

Projects For Which Funding From FWHMF Has Ended

Original Title: Effects of Landscape-scale Forest Management on Pacific Marten Occupancy and Population Connectivity in Coastal Oregon

Investigators:

Dr. John Bailey, Associate Professor, FERM Department, Oregon State University (OSU)

Dr. Katie Moriarty, Postdoctoral Research Wildlife Biologist, USDA Forest Service, Pacific Northwest Research Station

Project Duration:

2014 –Completed non-invasive Pacific marten (*Martes caurina humboldtensis*) surveys in the landscapes within northern Coos, western Douglas, and western Lane Counties. Conduct initial analysis for Year-1 survey region and produce progress report.

2015 – Completed surveys in the southern Coos, northern Curry, Lincoln, Polk, Tillamook, and Yamhill Counties. Conduct final analysis, submit manuscript.

2016 – Provide edits for the peer-reviewed publication (Moriarty *et al.* 2016) and complete this final report.

Objectives:

1. Conduct systematic surveys for martens across a gradient in management intensities on private, federal, and state lands in the vicinity of two marten populations in coastal Oregon.
2. Deploy hair snares at all marten detection locations to non-invasively collect genetic material for individual identification and abundance estimation.
3. Collaborate with all marten survey efforts to assess distribution, and, as sampling allows, minimum population size and indices of abundance.

Summary of Accomplishments:

Carnivore surveys were conducted during 2015 at over 845 camera stations across the study area, providing >250,000 photographs. Our surveys included over 100 sample units (with 4 camera stations) for assessing distribution and over 200 sample units (with 2 camera stations) to evaluate detectability (jointly funded by the Oregon Forestry Industries Council, OFIC, Figure 1). In total, there were **908** camera or track plate surveys at 348 sample units. We have successfully accomplished one of the *largest* organized carnivore surveys conducted in the Pacific Northwest in a relatively short period (Figure 1D). Our 2015 work built on 87 sample units surveyed during summer 2014 (Figure 1B), and we significantly expanded the geographic extent and focus.

We created and executed three carnivore sampling protocols. Slauson and Moriarty (2014) mirrored prior efforts with Humboldt marten in northern California. Sample units were comprised of two devices (track plate or camera), one at a 2-km systematic grid point and the second at a riparian area or the oldest stand within 500m. Stations were operational for 21 days and checked every 3-4 days.

A revised protocol by Moriarty *et al.* (2015) was created for the OFIC detectability study, a partnered endeavor with Oregon State University and the statistical team at Weyerhaeuser. Two cameras per sample unit, one baited with 2 randomized treatments (bait type, height) and one unbaited or lured along a trail were surveyed for 21 days and checked weekly. The publication is in a final draft phase and is under review by our Weyerhaeuser collaborator (J. Thornton). We expect that it will be submitted for publication this calendar year. Although it was anticipated earlier, we included data from

scent detection dog teams and cost evaluation such that managers could assess survey methods more broadly.

Winter survey efforts informed a new protocol, executed during summer 2015. During summer 2015, we modified the Sierra Nevada Carnivore Monitoring Protocol that has been focused on fishers for >10 years (Truex et al. 2013, Zielinski et al. 2013). Sample units consisted of 4 remote cameras, 3 placed in formation similar to Truex et al. (2013) and one trail-based set. Stations were lured, baited with both chicken and catfood, and checked weekly. Sample units were >6km apart and in a random stratified design by access and forest age class. Our goal with the final protocol was to examine the distribution of martens in coastal Oregon.

We detected fisher (*Pekania pennanti*) at 9 sample units and marten at 36 sample units. We detected over 28 species in the Oregon Coast Ranges in 2015. We report the total number of photos (No. Photos), sample units with detections ($n = 277$ surveyed), and percent for each species or group. Data are ordered by class (carnivores, small mammals, other) and by percent of sample units with detections (Overall Percent), also published in Moriarty *et al.* 2016.

