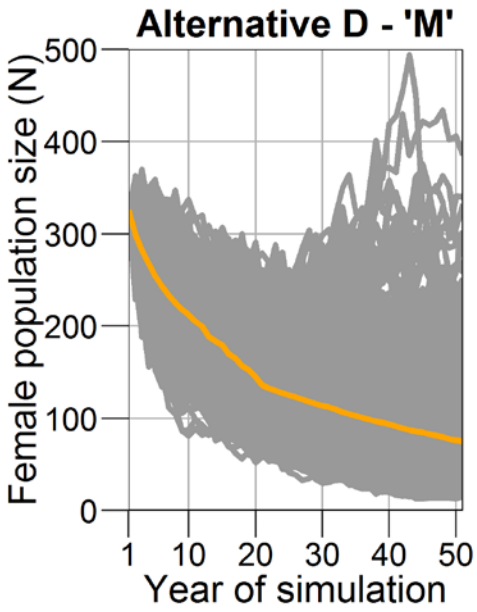
Risk - DNR

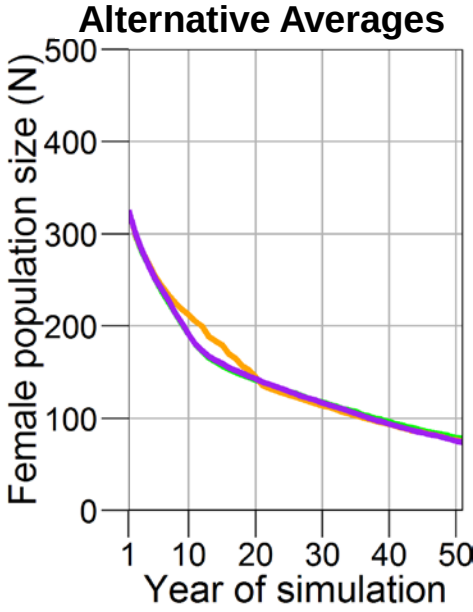

Quasi-extinction
1.00
0.75
0.50
0.25
0.00
P(Quasi-extinction)
Alternative
A
B
Baseline
C
D
E
F
1/16
1/8
1/4
1/2
Fraction of Initial N

Risk - DNR (D variants)

