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Project Title:

Balancing fuel considerations and rare carnivore habitat: an evaluation of risk and reward

Project # (leave blank; to be assigned by EMC)

Principal Investigator(s): Katie Moriarty with participation and assistance from Dr. Holly Munro and potential assistance from Dr. Lisa Ellsworth (not currently committed, email excluded)

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Name(s) and Affiliation(s) of Collaborator(s): Keith Hamm, Wildlife Biologist, Green Diamond Resource Company; Sal Chinnici, Wildlife Biologist, Mendicino & Humboldt Redwood Company

Research Theme(s), Critical Monitoring Question(s), and Rules or Regulations Addressed.

Theme 6: Wildfire Hazard

Are the FPRs and associated regulations effective in…

a) treating post-harvest slash and slash piles to mitigate fuel hazard, modify fire behavior and reduce wildfire risk?
b) treating post-harvest slash while retaining wildlife habitat structures, including snags and large woody debris?
c) managing fuel loads, vegetation patterns and fuel breaks for landscape-level fire hazard reduction and risk mitigation?
d) **managing forest structure and stocking standards over time to promote and maintain wildfire resistance and resilience? (Thematic question for Fiscal Year 2023/2024 funding).**

Theme 9: Wildlife Habitat: Cumulative Impact

Are the FPRs and associated regulations effective in …

a) protecting wildlife habitat and associated ecological processes?
b) avoiding significant adverse impacts to wildlife species?

Theme 10: Wildlife Habitat: Wildlife Habitat: Structures

Are the FPRs and associated regulations effective in retaining …

a) a mix of stages of snag development that maintain properly functioning levels of wildlife habitat?

Project Description:

Project Duration (Years/Months): If considered, we propose 3 levels of potential engagement.

Option 1: Vegetation surveys and analysis with pre-existing data: **1 year** with data collection during May-August 2025 and data summary/analyses September-December 2025. Estimated cost $60,000 for crew of 3 salary for 3 months and analysis.

Option 2: Collection of fisher location data and vegetation surveys and analyses: **1.5 years.** Estimated cost $150,000 for crew of 4 salary for 9 months, 6 GPS collars, and analysis.

Option 3: Either field option with additional landscape-level modeling of fire risk with the retention of large slash piles: concurrent timeline through the Ellsworth lab but additional funding would be needed. An additional $25,000 for salary of a graduate student would go towards fire modeling.

Background and Justification:

California has recently experienced catastrophic wildfires, which have devastated communities and public and private forests, leading to substantial economic costs and impacts to sensitive species. To inform the increased scale and pace at which land managers need to address the wildfire crisis, we propose to focus on opportunities to inform strategic fuels reduction prescriptions that minimize disturbance to forest-dependent species and their habitat. Protecting small populations while balancing the need to manage or treat forests has been difficult for both land managers and regulatory agencies. Unfortunately, broadly defining fire risk strategies across California may inadvertently negatively influence small populations in naturally fire resilient forests.

We propose to evaluate vegetation and fuel conditions in areas used by two rare species. Our goal is to evaluate tradeoffs of retaining or promoting both dense vegetation and coarse woody material that may benefit wildlife species with the risk and challenge of increasing fire risk in increasingly more common hot and dry weather conditions.

Objectives and Scope:

We propose 2 objectives with an opportunity to expand depending on funding: (1) describing the fine-scale vegetative conditions used by two rare forest carnivores [Humboldt marten (*Martes caurina humboldtensis*) and Pacific fisher (*Pekania pennanti*)] to inform vegetation strategies within fuel treatments or proposed habitat retention areas and (2) broadly modeling fire risk including retention of slash piles in managed forests which may be considered habitat. Our scope would be within the redwood belt of coastal northern California, an area with a maritime climate that may allow for increased habitat retention with minimal impacts to predicted fire risk compared to drier and warmer regions of California. If funding allows, we could enhance our first objective by live-capturing and collaring fishers with fine-scale GPS units to further investigate their use of slash piles and other features. This work would address complicated questions as to whether and how to best promote wildlife habitat in a unique geographic area.

Timeframe: 1-2 years depending on funding.

