

**Assessing Wildlife Habitat Changes
for the Southwest Crown of the
Continent CFLRP
Variance Analysis of Habitat Models**

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Species Included

- Fisher (*Pekania pennanti*)
- American marten (*Martes americana*)
- Northern goshawk (*Accipiter gentilis*)
- Flammulated owl (*Otus flammeolus*)
- Hairy woodpecker (*Picoides villosus*)
- Pileated woodpecker (*Dryocopus pileatus*).

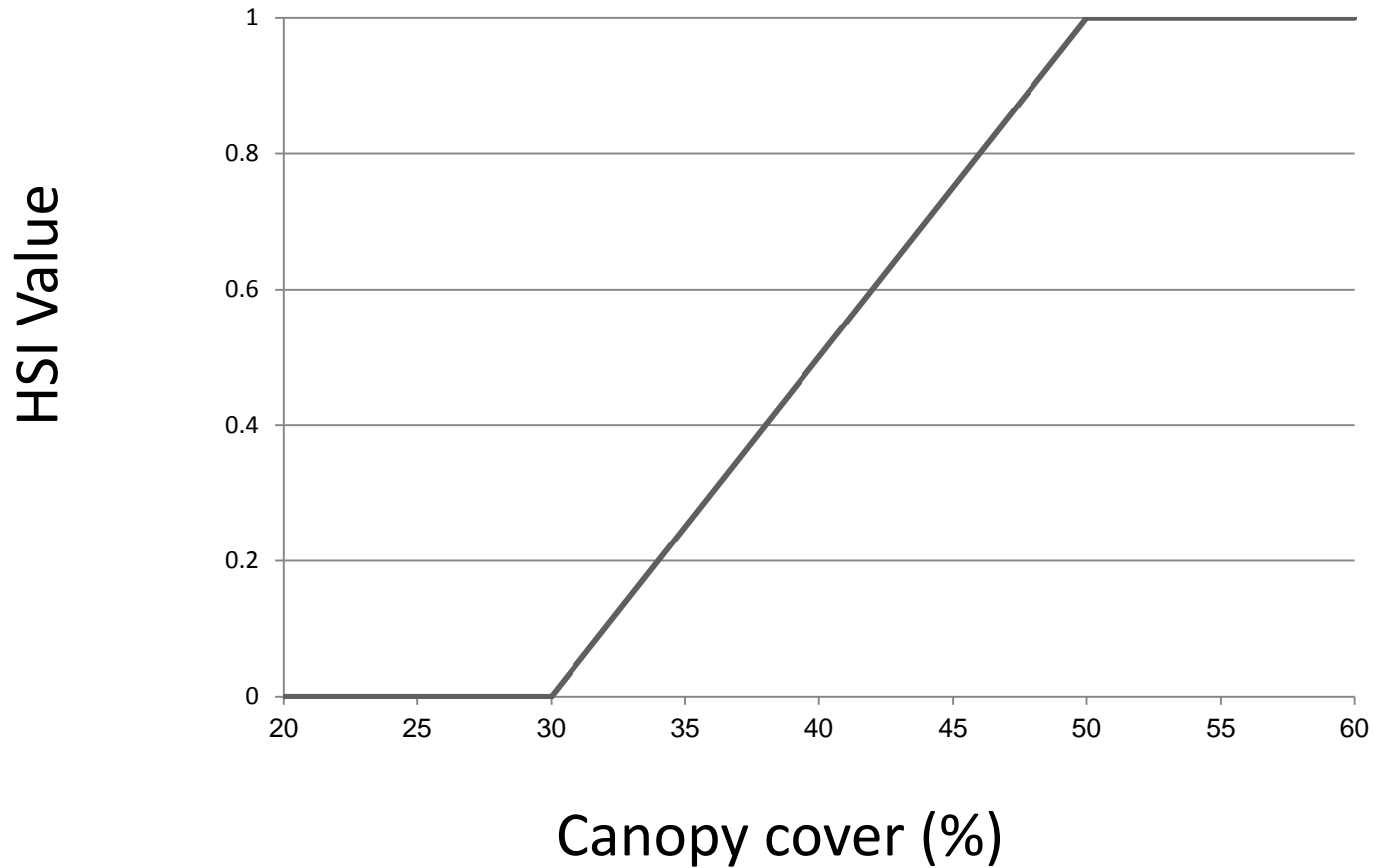
Monitoring Habitat Changes

- Species of interest primarily at low densities with large home ranges
- Population sampling unlikely to show significant responses to forest treatments

Habitat Suitability Modeling

- Identifies primary habitat requirements of species and quantifies measures of these requirements using empirical information and best scientific evaluation
- Models developed for each species
- Stand level values can be derived from sampling of pre and post treatment
- Landscape must assign values to vegetation map

Tree Canopy Cover - Nesting



Example of a vegetation variable and habitat suitability of a modeled wildlife species.