Species	FWHMF (%)	OFIC (%)	No. Photos	Sample Units	Overall Percent
Black Bear (<i>Ursus americana</i>)	81	23	23,995	106	47
Spotted Skunk (<i>Spilogale gracilis</i>)	54	41	16,777	106	47
Bobcat (<i>Lynx rufus</i>)	32	26	814	64	28
Grey Fox (<i>Urocyon cinereoargenteus</i>)	23	29	12,266	60	26
Opposum (<i>Didelphis virginiana</i>)	22	25	18,151	54	24
Pacific Marten (<i>Martes caurina</i>)	3	25	4316	36	16
Raccoon (<i>Procyon lotor</i>)	11	14	2195	29	13
Short-tailed Weasel (<i>Mustela erminea</i>)	7	8	304	17	7
Striped Skunk (<i>Mephitis mephitis</i>)	14	2	118	16	7
Domestic Dog (<i>Canis familiaris</i>)	0	11	269	15	7
Mountain Lion (<i>Puma concolor</i>)	11	3	197	14	6
Fisher (<i>Pekania pennanti</i>)	10	0	803	9	4
Coyote (<i>Canis latrans</i>)	4	4	83	9	4
Long-tailed Weasel (<i>Mustela frenata</i>)	4	1	31	5	2
House Cat (<i>Felis catus</i>)	0	2	25	3	1
Ringtail (<i>Bassariscus astutus</i>)	0	2	117	2	1
Mice and Voles (<i>Peromyscus</i> , <i>Myodes</i> , <i>Microtus</i>)	67	61	13,689	144	63
Douglas Squirrel (<i>Tamiasciurus douglassii</i>)	51	53	2128	118	52
Chipmunk (<i>Tamias</i> spp.)	65	29	6082	99	44
No. Flying Squirrel (<i>Glacomys sabrinus</i>)	47	23	1058	75	33
Woodrat (<i>Neotoma</i> spp.)	26	11	3381	39	17
Cottontail (<i>Sylvilagus</i> spp.)	23	8	1217	33	15
California Ground Squirrel (<i>Otospermophilus beecheyi</i>)	6	0	272	6	3
Gray Squirrel (<i>Sciurus griseus</i>)	0	5	27	6	3
Golden-manteled Ground Squirrel (<i>Callospermophilus lateralis</i>)	2	0	9	2	1
Birds	82	63	20,814	161	71
Deer (<i>Odocoileus</i> spp., <i>Cervus</i> spp.)	70	29	4880	104	46

The combination of the OFIC effort paired with the FWHMF marten distribution surveys were submitted to the Northwest Naturalist in December 2015 and published this fall (Moriarty *et al.* 2016). Title: Distribution of Pacific marten in coastal Oregon. Authors: Katie M. Moriarty, John D. Bailey, Sharon E. Smythe, and Jake Verschuyf.

Acknowledgement section: **“Survey efforts were largely funded by the Oregon State University Fish and Wildlife Habitat in Managed Forests Research Program** and the National Council for Air and Stream Improvement. The Oregon Forestry Industry Council funded surveys within 5-km of prior locations. USDA Forest Service, Pacific Northwest Research Station funded data management and provided external support. Additional surveys were conducted by Hancock Forest Management, Plum Creek, USDA Forest Service (USFS) Siuslaw National Forest, Oregon Department of Forestry, and the Confederated Tribes of Siletz Indians of Oregon. Considerable aid with field logistics, vehicles, housing, and equipment was provided by the US Fish and Wildlife Service, Salem District Bureau of Land Management (BLM), USFS Rogue River-Siskiyou and Siuslaw National Forests, Weyerhaeuser, Hancock Forest Management, and USFS Region 6 Regional Office. We obtained private land access or surveys were completed by trained staff within the ownership for all randomly selected survey points – thanks to Plum Creek, Weyerhaeuser, Hancock Forest Management, Starker Forests, and Roseburg Timber for access or data. Thanks to Keith Slauson, Pacific Southwest Research Station, who assisted during the 1st year with study design and explaining California protocols. Extreme thanks to all field crew leaders (S Smythe, M Linnell, B Peterson, GW Watts, J Bakke, C Shafer, K Kooi, and M Penk) and team members (D Baumsteiger, M.Cokeley, J Ellison, P Iacano, A Kornak, T McFadden, E Morrison, A Palmer, N Palazzotto, S Roon, S Riutzel, C Scott, R Smith, T Stinson, and M Williams).”

The field team above consisted of Oregon State employees, students, and the employees from Hancock Timber and Plum Creek that helped with the surveys.

Problems, Barriers, Proposed Changes to Objectives:

We changed our 2014 protocol and our plan from the original proposal given the lack of initial detections. Instead of continuing to survey martens along a gradient of forest types, we prioritized to simply evaluating the distribution of martens in coastal Oregon. This shift to a large-scale distribution survey required additional crew members, time, and funding. We consulted with our collaborators about the change in focus and revised protocols, and we obtained funds from the NCASI to supplement our efforts.

