Southern Sierra Nevada Fisher Conservation Strategy Update

Wayne Spencer, Heather Romsos &
The Fisher Technical Team

Fisher (Pekania pennanti) in California
- Federal and State ESA Candidate
- Current range a fragmented subset of historic range
- The southern Sierra Nevada population is well studied on Sierra NF, with less information in other areas.
Southern Sierra Nevada Fisher Conservation Assessment & Strategy

- A multi-agency planning effort to:
  - Conserve the fisher population
  - And restore more resilient forest conditions.
- Must address numerous threats:
  - Small, segmented population
  - Fires
  - Vegetation management
  - Climate change
  - Roadkill
  - Predation
  - Rodenticide poisoning
  - Prey reductions?

Habitat and vegetation dynamics must be at the heart of the strategy!

Fires, Fuels, Forests, and Fishers:
A Delicate Balancing Act
(Spencer et al. 2008, Syphard et al. 2011, Sheller et al. 2011)
Strategy Overview

Where we’ve been, where we are, where we’re going.
• Desired Conditions
• Guiding Principles
• Goals and Objectives
• Available models
• New approach to the Decision Framework (the Female Home Range Template System)
• Other discussion Items

Conservation Strategy:
Desired Conditions

A thriving (= resilient, healthy, expanding) fisher population,
• well distributed throughout available habitat
• and interbreeding among subpopulations,
• whose forest habitat is naturally heterogeneous and resilient to fires and other disturbances
• at the landscape scale and over the long term.
Conservation Strategy:
Guiding Principles

- Small populations are inherently at risk of extirpation, and this population is small and subdivided, with low genetic diversity.
- Fisher conservation requires habitat management plus risk reduction.
- Sierra Nevada forests are dynamic, and fisher habitat conditions will change.
- Current fisher habitat conditions do not represent historical or desired conditions.
- Current forest conditions are not resilient, due to increasingly severe wildfire conditions and climate change.
- Female fishers are most important to sustaining population viability, and they are more constrained by environmental conditions than males.
- Management should conserve and enhance fisher habitat conditions even where fishers don’t currently occur, but could in the future (e.g., potential habitat on Stanislaus National Forest).

Conservation Strategy:
Guiding Principles (continued)

- Fisher habitat is geographically and functionally structured at multiple scales:
  - The population is subdivided by major river canyons into discrete habitat “cores,” some of which are currently occupied, and some of which are not.
  - Between cores, maintaining and improving movement potential is critical to maintaining demographic connectivity and genetic diversity.
  - Within cores, fisher foraging, resting, and denning habitats represent hierarchically nested subsets of overall fisher “live-in” habitat.

- However, this dynamic and hierarchical structure may be too complex to guide management recommendations....
- We therefore need a simpler, integrative metric of habitat value (the female home range template).
Conservation Strategy

Biological Goals (from FTT):

- Restore and maintain a dynamic mosaic of vegetation that is resilient to wildfire and climate change, while striving for no net loss of fisher habitat value.
- Sustain and increase the size and distribution of the fisher population.
- Maintain fisher genetic diversity, by maintaining or improving dispersal potential between habitat core areas.
- Increase the potential for population expansion by reducing mortality factors, such as roadkill and pesticide exposure.

Other Desired Goals (from Managers):

- Accommodate other resource objectives.
- Efficient, implementable, and cost effective approach.
- Allow management flexibility and adaptability.
- Match goals, objectives and desired conditions to those of Forest Plan revisions.

Broad, Strategic Approach

- Ameliorate threats (pesticides, roads, etc.).
- Set fisher population targets for core areas and manage (and track) habitat as a proxy for those population targets.
  - Amounts of suitable habitat (for breeding females)
  - Arrangement/configuration of habitat
- Use regional monitoring to evaluate whether the above approach is working.
- Adapt methods based on results.
Developing Decision-support Tools

- Use spatially explicit habitat models to help guide siting and phasing of management actions.
- Combine habitat maps with dynamic models (e.g., FVS-based) to predict future conditions and help with project phasing.
- Provide a structured decision-support system to help guide management decisions and track changes over time.

(Thompson et al. 2010; Zielinski et al. 2010)

Fisher Values are Multiscalar:

- Landscape: overall habitat and population distribution
- Home Range: home range characteristics; individual interactions
- Sub-home range: resting, denning, foraging, and movement habitats
- Microsite: individual denning or resting structures, etc.

Also: Selection is gender specific!
Fisher Values are Multiscalar:

- Landscape: overall habitat and population distribution
- Home Range: home range characteristics; individual interactions
- Sub-home range: resting, denning, foraging, and movement habitats
- Microsite: individual denning or resting structures, etc.

Also: Selection is gender specific!

Fisher Technical Team is developing an approach for dealing with these scales.

Managers have been providing recommendations at these scales.

Landscape-scale Fisher Habitat Model

- Maxent model using regional fisher monitoring data
- Environmental variables averaged over 10 km² (~4 mi²; ~female home range size)
- Excellent statistical fit (F = 0.96; AUC = 0.94)
- Predictor Variables:
  - Proportion dense canopy (>60% CFA)
  - Basal area-weighted canopy ht.
  - Tassel-cap greenness
  - Min. temp. coldest month

Univariate Response Curves

- Min Temp Coldest Month
- % Dense Canopy
- BA-weighted Canopy Height
- Tassel-cap Greenness

SSN Framework Conservation Strategy

- Occupied
- Uncultivated
- National Forests
- National Parks
- Study Area (210k)

Min Temp Coldest Month

% Dense Canopy

BA-weighted Canopy Height

Tassel-cap Greenness

SSN Fisher Conservation Strategy

- Model Regions
- Model Regions
- Model Regions
- Model Regions
- Model Regions
- Model Regions
Core and Linkage Areas

- Cores: contiguous habitat areas (thresholded using strength of selection analysis) large enough to support ≥ 5 female home ranges.
- “Occupied” vs “Unoccupied” cores based on fisher monitoring data (Zielinski et al. 2013).
- Subdivisions consistent with landscape genetic patterns (Tucker et al. 2012; Tucker 2013)
- Linkages modeled as union of 50km normalized least-cost corridors under varying assumptions about dispersal behavior.