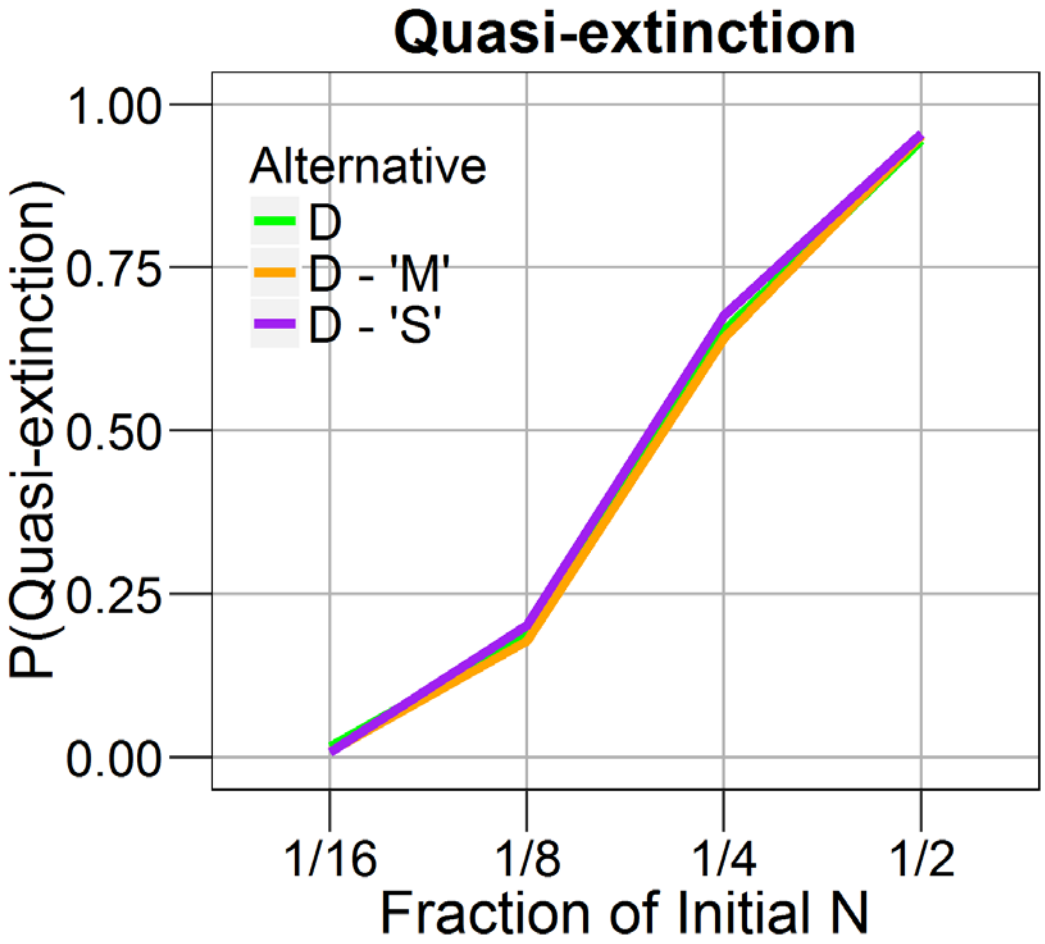




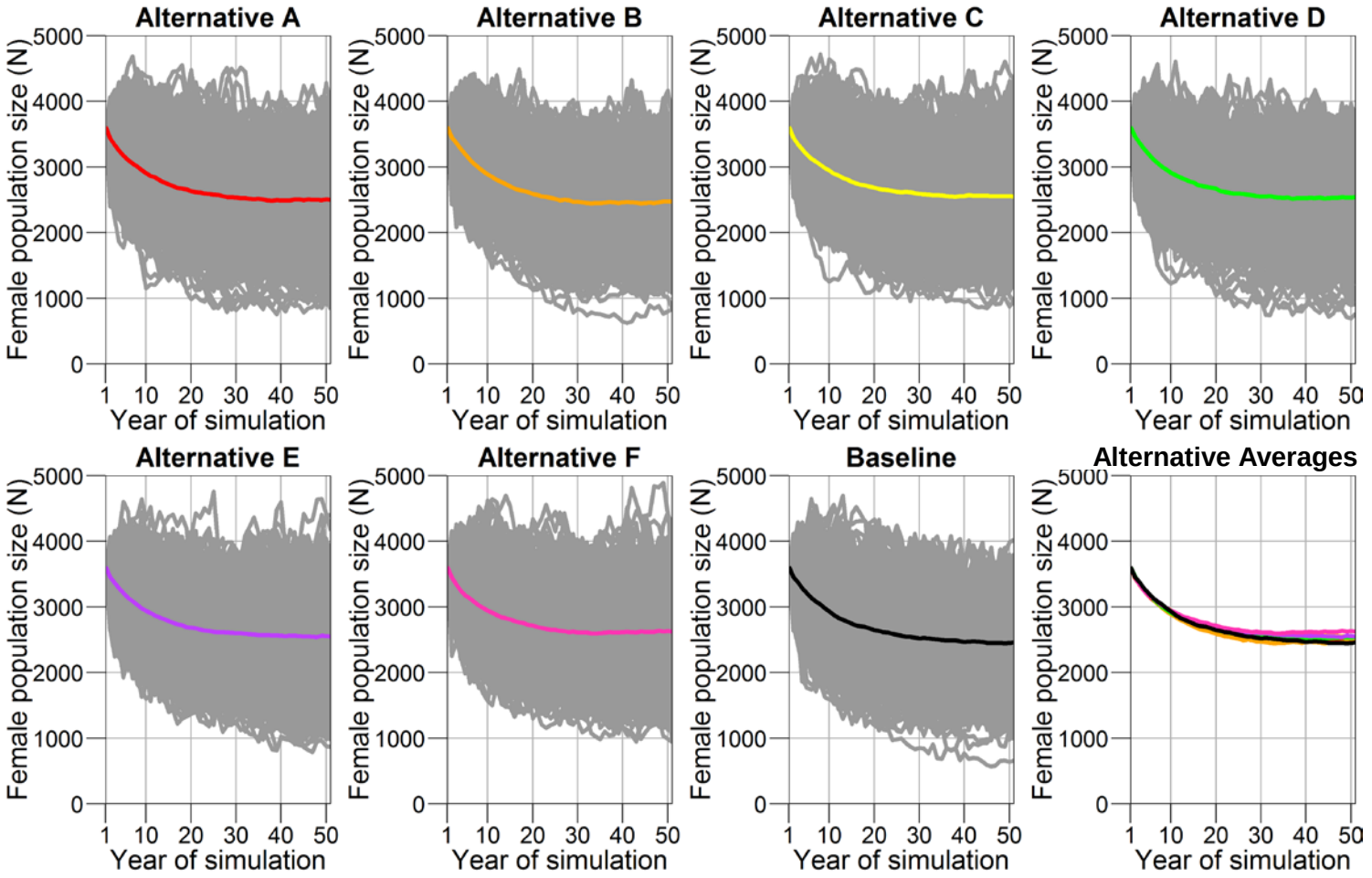