We therefore have neither the positive marten occurrence data nor additional funding/time to conduct home range analyses on vegetation composition and forest management configuration as originally proposed. We detected martens at two locations near the South Coast population and one location in the Central Coast survey during the 2014 and 2015 work from this grant. A model based from two positive occurrences (detection sites) and over 500 negative occurrences would, of course, not be representative of the conditions in which martens persist. We detected martens during surveys funded by the OFIC, but that study design was not randomized across the gradient of forest types. The OFIC detectability surveys were solely conducted within known marten populations and may not be representative of all home range and landscape conditions (but see Planned Work).

Planned Work:

N/A. A publication has been completed from this grant. However, in terms of future direction for related research, there are four efforts that are in progress:

1. We have collected fine-scale vegetation data and aim to compare between marten locations and northern spotted owl habitat expectations. Vegetation data were collected at a combination of locations in which martens have been detected (e.g., scat dog, telemetry). This work was funded by NCASI. Dennis Rock (NCASI) and his team completed the surveys by September 2016, 395 vegetation plots were planned. The data are being entered currently. We hope to prioritize these analyses in the very near future (J. Verschuyf and K. Moriarty, personal communication).
2. Charlotte Eriksson, a visiting scholar, has completed her masters on small mammal diversity and abundance in the Central Coast dunes (Eriksson 2016). She is currently using novel metabarcoding methods to evaluate marten diet and will be comparing diet versus available and potentially adding other camera data. She is being mentored by Dr. Taal Levi and Moriarty.
3. Mark Linnell and Moriarty finished GPS telemetry surveys during fall 2015 in the Central Coast dunes. Eleven martens were radio collared. Movement data, density, and minimum population size are being estimated.
4. Scat detection dog surveys have been funded by FWHMF in southern Oregon (see other report). In addition, Coos Bay BLM will be conducting detection dog surveys. With the combination of surveys, we hope to collect scats in the coast, Klamath-Siskiyou mountain range, and southern Cascades – focusing on fisher, marten, bobcat, and lion. NCASI funded meta-barcoding to evaluate diet and move forward to describing potential limiting factors for fisher and marten in Oregon. Field work will occur during 2017. Genetic analyses should be finished within 8 months following scat collections.

Comprehensive Summary:

These data will be used to inform the USFWS for listing petitions and decisions, although it is uncertain what the current state is within the agency. The USFWS was sued by the Center of Biological Diversity and partners during December 2015. It is unknown how agencies are using data, but we have provided timely peer-reviewed information as to the current status of martens in coastal Oregon.

These distribution data (Moriarty et al. 2016) have been the foundation for fisher and marten surveys in coastal Oregon (see Planned work). As of summer 2016, we surveyed 348 sample units using a total of 72 track plate and 908 remote camera stations for greater than 14 days each within a 25,330 km² area, yielding 355,018 photographs. Martens were detected (photographs, tracks, or genetically verified hair samples) at 72 sample units. We detected 28 individual martens in coastal Oregon using a combination of genetic confirmation and captured individuals. Marten observations were clustered in the Central and South Coast regions, suggesting existing populations have persisted since published observations prior to 1998. We did not locate new populations despite an extensive effort to survey new areas, but did learn a unique population exists in the coastal dunes of Central Oregon.

Undergraduate Engagement in Project:

We provided research experience and internships for four OSU undergraduates and one former undergraduate during 2014. In 2015, we worked with four recent OSU graduates (2 MS and 2 BS students) and two BS students from other institutions (Humboldt State and Paul Smith College). In addition, we are collaborating with a visiting scholar from Sweden (focusing her masters on small mammal abundance and diversity). Research experience consisted of training by multiple agencies

(Weyerhaeuser, Hancock Timber, BLM, and USFS) regarding field safety, participating in the field survey, and data management activities.

Undergraduate student participants from OSU included: Erin Morrison (female, senior status), Thomas Stinson (E-campus student, Fisheries emphasis, male junior status), Jordan Ellison (female, senior status), Corwin Scott (male, junior status), and Allen Palmer (male, senior status).

