

Summary of Recent Fisher Modelling Efforts, Risk Factors, and New Detection Data in the West Coast DPS

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Data contributions and content review by:

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- Integral Ecology Research Center
- USFS Pacific Southwest Research Station
- National Council for Air and Stream Improvement

Summary of Recent Fisher Modelling Efforts and Risk Factors in the West Coast DPS

Data sources:

- Fisher habitat models: SSFCS Resting & Denning models
CBI / USFWS foraging habitat suitability
- Fisher data: Kings River, SNAMP / SP, Ashland (USFS PSW)
- Risk models: Sierra tree mortality - eDaRT data (USFS R5 RSL)
Trespass grow site probability model (IERC)
Greater Klamath region fire severity models (CBI)
- Supplementary data: Fire history (2000-2017)

Model Overlays

- ➔ Percent habitat type & home range impacted by high and moderate risk
- ➔ Potential for interactions between multiple risk factors
- ➔ Effects of recent fires on habitat availability

SSN Fisher Habitat and Tree Mortality

- USFS R5 Remote Sensing Lab Ecosystem Disturbance and Recovery Tracker (eDaRT) data
- LANDSAT-based
- Cumulative 2009-2018
- Fire and management disturbance removed
- Crosswalk of 'Event Confidence' values into '% Canopy Cover Loss'
 - eDaRT confidence value <35 = absolute mean canopy loss of 7.6% (75% CI: 0-10%) **low**
 - eDaRT confidence value 35-80 = absolute mean canopy loss of 19% (75% CI: 10-25%) **moderate**
 - eDaRT confidence value >80 = absolute mean canopy loss of 30% (75% CI: 20-40%) **high**
- Variance within the eDaRT data makes direct comparison to canopy loss difficult, however the combined moderate and high categories can be interpreted as representing significant decreases in canopy cover.

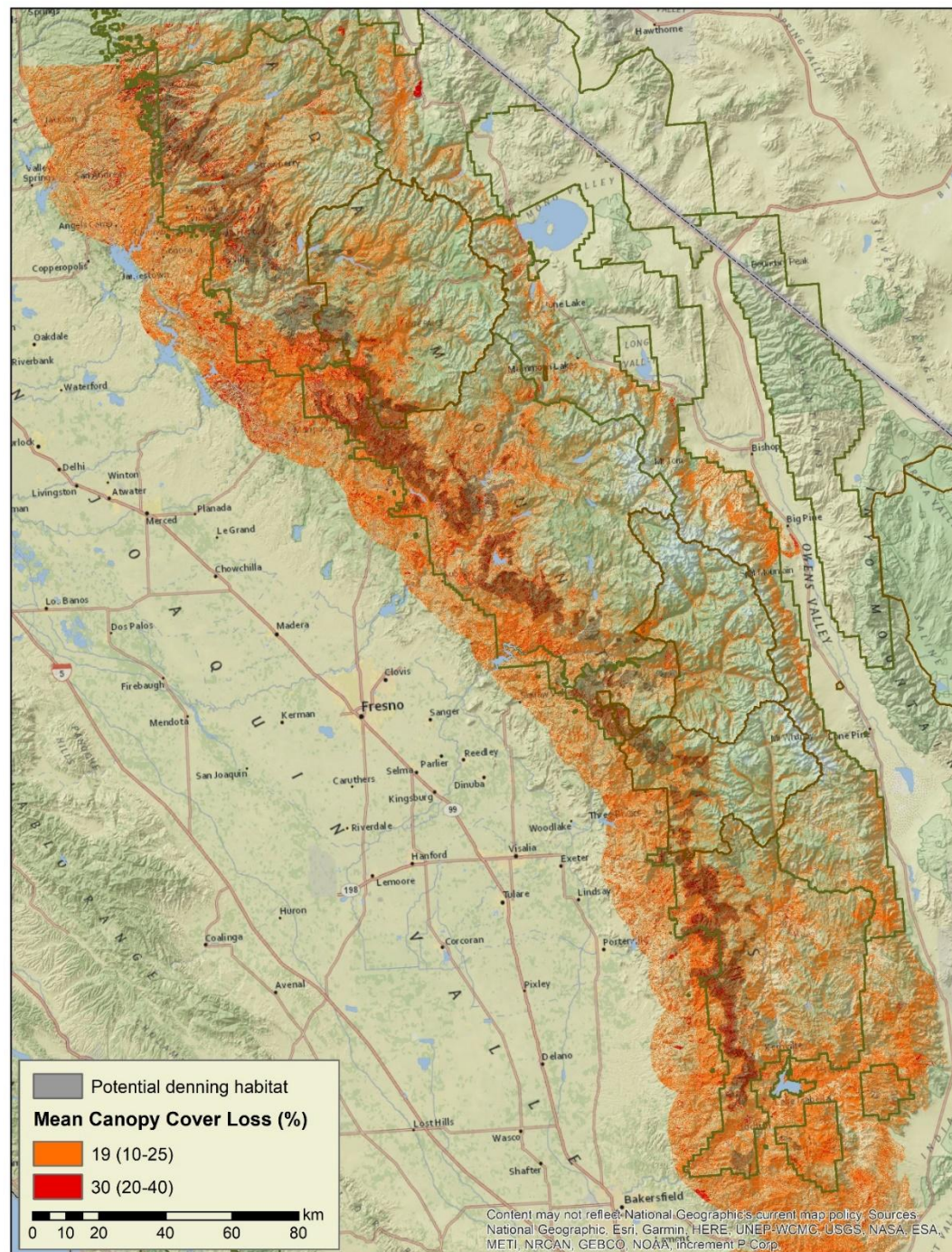
SSN Fisher Habitat Models

- From SSN Fisher Conservation Assessment & Strategy
- Denning:
 - KRFP & SNAMP locality data (2008-2013),
 - USFS EVEG vegetation predictors (2001-2008 releases, ~ 2000 conditions),
 - 30m resolution, projected across SSN
- Resting:
 - Same as Denning except: KRFP locality data 2007-2013 & Sequoia NF locality data (1994-1996)
- Foraging:
 - 90m resolution
 - USFWS/CBI model,
 - 1991-2011 detections,
 - 2000-2008 vegetation predictors
- Maximum sum of sensitivity and specificity threshold used to differentiate suitable from unsuitable habitat for all