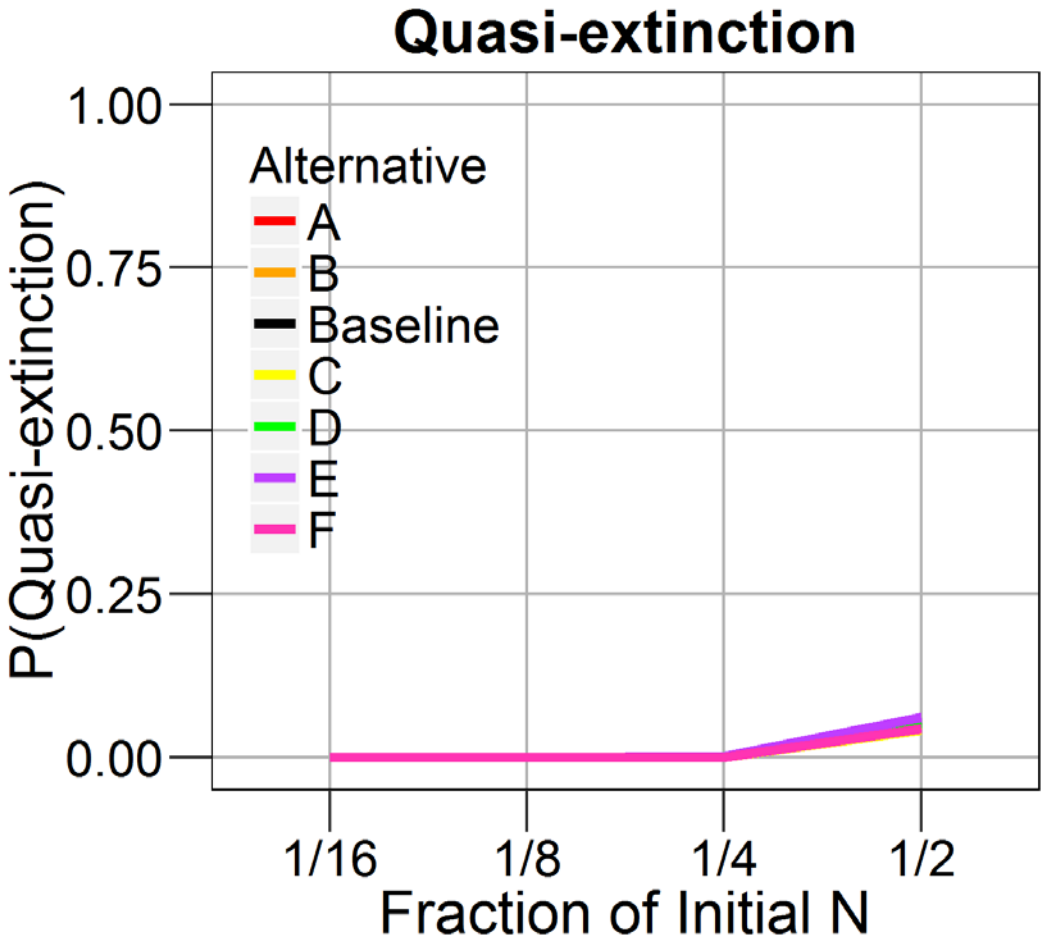
Risk - DNR (D variants)