List of Presentation and Publications:

Presentations with these data:

- Moriarty, K.M., M.A. Linnell., B.R. Barry. 2017. Distribution to Density: updates regarding coastal marten and fisher in Oregon and Washington. Western Section-TWS Annual Conference, Reno, NV.
- Moriarty, K.M., Golding, J. and many others. 2017. Assessing surveying methodologies to address information gaps for forest carnivores. Oregon Forest Carnivore Working Group. (January).
- Moriarty, K.M., Golding, J. and many others. 2016. Assessing surveying methodologies to address information gaps for forest carnivores. USDA Forest Service and Association of Fish and Wildlife Agencies Monthly Webinar Series (November).
- Moriarty, K. M., S.M. Matthews, T. Levi, J. Thornton, J.D. Bailey, M.A. Linnell, B.R. Barry. 2016. Update and considerations for marten and fisher monitoring. Oregon-TWS Annual Conference, Forest Carnivore Meeting, Seaside, OR.
- Moriarty, K. M., S.M. Matthews, T. Levi, J. Thornton, J.D. Bailey, M.A. Linnell, B.R. Barry. 2016. If we build it, will they come? Considerations for marten and fisher monitoring. Oregon-TWS Annual Conference, Seaside, OR.
- Watts, G.W. III, K.M. Moriarty, and M.A. Linnell. 2016. Comparing the cost-effectiveness and reliability of scent detection dogs and remote cameras for sampling coastal martens in Oregon. Poster. Western Section-TWS Annual Conference, Pomona, CA. (largely funded by OFIC)
- Moriarty, K.M., J.D. Bailey. 2015. Humboldt marten update. NCASI barbeque and campout ~40 representatives from all land ownerships and all regional projects (e.g., ODFW, BLM Region and districts, USFS R6 and districts, USFWS Roseburg, Hancock Timber, Plum Creek, Weyerhaeuser). 2 day meeting with 45 minute presentation.
- Moriarty, K.M., G.W. Watts. 2015. Humboldt marten ecology and knowledge. Dunes field trip with 9 representatives from local land ownerships dunes restoration (e.g., USFWS, Siuslaw National Forest, Central Coast Ranger District (Ranger, district biologist and staff), R6 Ecologist). Full day meeting with continuous marten discussions.
- Moriarty, K.M., K.M. Slauson, J.D. Bailey. 2014. Humboldt marten update – collaborative efforts and future strategies. U.S. Forest Service Region 6 Wildlife Program Managers Meeting. Green Springs, Oregon.
- Moriarty, K.M., K.M. Slauson, J.D. Bailey. 2014. Humboldt marten update – collaborative efforts, future strategies, and resource needs. National Council for Air and Stream Improvement (NCASI) West Coast Regional Planning Meeting. Vancouver, Washington.

Publications or official reports:

- Eriksson, C. 2016. Martens in a novel habitat - the importance of prey and habitat structure. M. S. thesis, Lund University. Lund, Skåne, Sweden.
- Moriarty, K. M., J. D. Bailey, S. E. Smythe, and J. Verschuyt. 2016. Distribution of Pacific marten in coastal Oregon. *Northwestern Naturalist* 97:71-81.

Literature cited:

- Eriksson, C. 2016. Martens in a novel habitat - the importance of prey and habitat structure. M. S. thesis, Lund University. Lund, Skåne, Sweden.
- Moriarty, K. M., J. D. Bailey, S. E. Smythe, and J. Verschuyt. 2016. Distribution of Pacific marten in coastal Oregon. *Northwestern Naturalist* 97:71-81.
- Moriarty, K. M., M. A. Linnell, J. Thornton, and J. D. Bailey. 2015. Humboldt marten detectability protocol Oregon State University, Unpublished protocol: 6.
- Slauson, K. M. and K. M. Moriarty. 2014. Determining the distribution and size of Humboldt marten populations in coastal Oregon: survey design and field survey protocol. Humboldt Marten Working Group, Unpublished Protocol:
- Truex, R. L., J. M. Tucker, J. S. Bolis, J. J. Vale, and S. J. Hegg. 2013. Forest carnivore monitoring protocol: phase II. Sierra Nevada Forest Plan Amendment Strategy Report.:
- Zielinski, W. J., J. A. Baldwin, R. L. Truex, J. M. Tucker, and P. A. Flebbe. 2013. Estimating trend in occupancy for the southern Sierra fisher *Martes pennanti* population. *Journal of Fish and Wildlife Management* 4:3-19.