Research Methods:

To quantify vegetation selection characteristics relevant to these rare forest specialists, we will randomly select a subset of locations known used by martens and fishers for our reference sites and pair each with a random location within 7 km, which is an averaged daily distance for either species. For each species, we will prioritize known resting or denning locations, then areas of foraging based on detection dog team surveys, and lastly may consider recent camera detections to obtain a relevant sample. We have collected GPS data from coastal Humboldt martens since 2020, providing 100s of resting locations in California (see methods in Hance et al. 2021, Movement Ecology). We have also identified both marten and fisher locations using scat detection dog teams, which can provide ecologically relevant locations for these elusive species. Specifically, we conducted paired searches in areas with large slash piles and in adjacent forest. A similar method could be employed on collaborator properties (Humboldt and Mendicino Redwood Company, Green Diamond Resource Company).

Fire risk and potential treatments remove often understory vegetation and lower limbs (ladder fuels). At each location (used/random), we will quantify canopy cover, basal area, snag density and size class, and woody material. Similar to Forest Inventory Analysis plots, we will establish three 18 meter (59.05 feet) transects at 30°, 150°, and 270° bearings. Along these transects we will be recording canopy cover, horizontal cover, shrub and small tree cover, and assess woody volume, including large log volume and slash. To measure horizontal cover and obstruction relevant to martens and fishers, we will use a modified Robel pole method (Robel et al., 1970, Bello et al. 2001, Toledo and Herrick 2010).

To measure fuels, we will be using an abbreviated version of the procedure described in Brown (1974). Within the first 1.8m, wood pieces under 0.6cm and 0.6cm-2.5cm diameter that intersect sub-transect will be tallied. Within the first 3m, we will additionally tally woody material between 2.5 and 7.6cm diameter. Throughout the total length of 18m, "logs" over 7.6cm diameter will be tallied, along with their length, diameter, and condition. This equates to 54m of log or large woody debris intersection, 18m of small wood, and 10.8m of small fire prone material tallied per plot. Debris depth will be measured at three points per sub-transect by inserting a meter stick through the debris and measuring from the highest point of the debris and down past the litter layer to the duff below.

We will use decision trees to evaluate fine-scale vegetation use of marten resting and denning locations. Decision trees and other supervised machine learning approaches (e.g., random forest) attempt to model the relationship between a response and its predictors and offer powerful alternatives to traditional ecological modeling approaches (e.g., generalized linear models; De'ath and Fabricius 2000, Olden et al. 2008). We will build decision trees by incorporating plot-level data into a boosted C5.0 algorithm using the same methods reported within Delheimer et al. (2023). Vegetation data describing selection of martens and fishers will be analyzed by Dr. Munro.

If this project was selected for a full proposal, we envision one of 3 options described in the timeline section. All options focus on addressing aspects in Themes 6, 9, and 10.

If we were to focus on collecting vegetation and fuel data at known and random locations and analyzing selection (option 1), we would address Themes 9 (Wildlife Cumulative impacts) by providing direction to promote and not adversely affect wildlife species, 10 (Wildlife structures) by evaluating the prevalence and type of structures used. We would directly address Theme 6 by describing use of post-fire slash as habitat structures (or the lack thereof) and by describing the vegetation and fuel aspects selected for by species.

If we were to increase geographic scope and focus on both coastal martens and fishers, we would address the same themes. Fishers appear much more likely to use slash piles compared to martens. It would be a boon to identify fisher movement and use in similar and extended areas compared to coastal marten.

Lastly, these data are difficult to collect and often not fully utilized. Here, we aim to increase collaborations and model fire risk potential – both locally with increases in slash pile occurrence and broadly on the landscape. Here (option 3), we would need new field data to inform fire models and evaluate increases in flame length and predicted spread given the retention of slash piles for wildlife habitat. This option would directly address Theme 6, including how best to manage fuel loads, vegetation patterns and fuel breaks for landscape-level fire hazard reduction and risk mitigation to promote and maintain wildfire resistance and resilience while minimizing adverse impacts to wildlife habitat and resting/denning structures.

We believe this proposal has value to land managers, and would address several EMC themes and critical monitoring questions. We provide information focused on several themes centered around maintenance of functional/suitable wildlife habitat and technical rule addendum #2 that provides guidance on assessment of snags and den trees, snags, downed large woody debris, hardwoods, and habitat continuity. Because some of the difficult location data are collected, this addition provides a unique opportunity to study marten and fisher on managed timberlands relative to these topics.

Scientific Uncertainty and Geographic Application:

Data collection and implementation would be most appropriate within the coastal region of northern California, including Del Norte, Humboldt, and Mendicino counties. Information learned could be broadly extrapolated to much of the range of coastal martens and fishers in northwest California.

We propose an observational study, but one where we can first conduct a power analysis to inform the number of needed vegetation plots to characterize potential uncertainty. Because of the lack of information on marten habitat, even small datasets can provide significant value.