DRAFT SSN Fisher Strategy Area

- Uses a grid of female home range-sized (10km²; 4mi²) hexagons fitted to core and linkage habitats.
- Represents the area within which management recommendations and decision-support system will apply.
- Excludes areas probably not important to fisher recovery, at least for ~20 years.
- Grid can be updated to accommodate habitat shifts and new information.
Connectivity Modeling: Movement Cost Layer

- Resistance ranges from 1 to 325 based on:
  - Vegetation (type, density, size)
  - Terrain (elevation, slope)
  - Roads (weighted by traffic volume)
  - Water (major rivers and lakes)
  - Urban
- Informed by:
  - Fisher movement data from SNAMP
  - Landscape genetic data from Tucker (2013)

Normalized Least Cost Corridors

- Union of 50km NLCCs run between:
  - Core edge to edge
  - Core centroid to centroid
  - Select termini at northern and southern extremes and areas of high habitat value
- Cost surface modified to reflect effects of recent severe fires: pre-fire and post-fire corridors

Rim Fire aerial view
Resting Habitat
• Rest-site localities from Kings River and Sequoia National Forest fisher
• Variables averaged over 2 km²:
  • % Med-lg trees
  • % Forest Type
  • Jan Tmin
  • % Dense canopy (>80% CFA)
  • % Hardwoods
  • Slope
• 10-fold cv AUC = 0.934
• But projections outside model extent are uncertain

Denning Habitat
• Den locality data from SNAMP and Kings River fisher studies
• Variables averaged at 2 km²:
  • % Forest Type
  • % Dense canopy (>60% CFA)
  • Aug Tmax
  • % Hardwoods
  • Slope
• 10-fold cv AUC = 0.946
• But projections outside model extent are uncertain.
Overlap of Foraging, Resting, and Denning Habitat

Foraging habitat (using landscape-scale habitat model)

+ Resting habitat

+ Denning habitat

• Although biologically informative, this nested hierarchy of functional habitat types may be too complicated to guide management.
• Luckily, female fishers naturally integrate what is important about habitat within home ranges.

Tackling the Home Range to Landscape Level Decision-support System: The Female Home Range Template Approach

The FTT “Template Team” Subcommittee:

• Bill Zielinski
• Craig Thompson
• Sue Britting
• Wayne Spencer
• With support from:
  – Heather Romsos
  – Jim Baldwin
Range Template Approach

**Intent:**
- Provide managers flexibility in siting and phasing vegetation treatments,
- While conserving/improving:
  - Critical connectivity areas and
  - Integrity of core areas.
- Uses a grid of female home range-sized (10km²; 4mi²) hexagons overlaid on fisher core and linkage areas.
- Spatial and temporal rule sets to:
  - Protect/improve “critical connectivity” hexagons
  - Maintain sufficient number and dispersion of potential female home ranges within each core.
- Provide a simple accounting system to track success criteria.

Conceptual Foundations

- Maintaining adult female breeding habitat at the home range scale is key to sustaining/increasing the population.
- Female home ranges must contain ("integrate") sufficient foraging, resting, and denning habitat.
- Therefore, a single home range habitat metric (the “template”) can replace the need to focus separately on foraging, resting, and denning habitat values.
- Fishers will tolerate some level (~2.6% of area annually or ~13% in 5 years?) of vegetation treatments within their home ranges (Garner 2013, Zielinski et al. 2013).
- Too much impact (how much? Depends on nature of treatments) may displace a home range or make an area unsuitable for reproduction, at least for a while…
- while other areas may become suitable due to succession.
- **Goal:** Maintain a dynamic equilibrium (no net loss) of suitable breeding home ranges over time, with adequate dispersion and connectivity, to sustain (or increase) the population…
- even though suitable breeding locations may change over time due to treatments and fires.
The Female Home Range Template Approach

- Principal component analysis (PCA) of adult female home range composition (based on Thompson et al. 2010).
- Home range data from 3 study areas:
  - SNAMP
  - KRFP
  - Sequoia NF (Tule River)
- PCA equation used to score each home range-sized hexagon.
- Hexes within 95% CIs of breeding home range conditions are considered “suitable” as potential female home ranges (green).
- Hexes between cores along corridors are “critical linkage hexagons” (brighter colors).

DRAFT

Denning
Habitat
Variables

95% confidence ellipse (approximated)

Translocated as kits
statistical outliers

Old Forest Variables
Dead Wood Variables

PCA 1

TTFA, NBSEX1, SEX1

0
Female Home Ranges and Denning Habitat

**Green** = female home ranges within 95% CIs of PCA 1 and 2.

**Red** = statistical outliers.

Suitable & unsuitable template hexagons

- **Plan:** Derive simple rules for siting projects to maintain:
  - Connectivity between cores across critical linkage hexagons.
  - "Sufficient" number of potential female breeding home ranges.
  - Connectivity among suitable home ranges within cores.
Suitable & unsuitable template hexagons

- Principal component analysis (PCA) of breeding female home range composition (Thompson et al. 2010).
- PCA equation used to score each hexagon.
- Hexes within 95% CIs of breeding home range conditions are “suitable” (green).
- Critical linkage hexes based on modeled least-cost paths and corridors.

More study needed; restoration zone?
Questions?