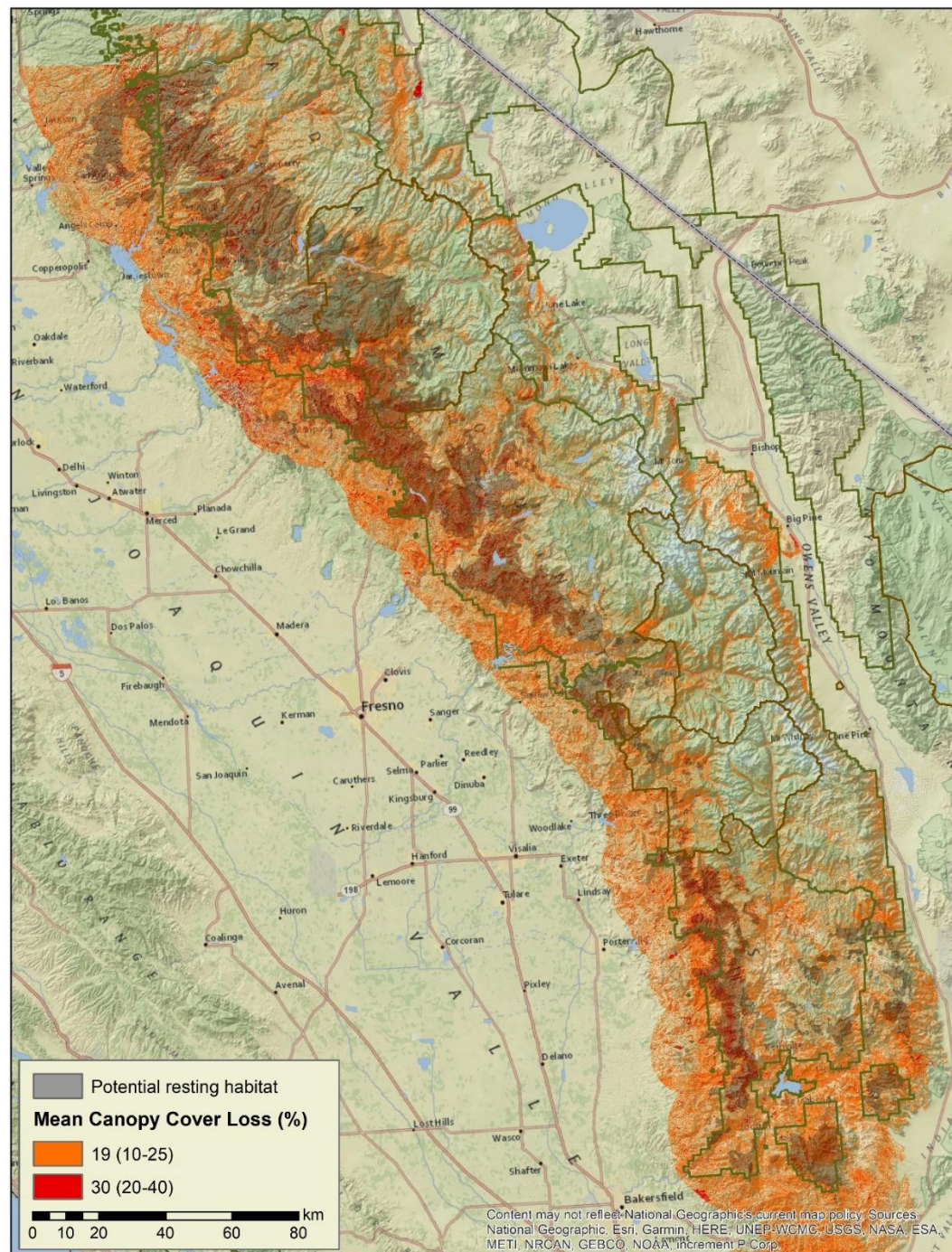
SSN Fisher Home Range Data

- Kings River - 29,288 locations; 2007-2018
- SNAMP / Sugar Pine - 36,726 locations; 2008-2016
- 95% fixed kernel home ranges calculated using the Local Convex Hull method to minimize differences due to methodology (Getz et al. 2007)
- 25 location minimum for home range calculation
- 216 animals (134 females & 82 males) met this criteria

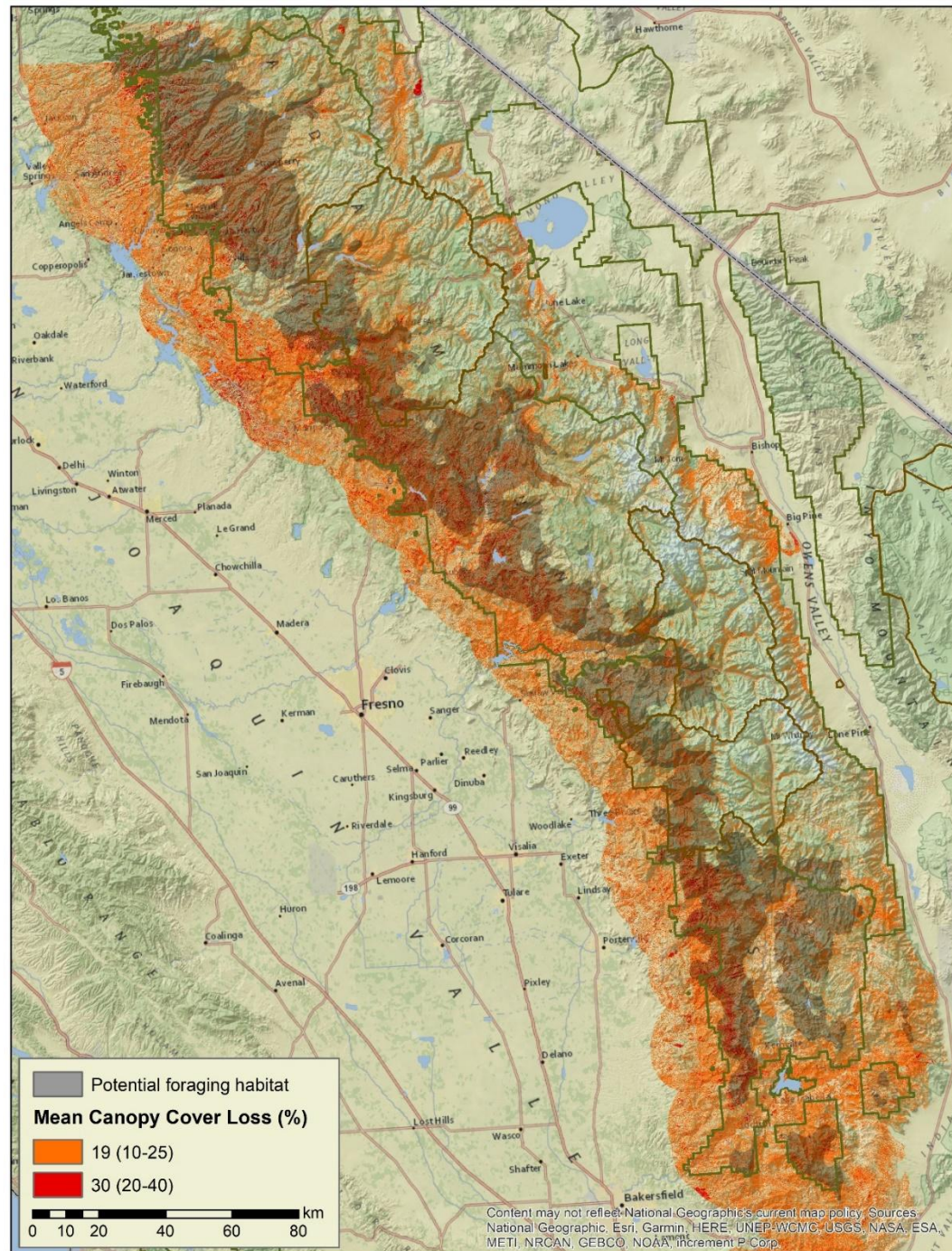
Overlap
between
potential
fisher
denning
habitat and
USFS R5
eDart-based
canopy loss
estimates