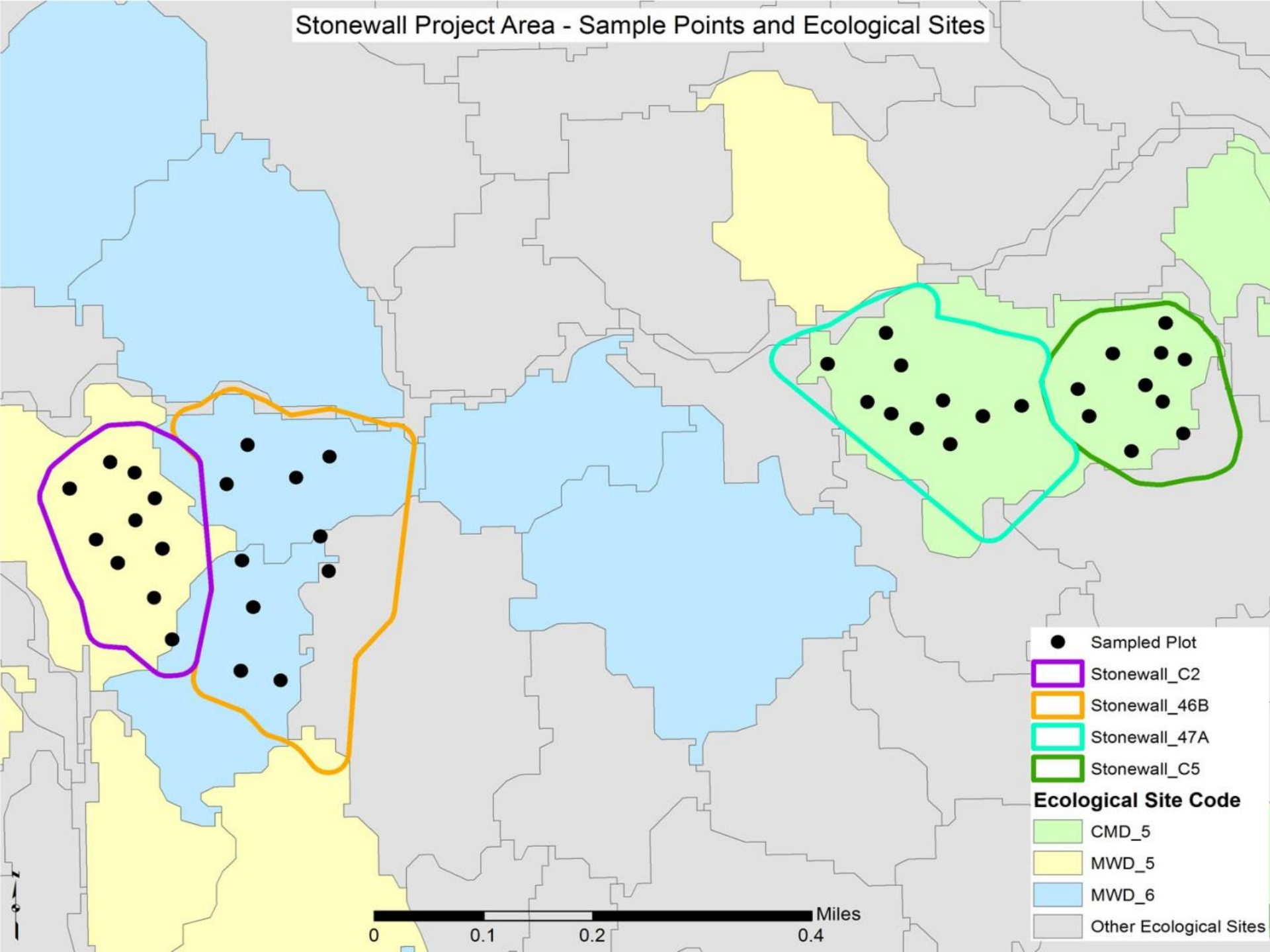
HSI Variables

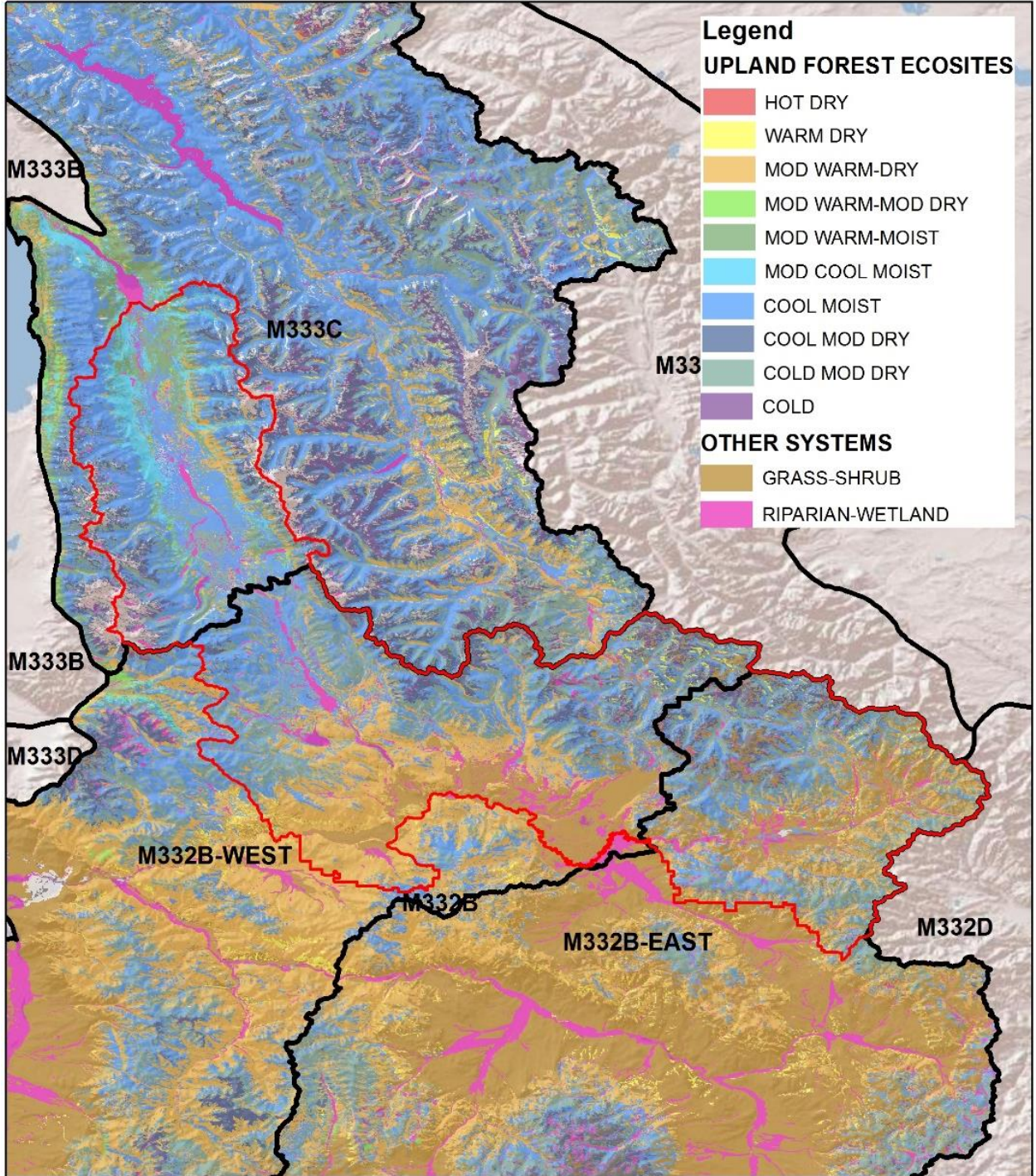
- Overstory tree canopy cover
- Ecological site (Groupings of habitat types)
- Trees per acre (>1 in.) by size class
- Snags per acre by size class
- Percent ground covered by coarse woody debris by size class (diameter)
- Shrub canopy cover by species (for shrubs >1m)
- Average shrub height
- Basal area of trees
- Understory canopy cover

Stand and Vegetation Map Variance

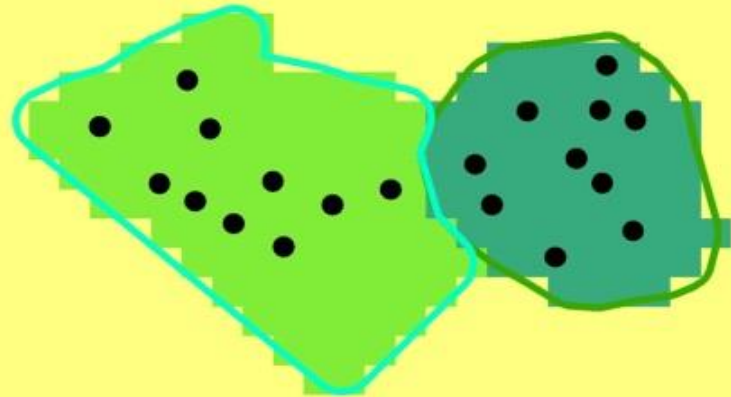
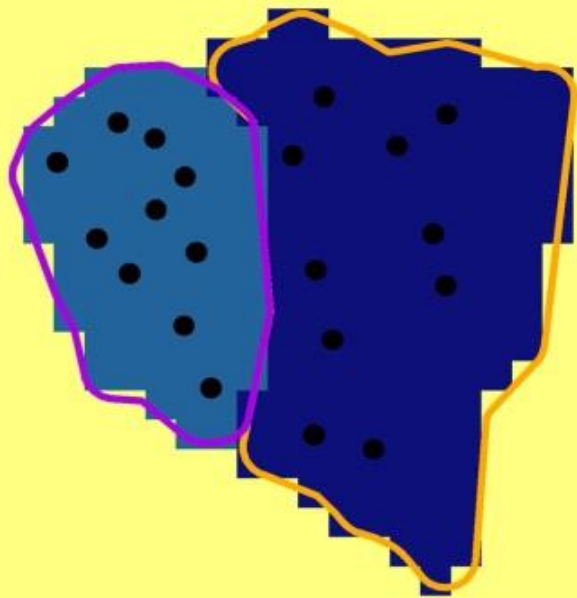
- Samples of HSI variables in a stand produce a mean estimate with variance estimates
- Mapped vegetation uses a classification system with variation in what is included in each classification category, and variation in HSI variables
- Objective of project was to evaluate how this variance could be used to indicate confidence in model outputs