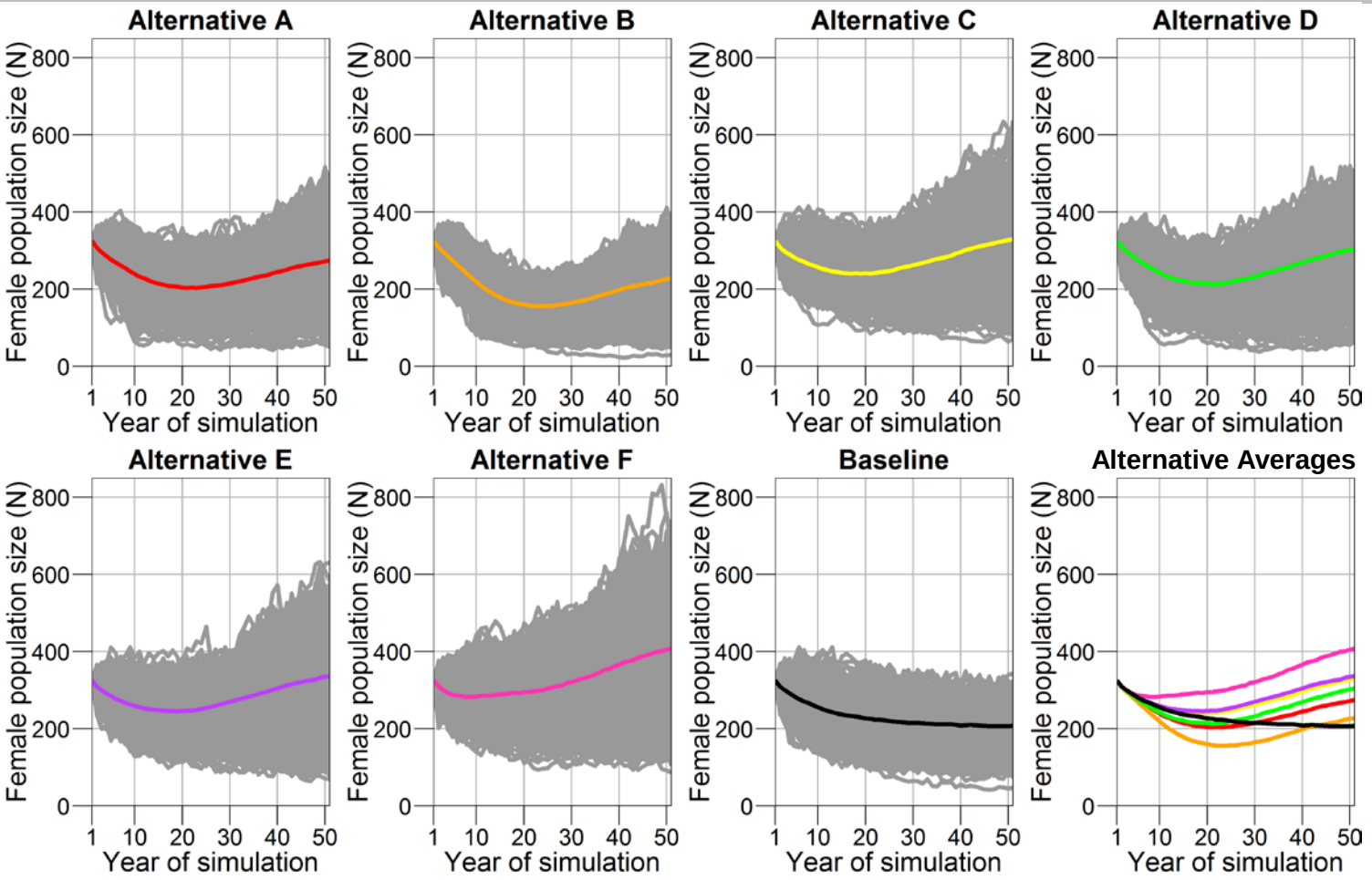
Enhancement - WA



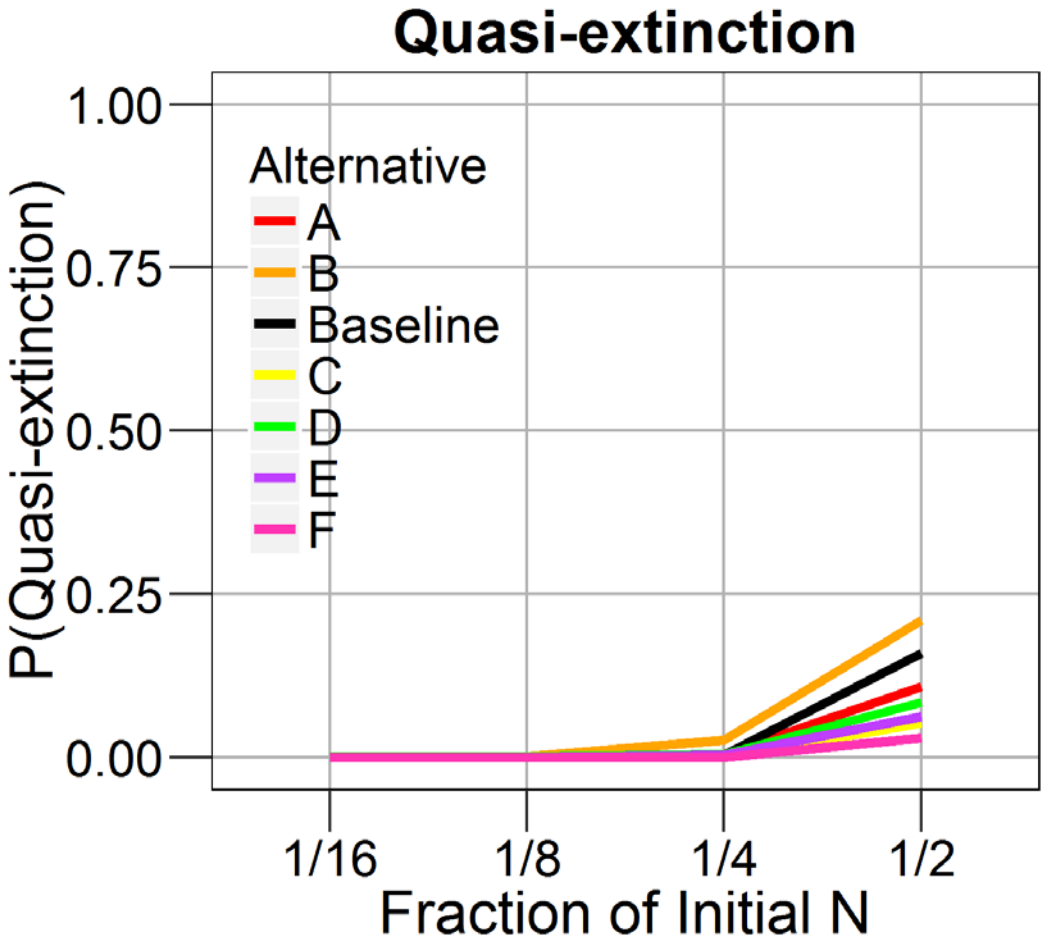
Enhancement - WA