Overlap
between
potential
fisher resting
habitat and
USFS R5
eDart-based
canopy loss
estimates



Overlap
between
potential
fisher
foraging
habitat and
USFS R5
eDart-based
canopy loss
estimates



Percent of Potential Habitat by eDaRT Percent Canopy Cover Loss Class

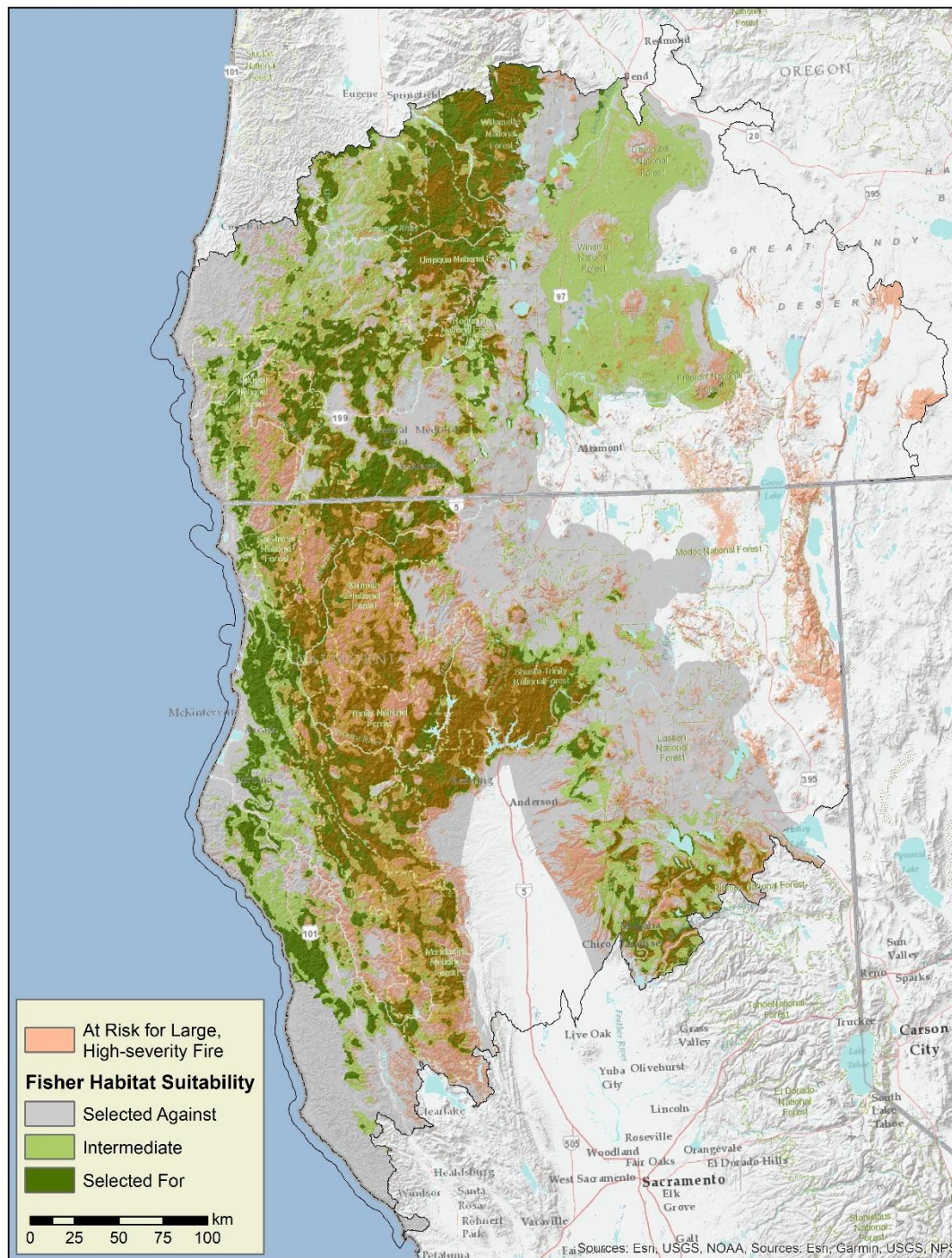
	Mean Percent CC Loss (75% CI)			
Habitat Type	7.6 % (0 - 10) low	19% (10 - 25) moderate	30% (20 - 40) high	moderate + high
Denning	37.80	48.39	13.81	62.20
Resting	43.03	47.07	9.89	56.97
Foraging	49.96	42.56	7.48	50.04

- Over half the fisher habitat in the Sierra Nevada has been significantly impacted by canopy loss (excluding fires and management)
- Greater canopy loss has occurred in denning habitat as opposed to resting and foraging.

