Title: 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 –Complete 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 –Complete surveys in the southern Coos, northern Curry, Lincoln, Polk, Tillamook, and Yamhill Counties. Conduct final analysis and complete 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 Humboldt 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 over 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). Although we await data from our collaborators as well as a backlog of photo processing, we have successfully accomplished one of the largest organized carnivore surveys conducted in the Pacific Northwest in a relatively short period (Figure 1D). Our work builds 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 by 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.
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. 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.

During 2015 we detected fisher (*Pekania pennanti*) at 5 sample units and Humboldt marten at 2 sample units. Field data revealed black bear (39% of 569 stations evaluated), spotted skunk (18%), grey

fox (10%), fisher (3%), bobcat (3%), mountain lion (2%), and marten (1%). Small mammals were also detected, such as mice (19%), grey squirrels (14%), Douglas squirrels (10%), and flying squirrels (6%). Not all species are reported or compiled here, and these numbers are preliminary. Two cameras were damaged by bear and 3 were stolen.

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 (NCASI). 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 were provided by the U.S. 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 ownerships, for all randomly-selected survey points – thanks to: Plum Creek, Weyerhaeuser, Hancock Forest Management, and Roseburg Timber for access and/or data. Thanks also to all field crew leaders (Sharon Smythe, Mark Linnell, Bryce Peterson, G. Wes Watts) and crew members (Dennis Baumsteiger, Marinda Cokeley, Jordan Ellison, Peter Iacano, Erin Morrison, Allen Palmer, Sean Roon, Corwin Scott, Thomas Stinson, Matthew Williams).

Problems, Barriers, Proposed Changes to Objectives:
We changed our protocol and our plan from the original proposal given the lack of initial detections in 2014. 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. With a combination of use-only data, or locations in which martens have been detected (e.g., scat dog, telemetry), we hope to collect fine-scale vegetation data and compare that with northern spotted owl habitat expectations. This proposal has been submitted to NCASI for the upcoming season (J. Verschuyl and K. Moriarty, personal communication).

Planned Work:
This work will be submitted for publication and as a final report. We aim for completion during late 2015 and early 2016.

Additional planned or current projects have been made possible by our continued efforts:

- Will northern spotted owl habitat suffice for Humboldt marten? (Verschuyl, Moriarty, Kroll, Rock)

- Humboldt marten use of dune ecotypes (Linnell, Moriarty; in progress)
- Small mammal indices of abundance and diversity in Humboldt marten coastal habitat types (Eriksson, Levi, Moriarty; in progress)

Comprehensive Summary: Not applicable –concluding in 2015.
These data will be used to inform the USFWS for listing petitions and decisions. Marten surveys have also been used heavily by the Siuslaw National Forest during their current dune restoration efforts.

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: Although we do not plan to give any data-related presentations or publications until the completion of all related field work, this project has provided opportunities to update forest managers and biologists with the aim of facilitating additional collaboration and efforts regarding this species petitioned for Federal listing.

Presentations:

Moriarty, K.M., J.D. Bailey. Jul 24-25, 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. Aug 19, 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. Oct. 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. Sep. 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 in preparation:

Moriarty, K. M., S.E. Smythe, and J.D Bailey. *In prep, Dec 15 goal*. Distribution of Humboldt marten in coastal Oregon.

Moriarty, K. M., M.A. Linnell, J. Thornton, G.W. Watts, and J.D. Bailey. *In prep, Dec 15 goal*. Carnivore detectability influenced by season, bait type, bait height, and survey method: a case study with elusive martens.