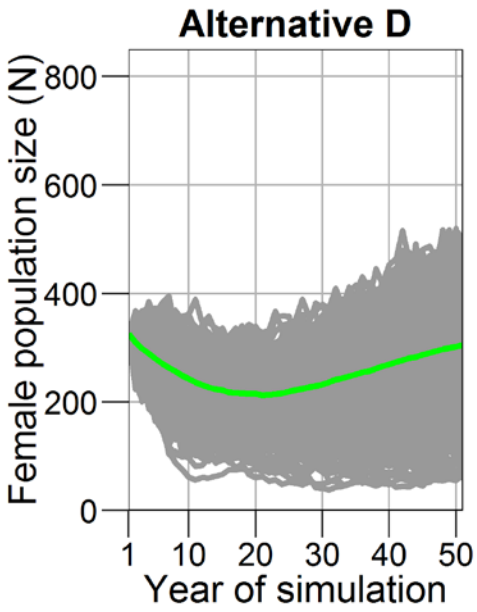
Enhancement - DNR

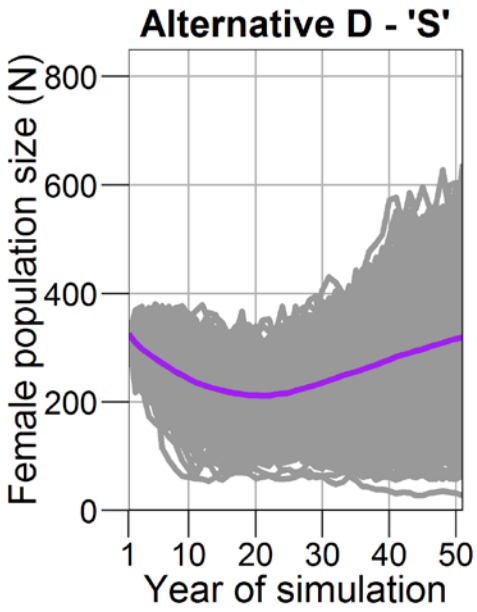