Stonewall Project Area - Sample Points and Ecological Sites





Stonewall Project Area - Flammulated Owl HSI - Iteration 2

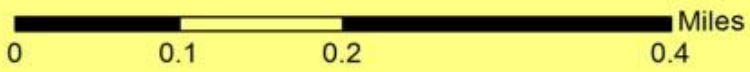


- Sampled Plot
- Stonewall_C2
- Stonewall_46B
- Stonewall_47A
- Stonewall_C5

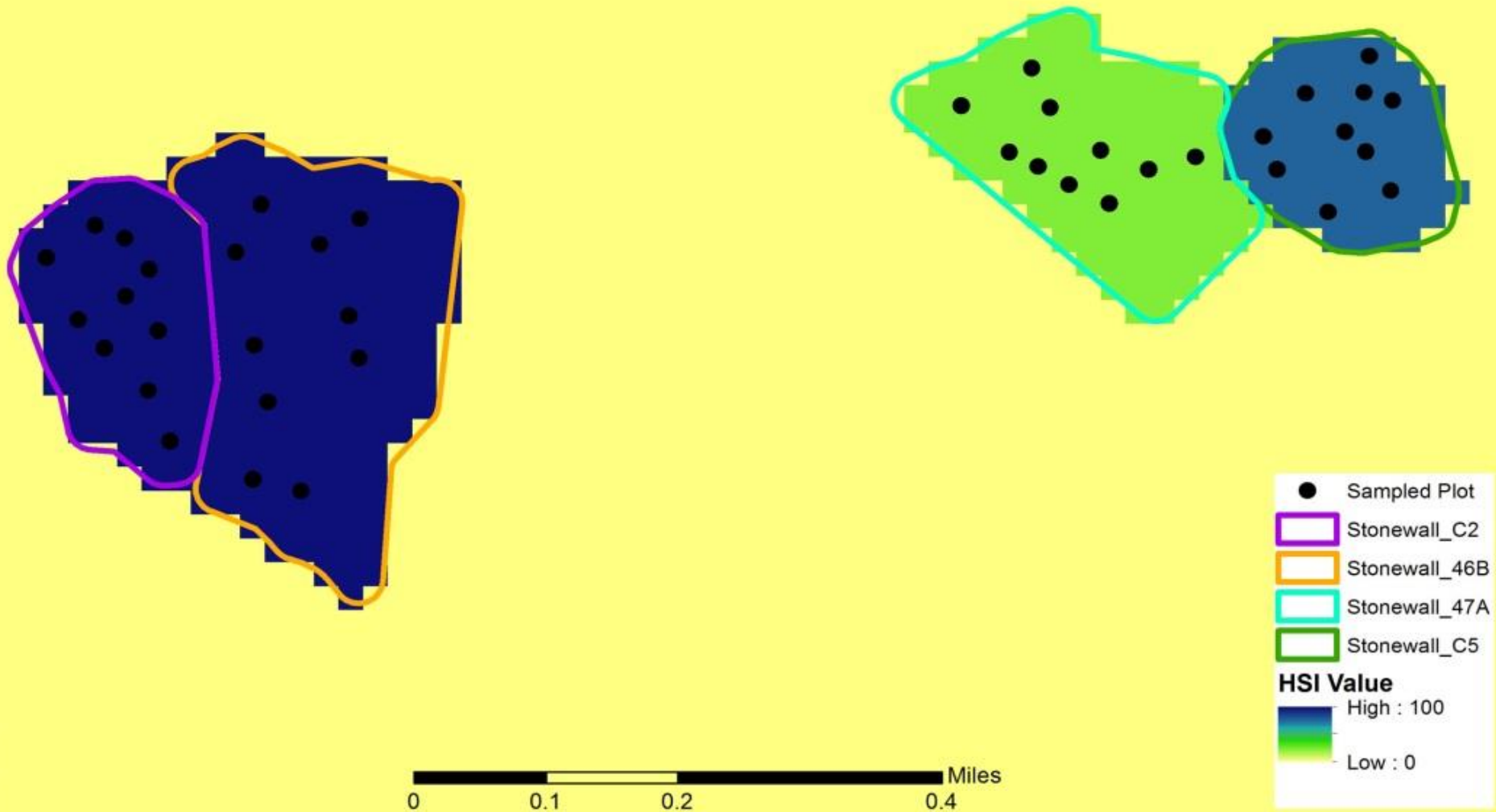
HSI Value

High : 100

Low : 0



Stonewall Project Area - Flammulated Owl HSI - Iteration 6

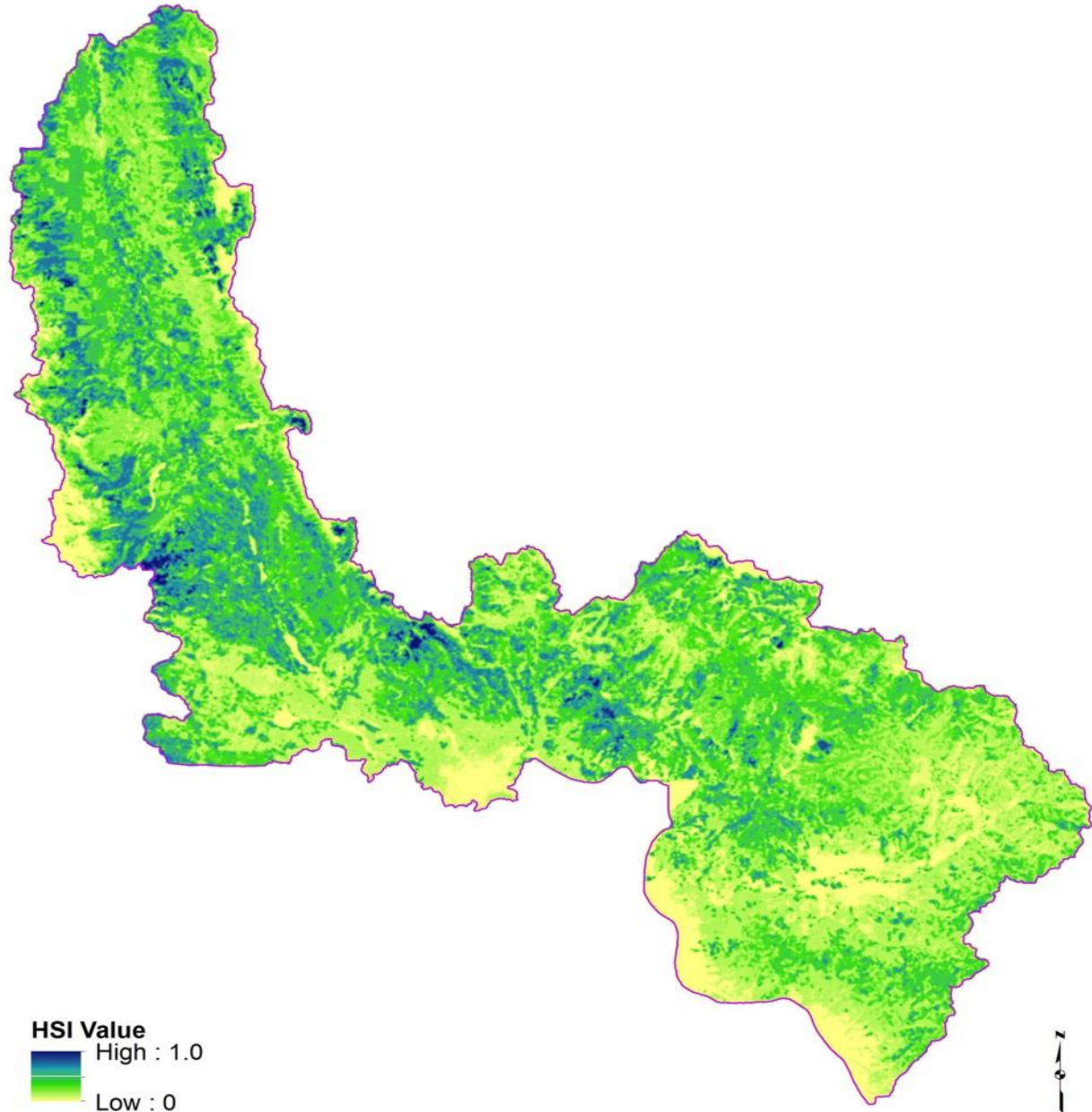


		STONEWALL - C5		FIA PLOT DATA		STONEWALL - C2		FIA PLOT DATA		STONEWALL - 46b		FIA PLOT DATA	
		CWD-5		CWD-5		MWD-5		MWD-5		MWD-6		MWD-6	
Habitat Variable	Measure	Mean Value (95% CI)	Mean HSI (Min- Max ^b)	Mean Value (95% CI)	Mean HSI (Min- Max ^b)	Mean Value (95% CI)	Mean HSI (Min- Max ^b)	Mean Value (95% CI)	Mean HSI (Min- Max ^b)	Mean Value (95% CI ^a)	Mean HSI (Min- Max ^b)	Mean Value (95% CI ^a)	Mean HSI (Min- Max ^b)
Fisher													
Tree Canopy Cover	%	41.7 (7.9)	0.5 (0.4 - 0.7)	50.0 (0.0)	0.8 (0.8 - 0.8)	61.1 (9.8)	1.0 (0.8 - 1.0)	50.0 (0.0)	0.8 (0.8 - 0.8)	60.3 (12.9)	1.0 (0.7 - 1.0)	80.0 (0.0)	1.0 (1.0 - 1.0)
Overstory Tree Size (DBH)	inches	8.7 (1)	0.5 (0.4 - 0.6)	12.5 (0.0)	0.8 (0.8 - 0.8)	13.5 (2.6)	0.9 (0.7 - 1.0)	12.5 (0.0)	0.8 (0.8 - 0.8)	10.7 (0.7)	0.7 (0.6 - 0.7)	12.5 (0.0)	0.8 (0.8 - 0.8)
Shrub (≥3 ft) Canopy Cover	%	0.1 (0.2)	0.0 (0.0 - 0.0)	18.3 (6.4)	1.0 (0.7 - 1.0)	7.3 (7.1)	0.2 (0.0 - 0.9)	15.8 (8.3)	1.0 (0.3 - 1.0)	4.1 (2)	0.0 (0.0 - 0.1)	9.6 (4.2)	0.5 (0.0 - 0.9)
Spruce/Fir Canopy Cover	%	21.6 (6.2)	0.4 (0.3 - 0.6)	16.3 (6.1)	0.3 (0.2 - 0.4)	42.6 (8.5)	0.9 (0.7 - 1.0)	0.3 (0.6)	0.0 (0.0 - 0.0)	40 (11.6)	0.8 (0.6 - 1.0)	0.1 (0.2)	0.0 (0.0 - 0.0)
Overall HSI Value (95% CI)		0.5 (0.3 - 0.6)		0.8 (0.7 - 0.8)		0.9 (0.7 - 1.0)		0.7 (0.4 - 0.7)		0.8 (0.6 - 0.9)		0.6 (0.3 - 0.7)	
Flammulated Owl													
Tree Canopy Cover	%	41.7 (7.9)	1.0 (1.0 - 1.0)	50.0 (0.0)	1.0 (1.0 - 1.0)	61.1 (9.8)	0.8 (0.6 - 1.0)	50.0 (0.0)	1.0 (1.0 - 1.0)	60.3 (12.9)	0.8 (0.5 - 1.0)	80.0 (0.0)	0.4 (0.4 - 0.4)
Snags (>20 in dbh)	per acre	6.8 (7.4)	1.0 (0.0 - 1.0)	1.2 (2.4)	0.8 (0.0 - 1.0)	5.2 (3.7)	1.0 (1.0 - 1.0)	0.1 (0.2)	0.1 (0.0 - 0.2)	16.4 (6.8)	1.0 (1.0 - 1.0)	0.0 (0.0)	0.0 (0.0 - 0.0)