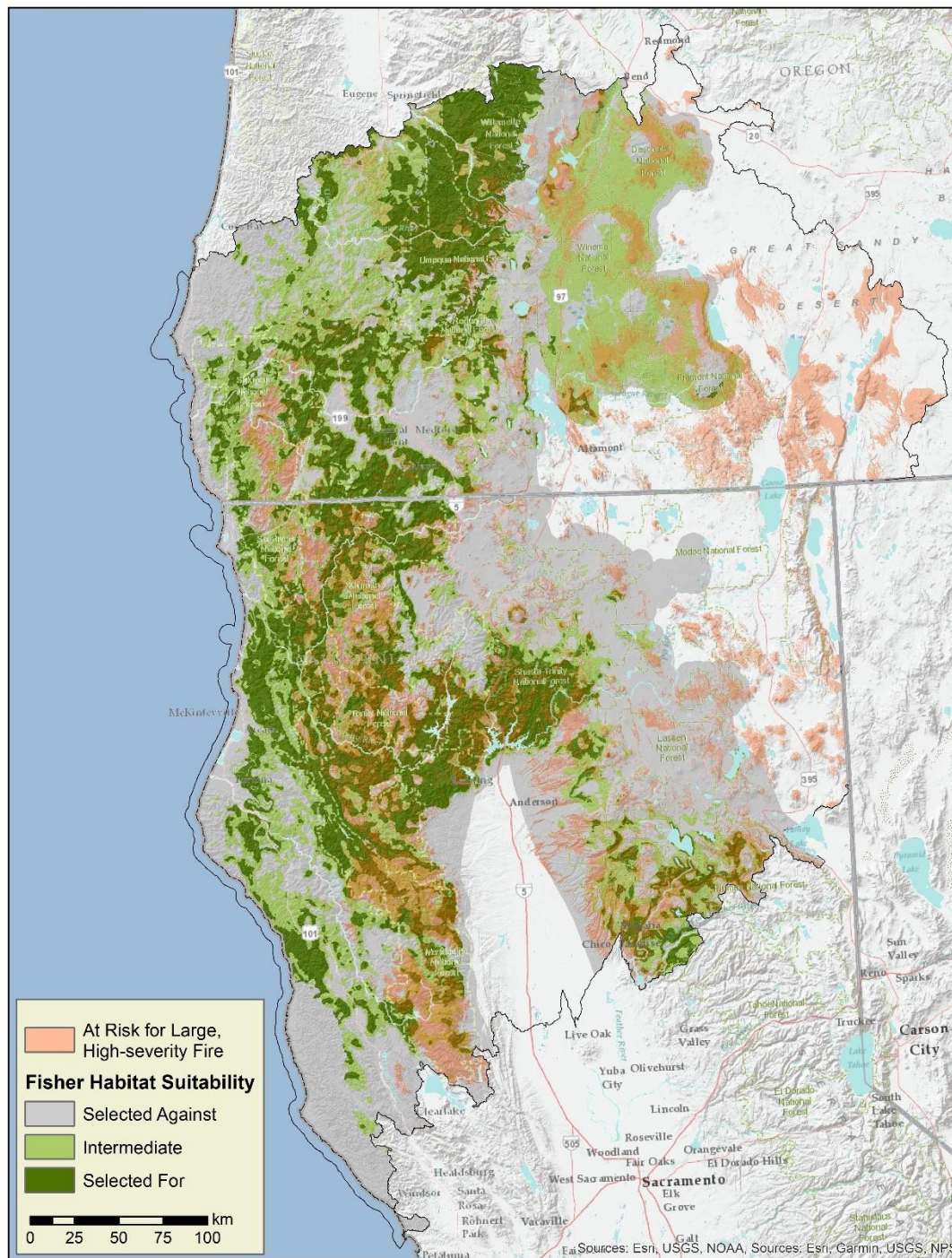
Greater Klamath Region Fisher Habitat and Fire Risk

- USFWS / CBI Fisher habitat model
 - 3 classes: 'Selected For', 'Intermediate', 'Selected Against'
- Home Ranges (Tessa Smith / Dave Clayton)
 - 95% MCP
 - N = 10 (3 M, 7 F)
 - 2010 - 2016
- New Klamath Fire models: 1984-2010 high severity fires
 - Presence-only, Maxent model
 - 90m resolution
 - 2 versions: Region-wide Model and Sub-Regional Models
 - 2 risk classes: 'At risk'/'Not at risk'

Overlap
between
fisher
foraging
habitat
suitability
and the
Klamath
region-wide
fire risk
model



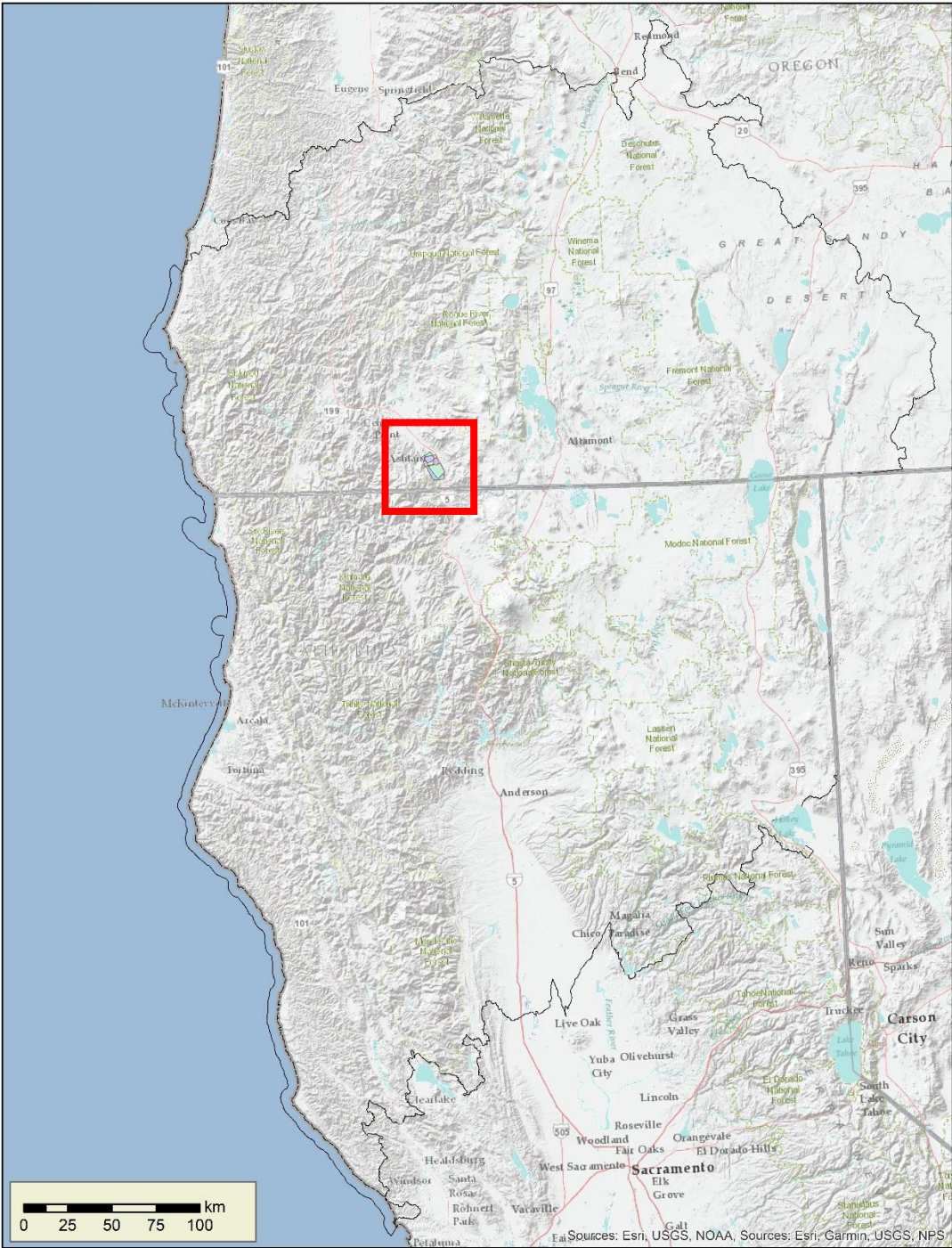
Overlap
between
fisher
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and the
Klamath
sub-regional
fire risk
models