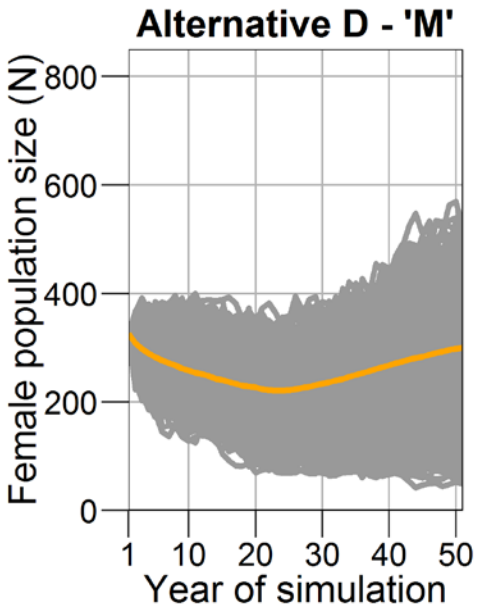
Enhancement - DNR

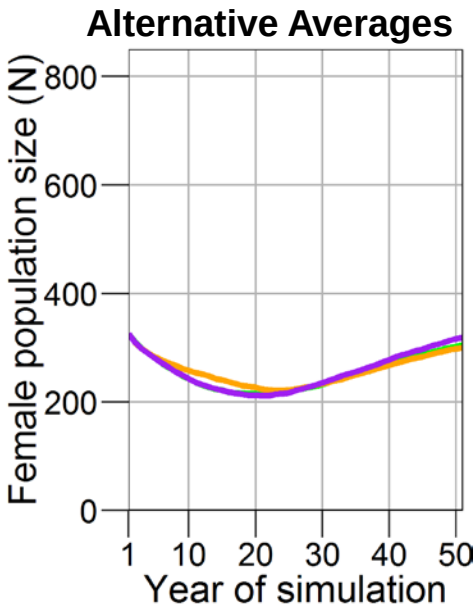


Enhancement - DNR (D variants)