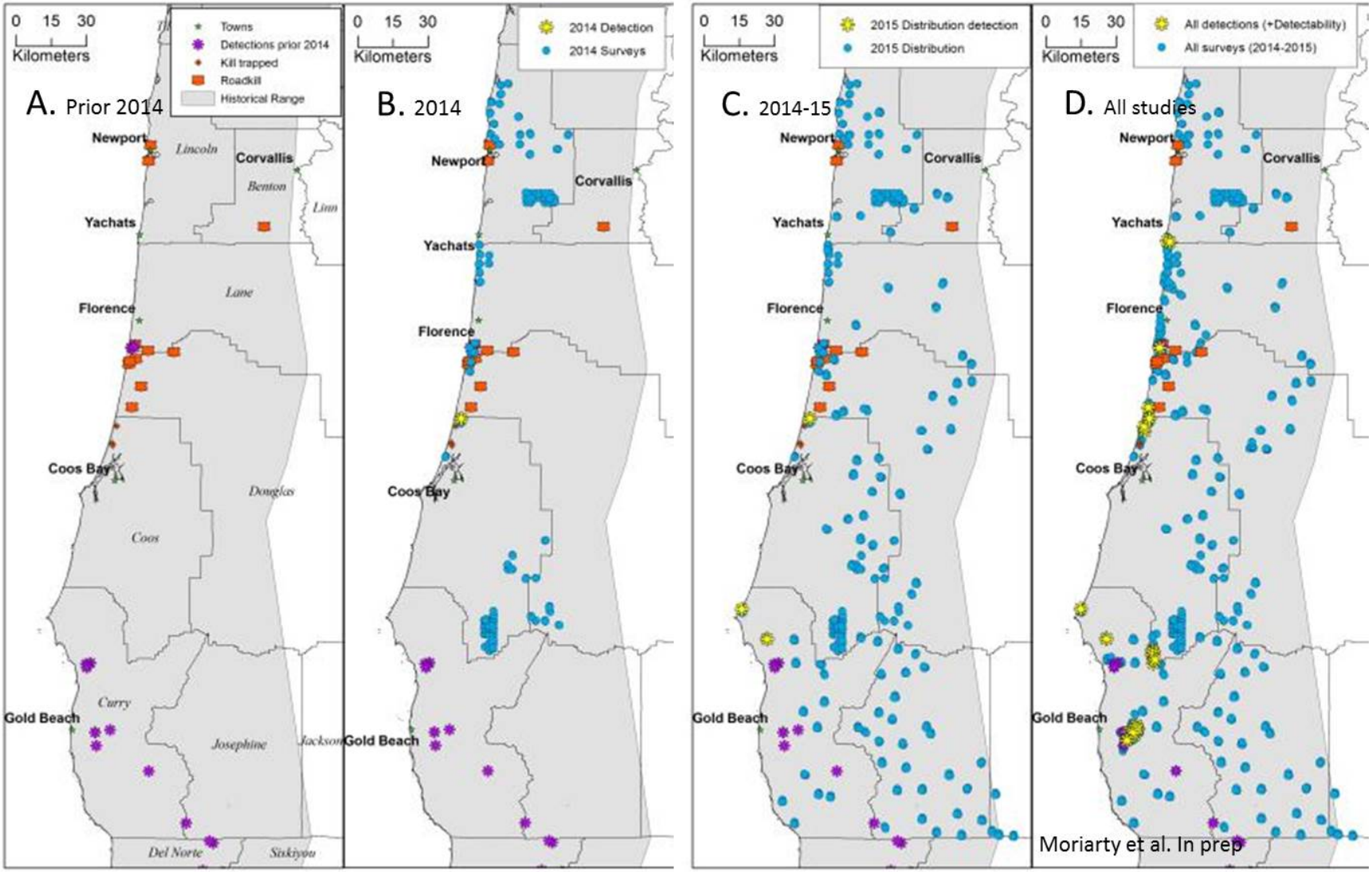
Literature Cited:

MORIARTY, K. M., M. A. LINNELL, J. THORNTON, AND J. D. BAILEY. 2015. Humboldt marten detectability protocol Pp. 6, Oregon State University, Unpublished protocol.

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.


A. Prior 2014
B. 2014
C. 2014-15
D. All studies
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Kilometers
Towns
Detections prior 2014
Kill trapped
Roadkill
Historical Range
2014 Detection
2014 Surveys
2015 Distribution detection
2015 Distribution
All detections (+Detectability)
All surveys (2014-2015)
Newport
Corvallis
Yachats
Florence
Coos Bay
Gold Beach
Lincoln
Benton
Linn
Lane
Douglas
Coos
Curry
Josephine
Jackson
Del Norte
Siskiyou
Moriarty et al. In prep

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 >30 locations with new locations verified weekly with current efforts in the Central Coast population.