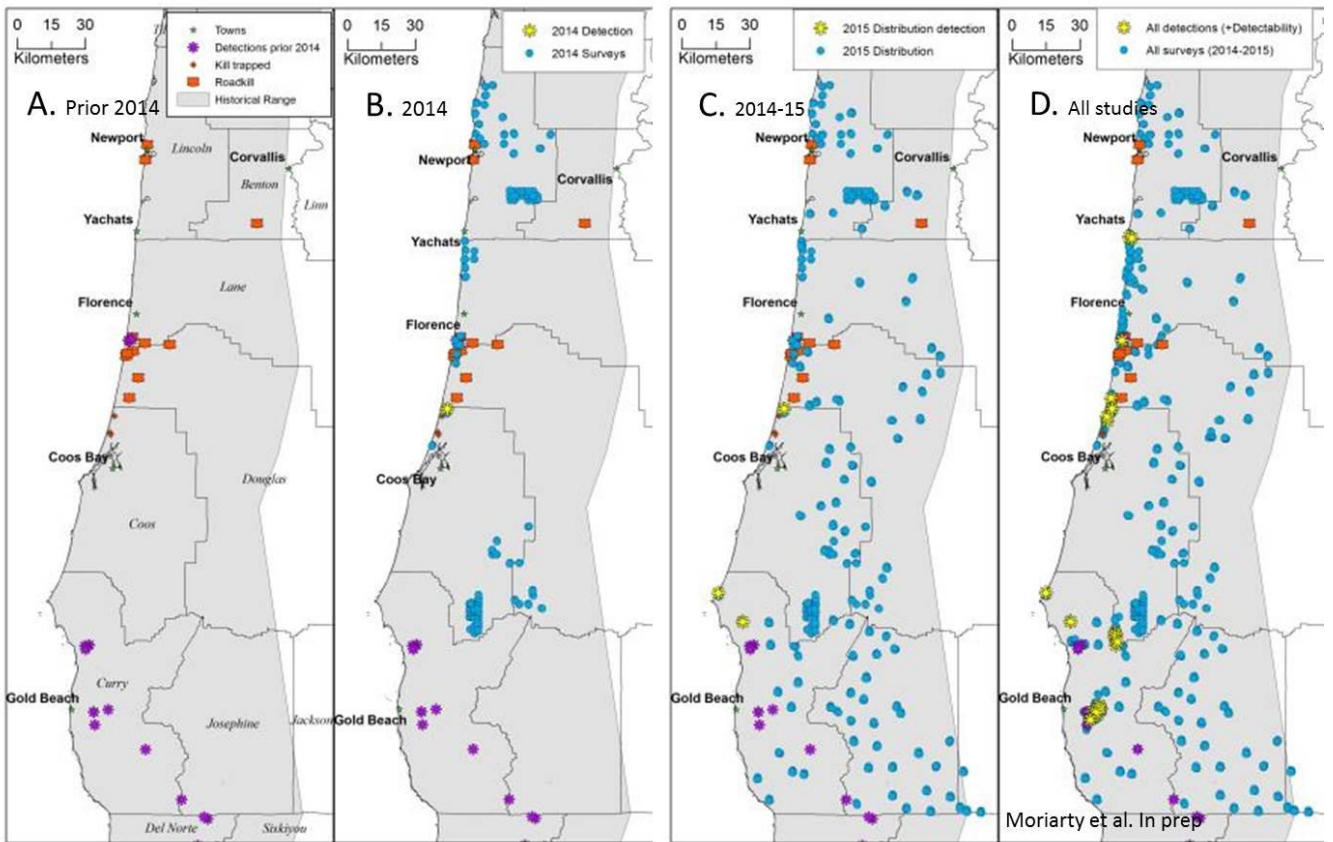


Figure 1. Humboldt marten (*Martes caurina humboldtensis*) distribution map. **A)** Verified locations before included 14 road kill (red highway symbols), 3 legal kill trap records (red bullseye) and 9 locations from surveys (purple stars). **B)** Teams surveyed 87 sample units (blue) in 2014 for 21 days using the Slauson and Moriarty (2014) protocol with two stations per sample unit, one on a systematic point and one near a riparian area or the oldest stand within 500m. A single marten was detected (yellow star) during fall surveys sponsored by the Siuslaw National Forest and Hancock. **C)** Teams surveyed over 100 sample units for 15 days using the Moriarty et al. (2015) protocol sympatric with Sierra Nevada Carnivore Monitoring, each sample unit consisted of 4 remote cameras, 3 in a triangle and 500m apart and one along a trail >75m from a station. Two martens were detected (yellow stars). **D)** All surveys completed in 2014-2015 (blue, some still in progress and to be added) and all detections (yellow stars). This includes the OFIC sponsored detectability study with greater than 200 sample units and 400 camera stations surveyed for 21 days as well as scat detection dog (Conservation Canines) verified locations. With all efforts combined, martens have been detected at 72 locations with new locations verified weekly with current efforts in the Central Coast population.