% of Potential Habitat at large high-severity fire risk in Greater Klamath Region

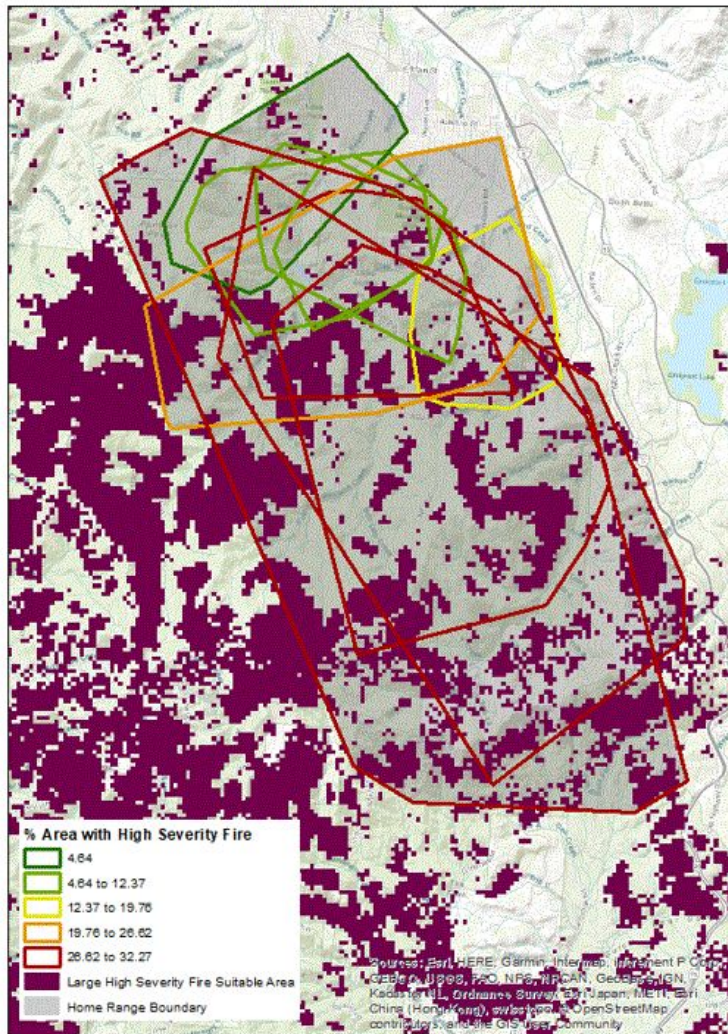
	Regional Models	Region-wide Model
Selected For	25.56	48.71
Intermediate	26.21	29.94
Selected Against	17.56	21.88

Ashland Home Ranges

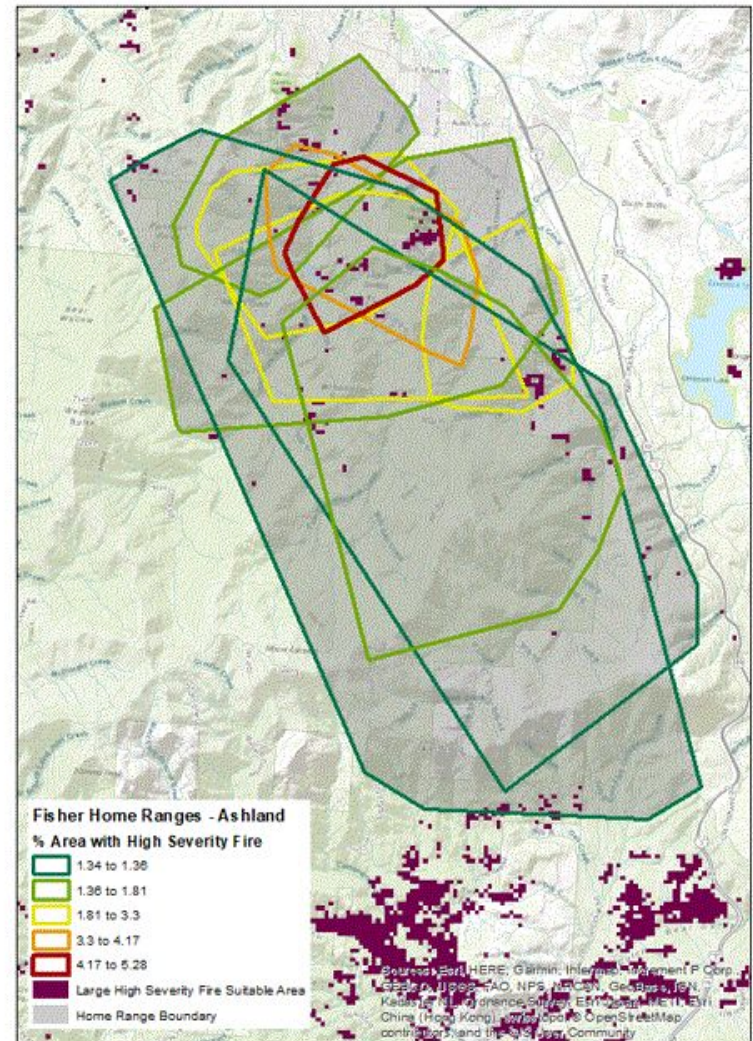


Overlap of fisher homer ranges on the Ashland, OR study area with both region-wide and sub-regional fire risk models