Relative Stand Density Index	% max	6.4 (1.4)	0.6 (0.5 - 0.8)	17.6 (2.1)	1.0 (1.0 - 1.0)	10.8 (2.7)	1.0 (0.8 - 1.0)	16.5 (1.1)	1.0 (1.0 - 1.0)	9.4 (1.1)	0.9 (0.8 - 1.0)	29.2 (2.7)	0.7 (0.6 - 0.8)
Ecosite Rating		1.0 (0.0)	1.0 (1.0 - 1.0)	1.0 (0.0)	1.00 (1.00 - 1.00)	0.1 (0.0)	0.1 (0.1 - 0.1)	0.1 (0.0)	0.1 (0.1 - 0.1)	1.0 (0.0)	1.0 (1.0 - 1.0)	1.0 (0.0)	1.0 (1.0 - 1.0)
Overall HSI Value		0.9 (0.2 - 0.9)		0.9 (0.2 - 1.0)		0.1 (0.1 - 0.1)		0.0 (0.0 - 0.1)		0.9 (0.8 - 0.9)		0.1 (0.1 - 0.1)	
Pileated Woodpecker													
Tree Canopy Cover - Nesting	%	41.7 (7.9)	0.8 (0.5 - 1.0)	50.0 (0.0)	1.0 (1.0 - 1.0)	61.1 (9.8)	1.0 (1.0 - 1.0)	50.0 (0.0)	1.0 (1.0 - 1.0)	60.3 (12.9)	1.0 (0.9 - 1.0)	80.0 (0.0)	1.0 (1.0 - 1.0)
Tree Size - Foraging (DBH)	inches	16.8 (2.1)	0.7 (0.5 - 0.9)	12.5 (0.0)	0.3 (0.3 - 0.3)	17.2 (1.9)	0.7 (0.5 - 0.9)	12.5 (0.0)	0.2 (0.2 - 0.3)	14.7 (0.5)	0.5 (0.4 - 0.5)	12.5 (0.0)	0.3 (0.3 - 0.3)
Tree Size - Nesting (DBH)	inches	21.1 (2.8)	0.4 (0.2 - 0.6)	0.0 (0.0)	0.0 (0.0 - 0.0)	32.1 (4.1)	1.0 (0.9 - 1.0)	21.0 (1.0)	0.4 (0.3 - 0.5)	26.2 (3.6)	0.7 (0.5 - 1.0)	27.0 (2.3)	0.8 (0.6 - 0.9)
Large Snags (>30 in DBH)	per acre	0 (0)	0.0 (0.0 - 0.0)	0.0 (0.0)	0.0 (0.0 - 0.0)	0 (0)	0.0 (0.0 - 0.0)	0.0 (0.0)	0.0 (0.0 - 0.0)	2 (1.8)	0.7 (0.1 - 1.0)	0.0 (0.0)	0.0 (0.0 - 0.0)
Foraging Sites	per acre	87.2 (65.6)	1.0 (1.0 - 1.0)	28.2 (16.6)	1.0 (0.4 - 1.0)	112.8 (81)	1.0 (1.0 - 1.0)	8.9 (4.1)	0.0 (0.0 - 0.5)	89.6 (67.4)	1.0 (1.0 - 1.0)	18.3 (21.9)	0.9 (0.0 - 1.0)
Target Tree Species	per acre	36 (7.7)	0.2 (0.0 - 0.4)	82.8 (8.1)	1.0 (1.0 - 1.0)	45.9 (13.3)	0.4 (0.1 - 0.8)	99.7 (0.6)	1.0 (1.0 - 1.0)	49.2 (13.1)	0.5 (0.2 - 0.9)	96.5 (6.6)	1.0 (1.0 - 1.0)
All Snags (>15 in DBH)	per acre	1.6 (1.3)	0.2 (0.0 - 0.4)	30.3 (17.6)	1.0 (1.0 - 1.0)	1.2 (2.4)	0.1 (0.0 - 0.5)	8.9 (4.1)	1.0 (0.7 - 1.0)	5.6 (4.4)	0.8 (0.1 - 1.0)	7.1 (2.3)	1.0 (0.7 - 1.0)
Overall HSI Value		0.3 (0.1 - 0.6)		0.7 (0.6 - 0.7)		0.6 (0.3 - 0.8)		0.5 (0.4 - 0.7)		0.7 (0.3 - 0.9)		0.8 (0.5 - 0.8)	