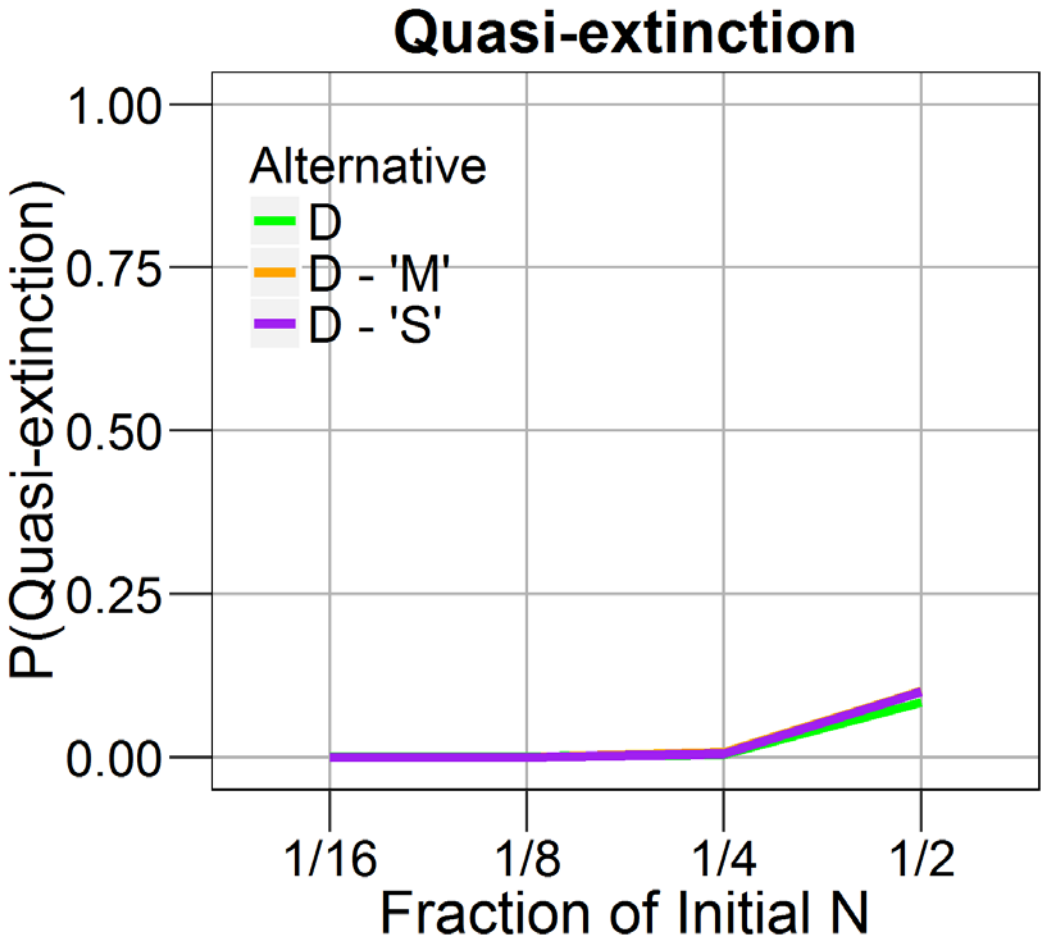








Enhancement - DNR (D variants)



Trust Mandate

As manager of state trust lands, DNR has legal fiduciary responsibilities under the State Constitution to:

- Generate revenue and other benefits for each trust, in perpetuity
- Preserve the corpus of the trust
- Exercise reasonable care and skill
- Act prudently to reduce the risk of loss for the trusts
- Maintain undivided loyalty to beneficiaries
- Act impartially with respect to current and future beneficiaries

Evaluation Criteria

1. To the maximum extent practicable, minimize and mitigate the impacts of take.

2. Not appreciably reduce the likelihood of the survival and recovery of the species in the wild.

3. Make a significant contribution to maintaining and protecting marbled murrelet populations in western Washington over the life of the HCP.


WASHINGTON
DEPARTMENT OF NATURAL RESOURCES