Fisher Home Range at Risk of High-severity Fire (Region-wide Model),
Greater Klamath Region - OR and CA



Fisher Home Range at Risk of High-severity Fire (Regional Models),
Greater Klamath Region - OR and CA



% Area of Fisher Home Ranges in the Ashland watershed with
High Risk of High-Severity Fire

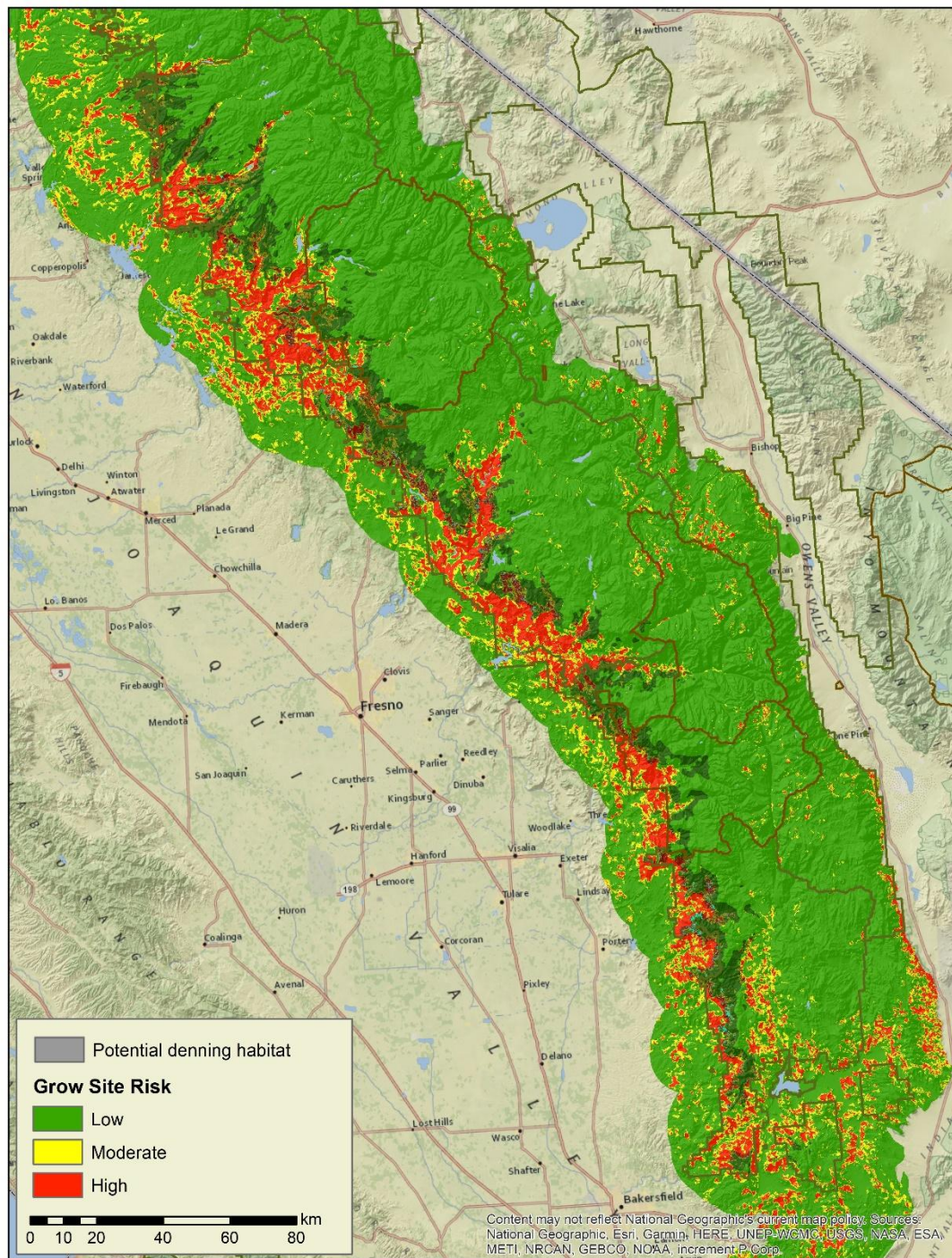
	Regional Models	Region-wide Model
Mean	2.62	21.19
StDev	1.32	10.3
Min	1.34	4.64
Max	5.28	32.27

Note - Ashland fisher monitoring occurred primarily within the Ashland watershed, an area of high fuel reduction activity beginning in 2010. This may help explain the variation between the risk defined by the coarser, region-wide model and more localized sub-regional model, as well as differences between the population and home range results.