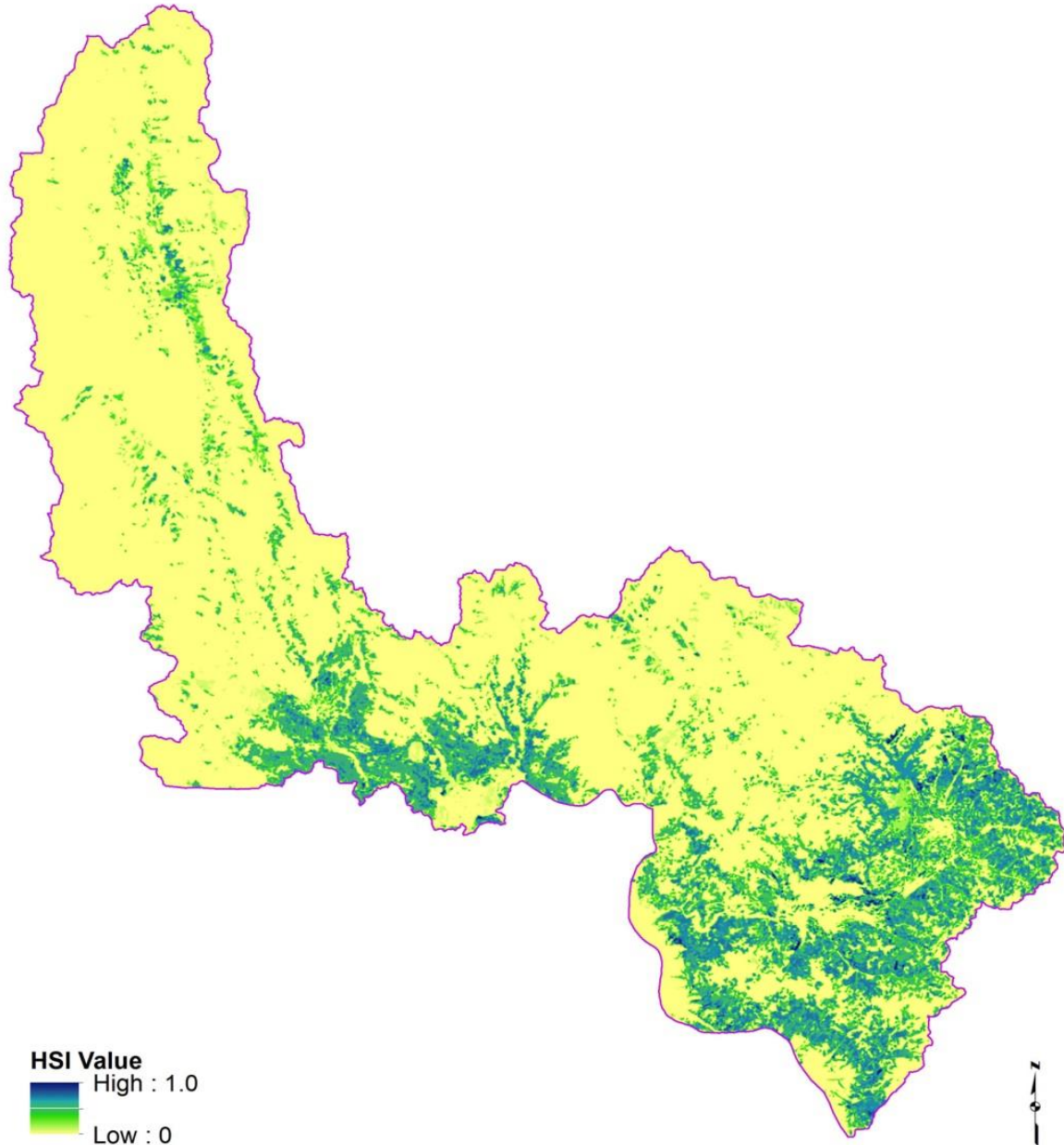
^a CI - Confidence Interval

^b Min-Max 95% CI HSI

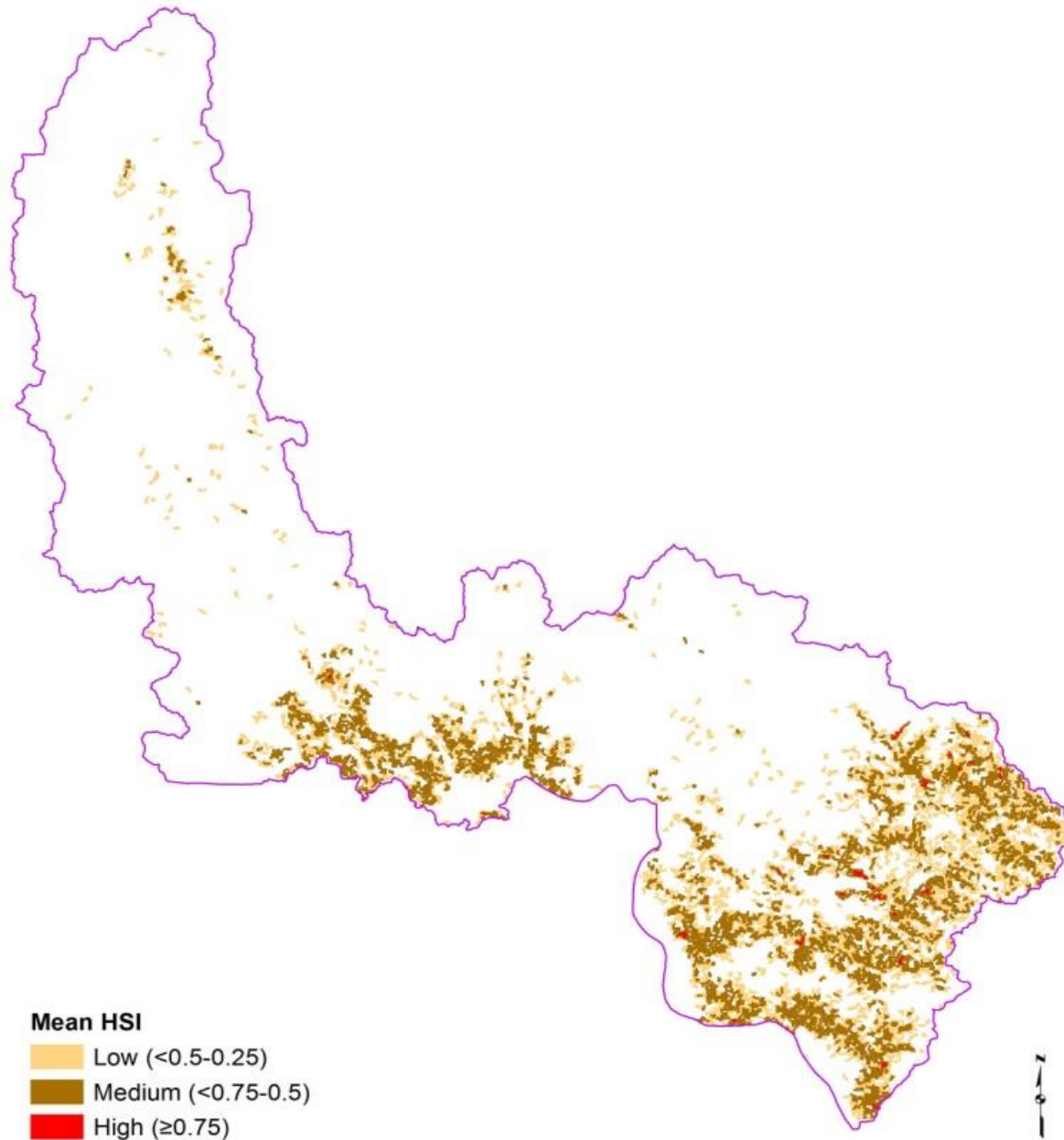
SWCC - Marten HSI - Step 2



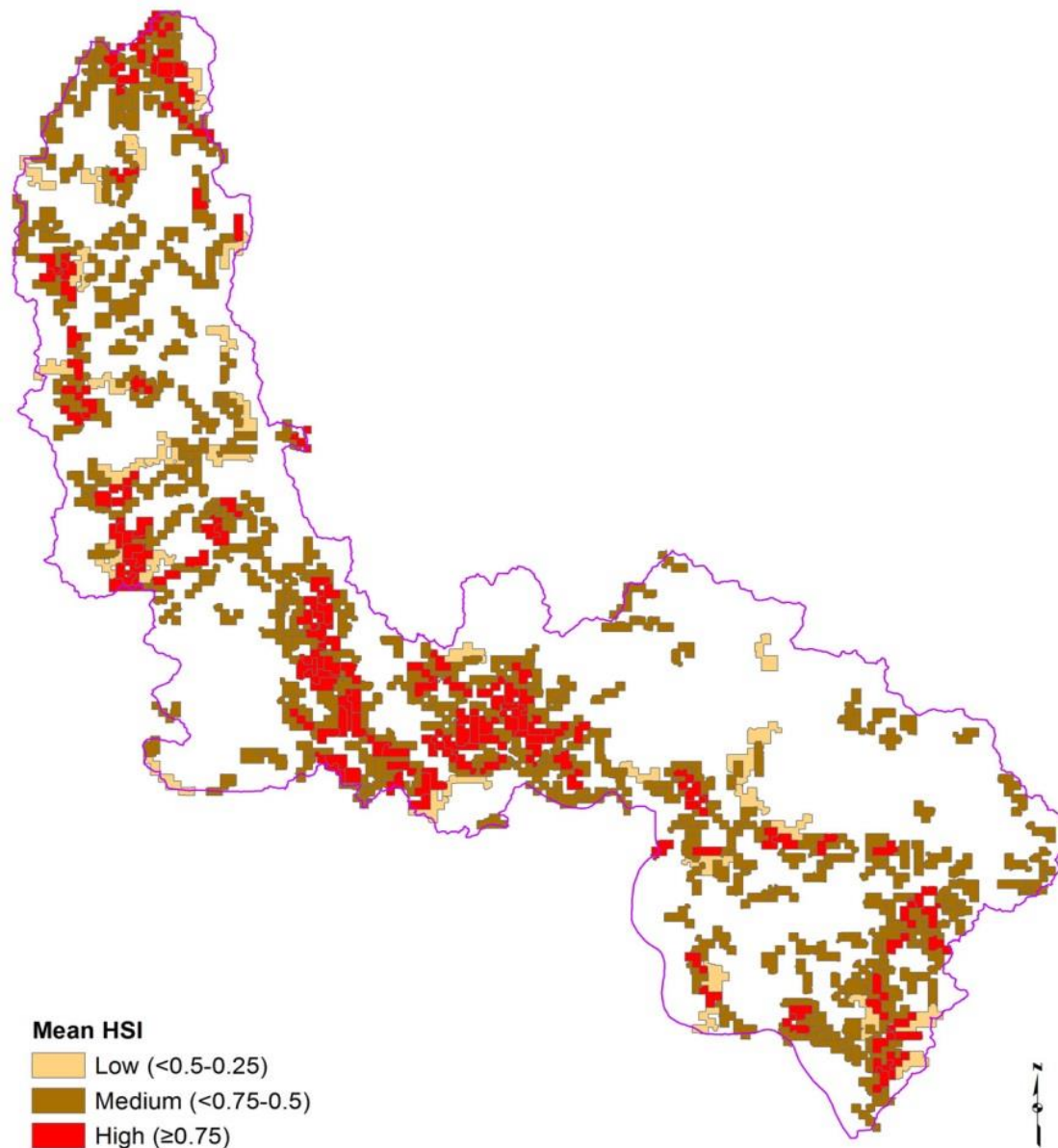
SWCC - Flammulated HSI - Step 6



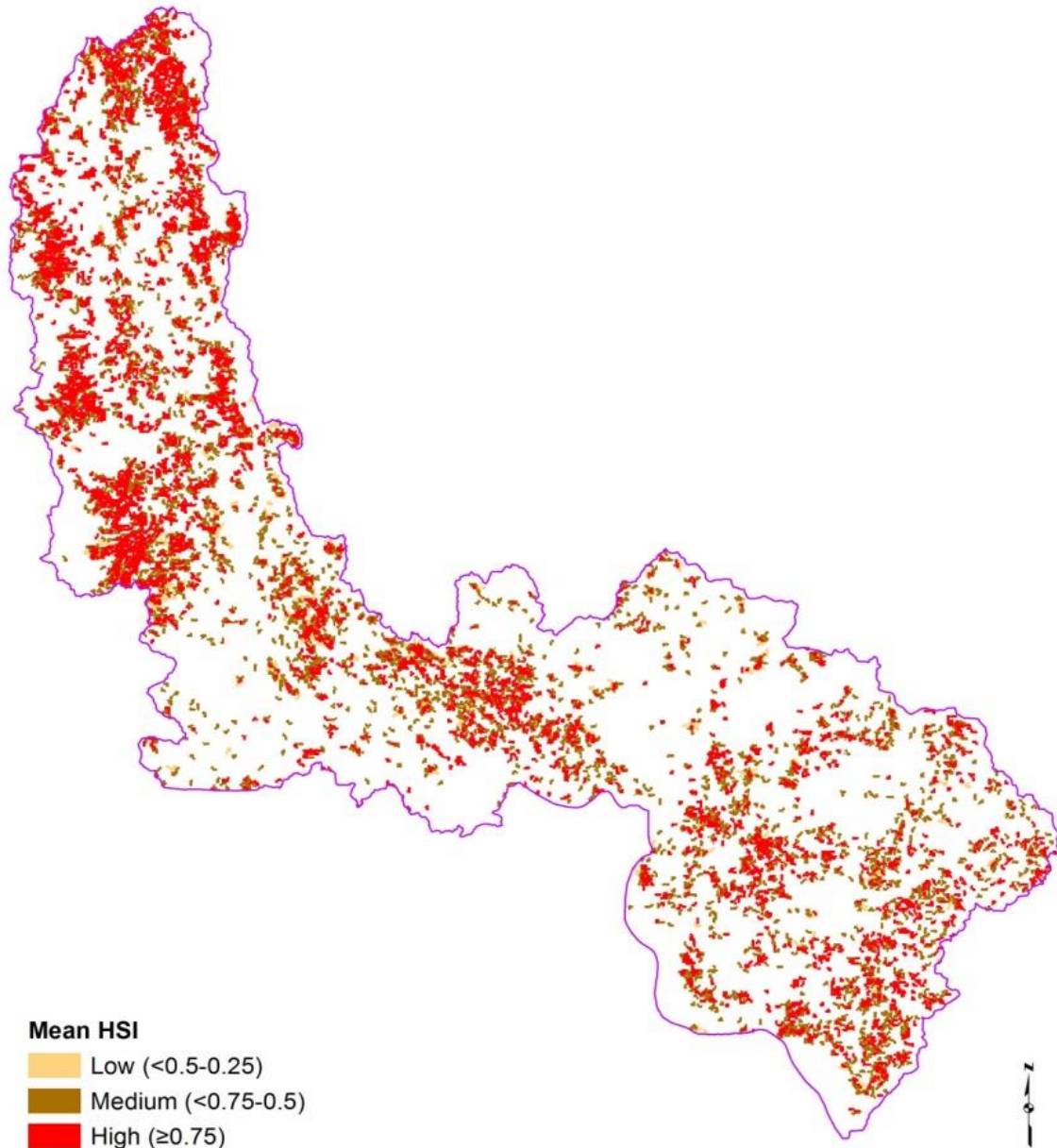
SWCC - Flammulated Home Range - Step 6



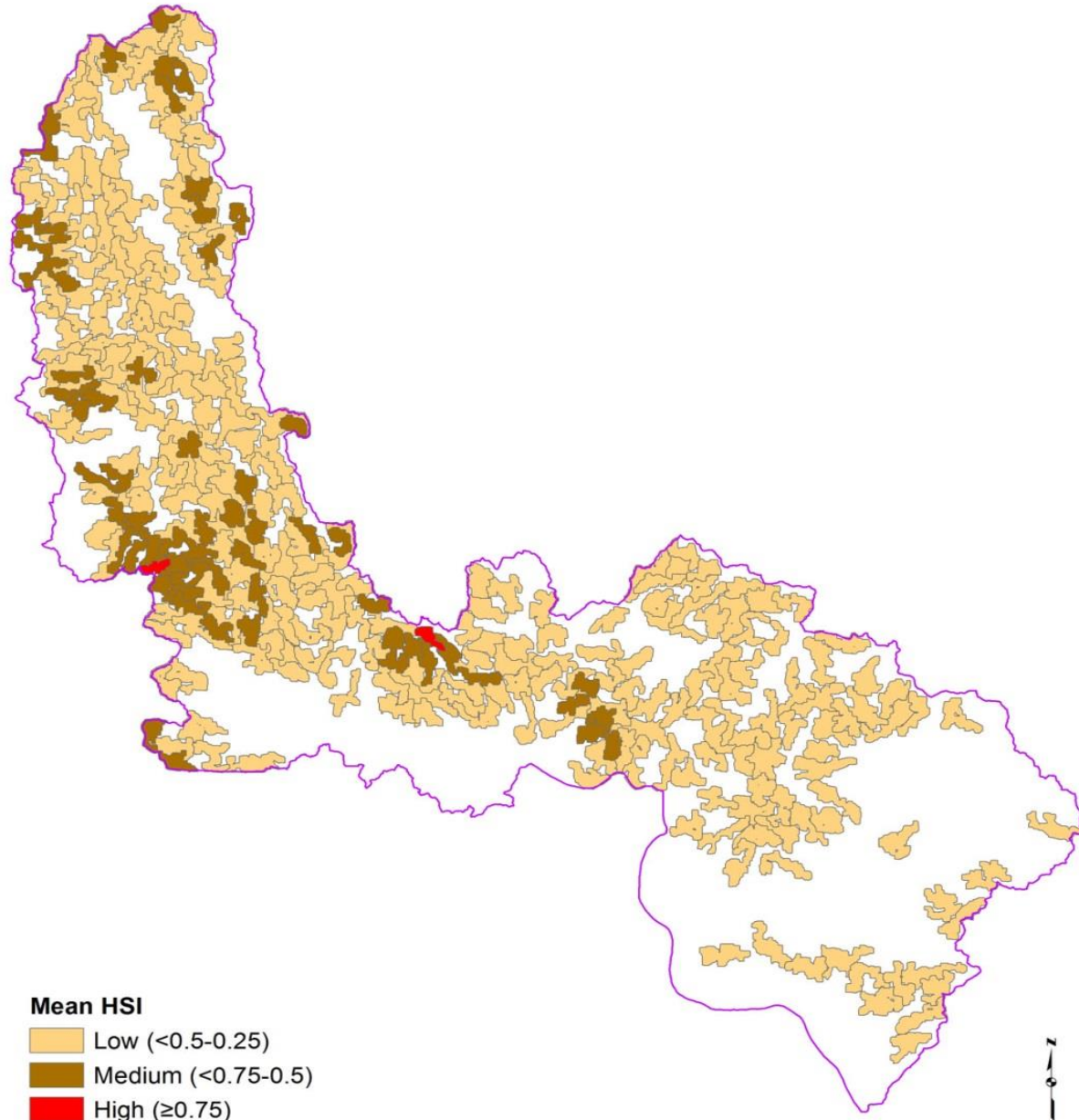