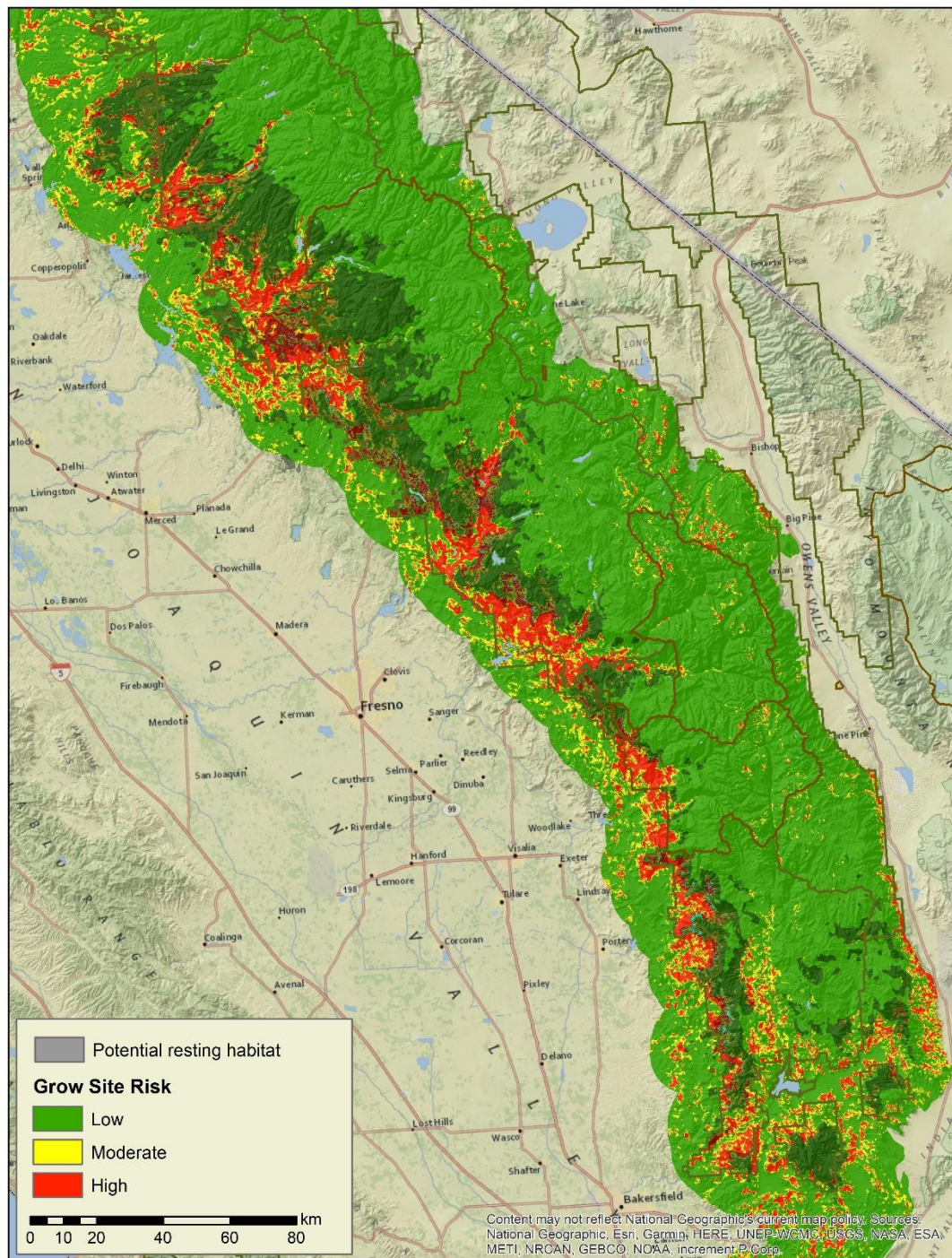
Fisher Habitat and Grow Site Risk

- IERC / CBI Grow Site Risk Model
- 2007-2014
- Presence-only, Maxent model
- 90m resolution
- 10 predictors:
 1. stand age
 2. tree canopy cover
 3. slope
 4. slope aspect (transformed)
 5. distance to nearest private lands
 6. distance to nearest disturbance (6-10 years prior to 2013)
 7. distance to nearest road
 8. distance to nearest fresh water
 9. latitude adjusted elevation
 10. average annual precipitation
- 3 risk classes: high/moderate/low
- Overlaid with SSFCS habitat models and home range data

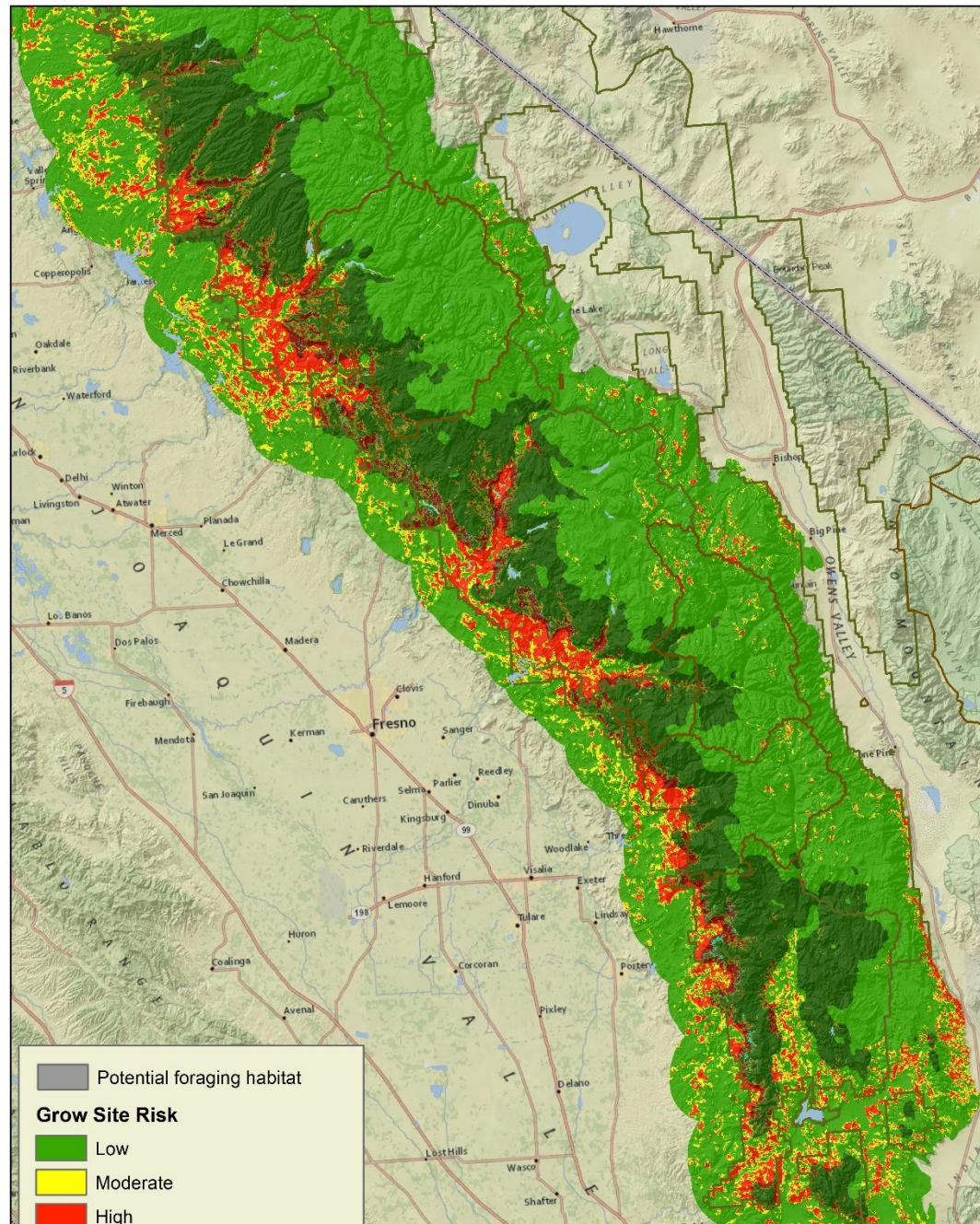
Overlap
between
potential
denning
habitat and
grow site risk