SWCC - Goshawk Home Range - Step 6



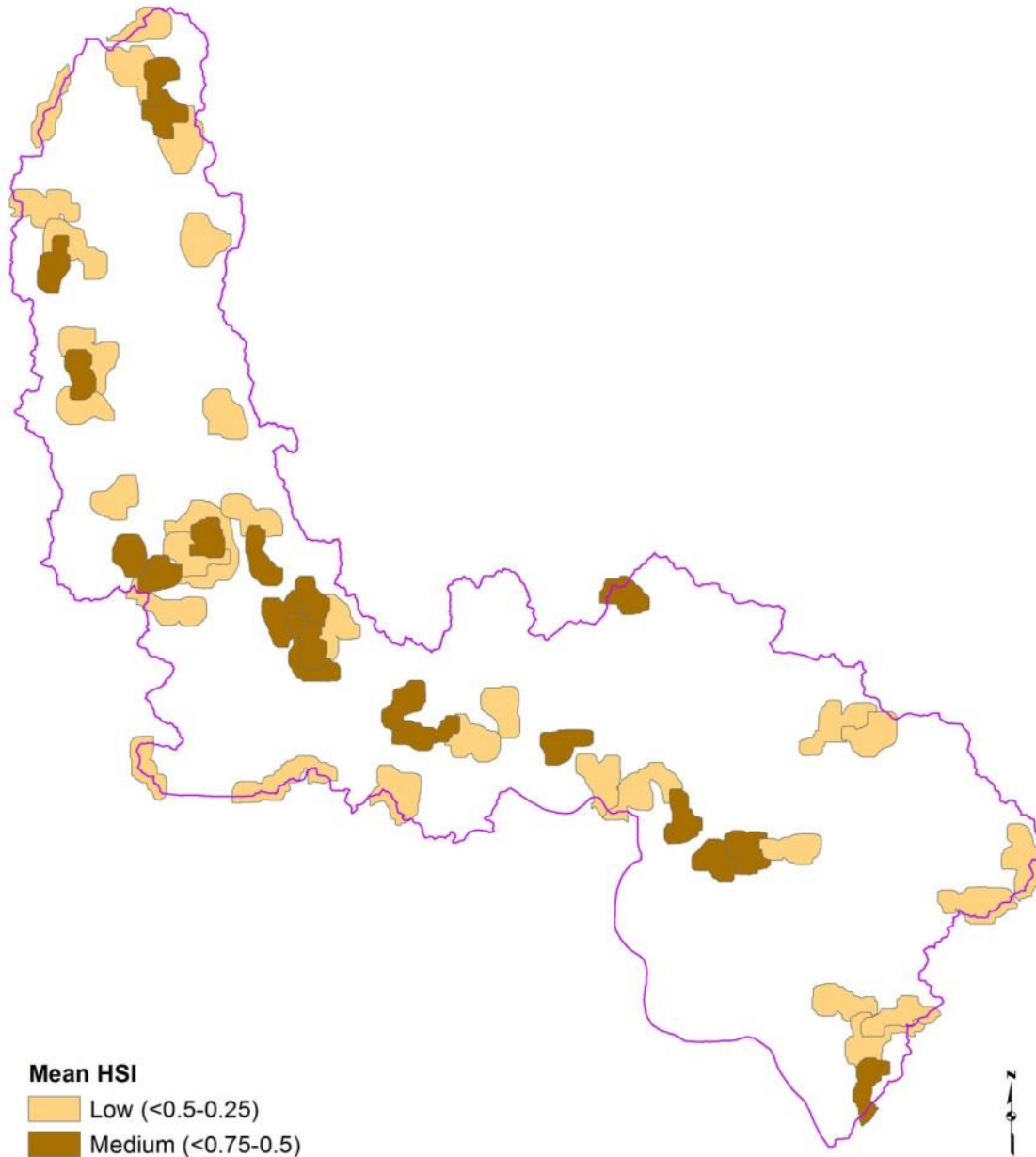
SWCC - Hairy WP Home Range - Step 6



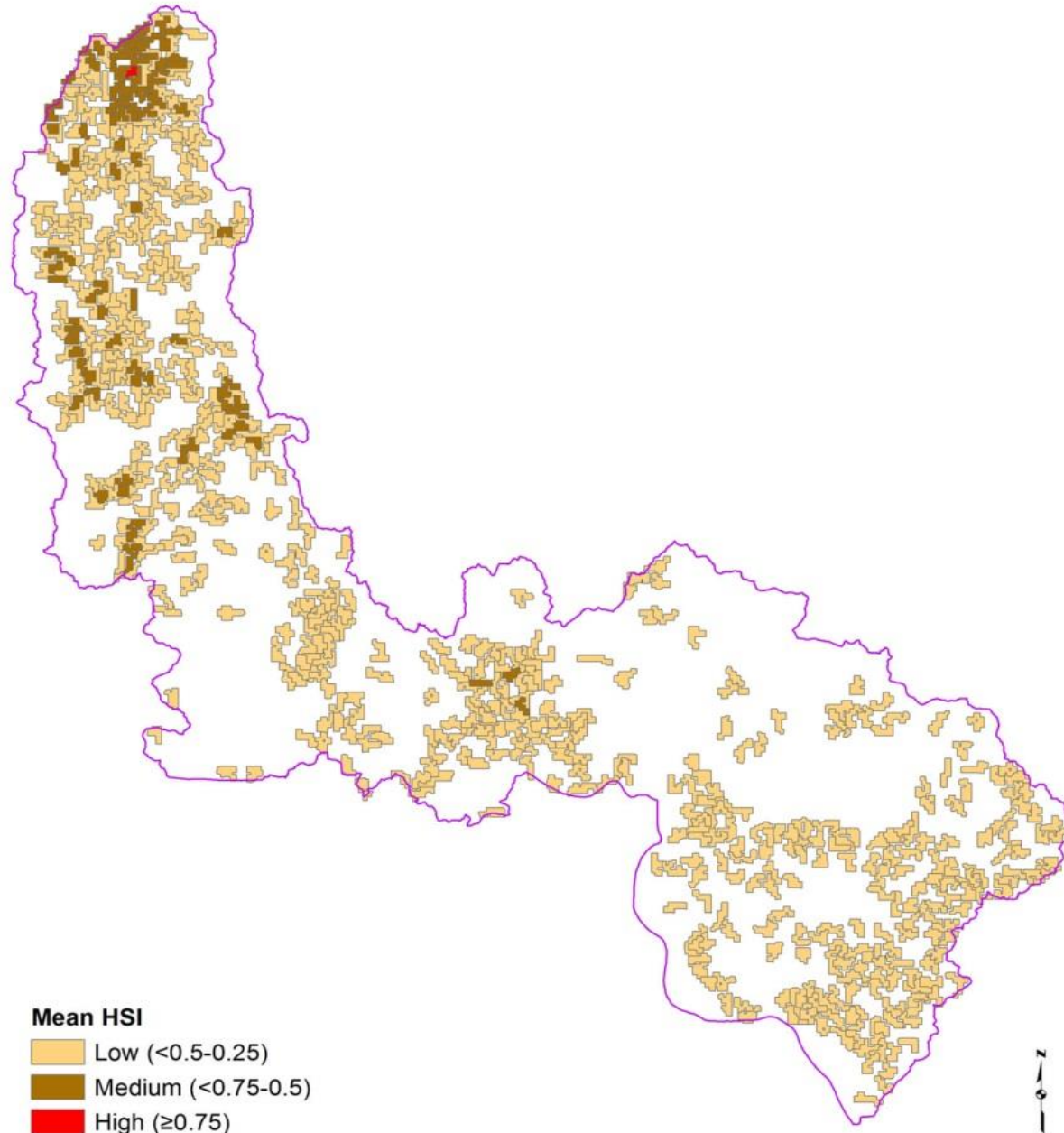
SWCC - Marten Home Range - Step 2



SWCC - Fisher Home Range - Step 6



SWCC - Pileated WP Home Range - Step 6



Species	Habitat Quality					
	High		Moderate		Low	
	Mean	95% CI ^a	Mean	95% CI	Mean	95% CI
Hairy Woodpecker	3451.0	232.2	1665.4	262.3	135.6	37.6
Flammulated Owl	38.6	8.0	1593.4	272.5	1660.4	119.3
Northern Goshawk	106.2	11.3	264.6	9.0	38.6	4.9
Pileated Woodpecker	0.4	0.7	52.0	13.4	503.6	20.9
Fisher	0.6	0.4	15.4	4.7	33.2	2.7
American Marten	2.4	0.4	59.0	8.0	239.6	8.2

^a CI - Confidence Interval

Conclusions

- Considerable variation in habitat variable, especially in VMAP classification categories
- Differences found between FIA estimates and sampled stands
- Existing conditions generally good except for fisher and to a lesser degree pileated woodpeckers
- Project demonstrates how variance can be used to estimate confidence intervals around habitat quality estimates