Overlap
between
potential
resting
habitat and
grow site
risk



Overlap
between
potential
foraging
habitat and
grow site
risk



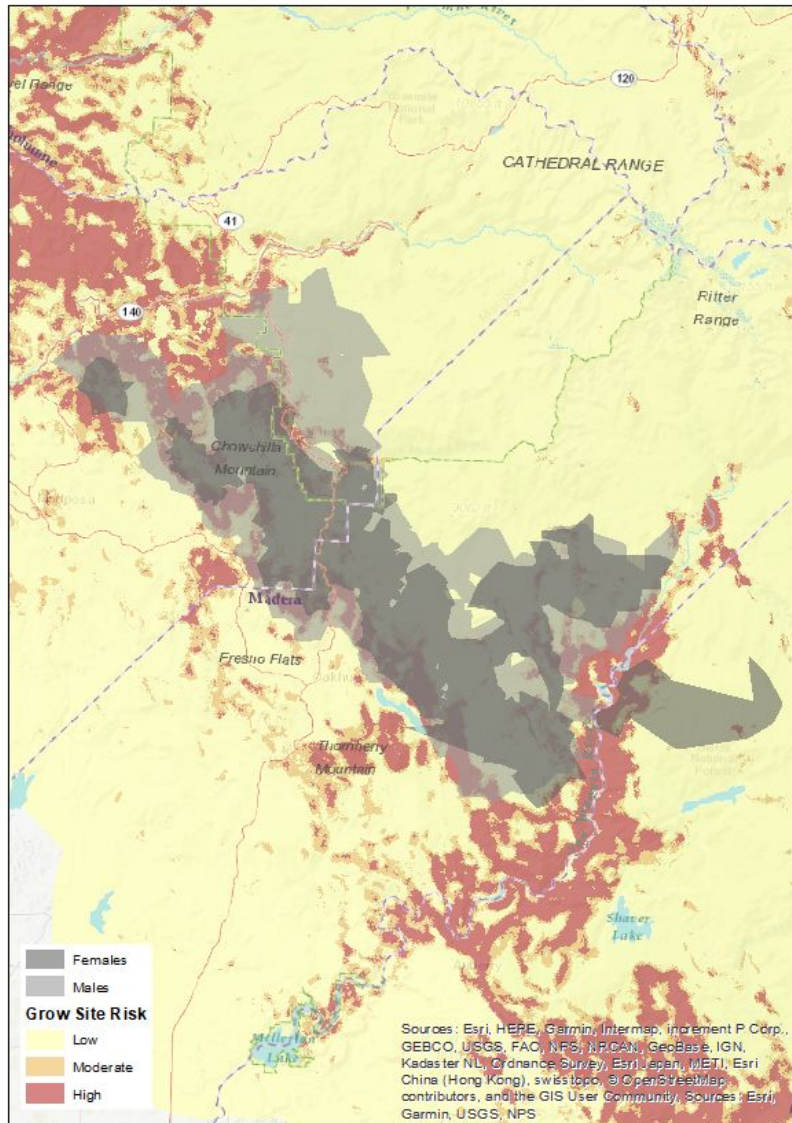
Percent of Potential Habitat by Grow Site Risk Class

	Grow Site Risk		
Habitat Type	High	Moderate	Low
Denning	18.37	19.35	62.28
Resting	15.20	14.68	70.12
Foraging	11.96	10.72	77.32

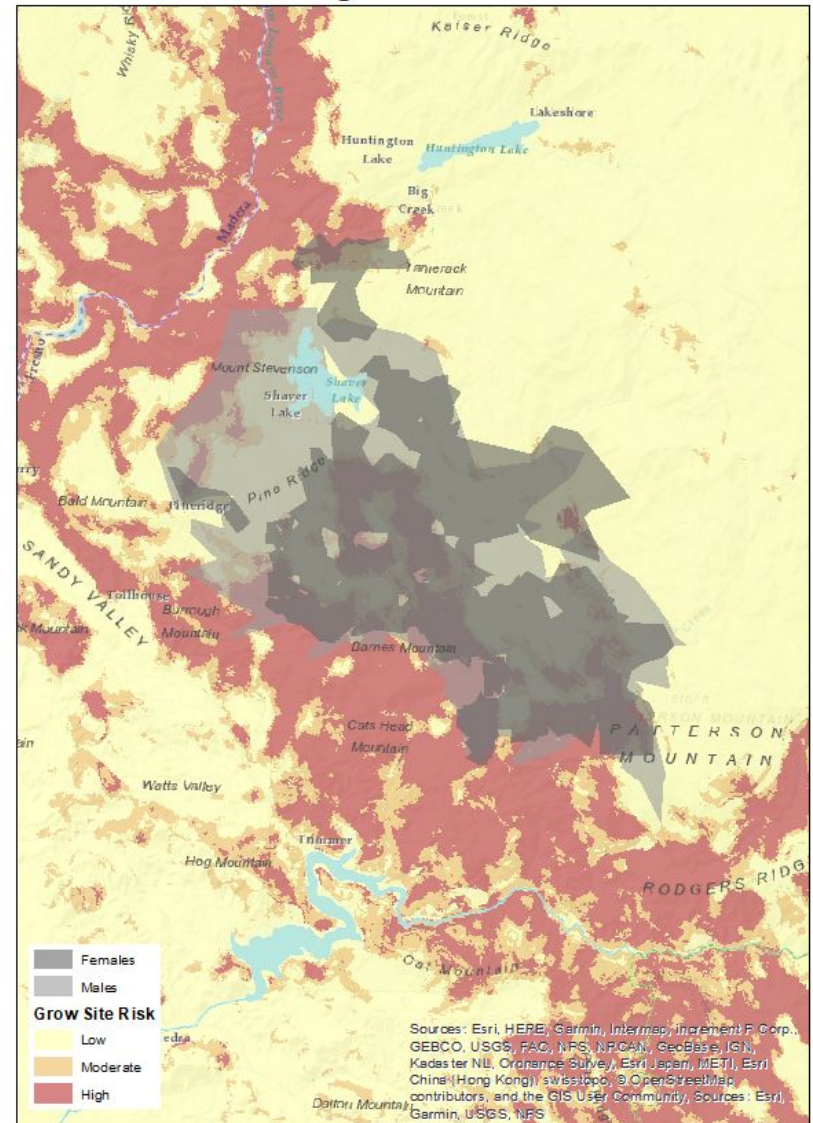
- 20-40% of the population is at risk of exposure to grow site-related toxicants
- 10-20% of the population is at high risk of exposure to grow site-related toxicants
- Denning habitat showed the greatest overlap with high risk areas.

Overlap of fisher home ranges on the Kings River and SNAMP / Sugar Pine study areas with grow site risk potential

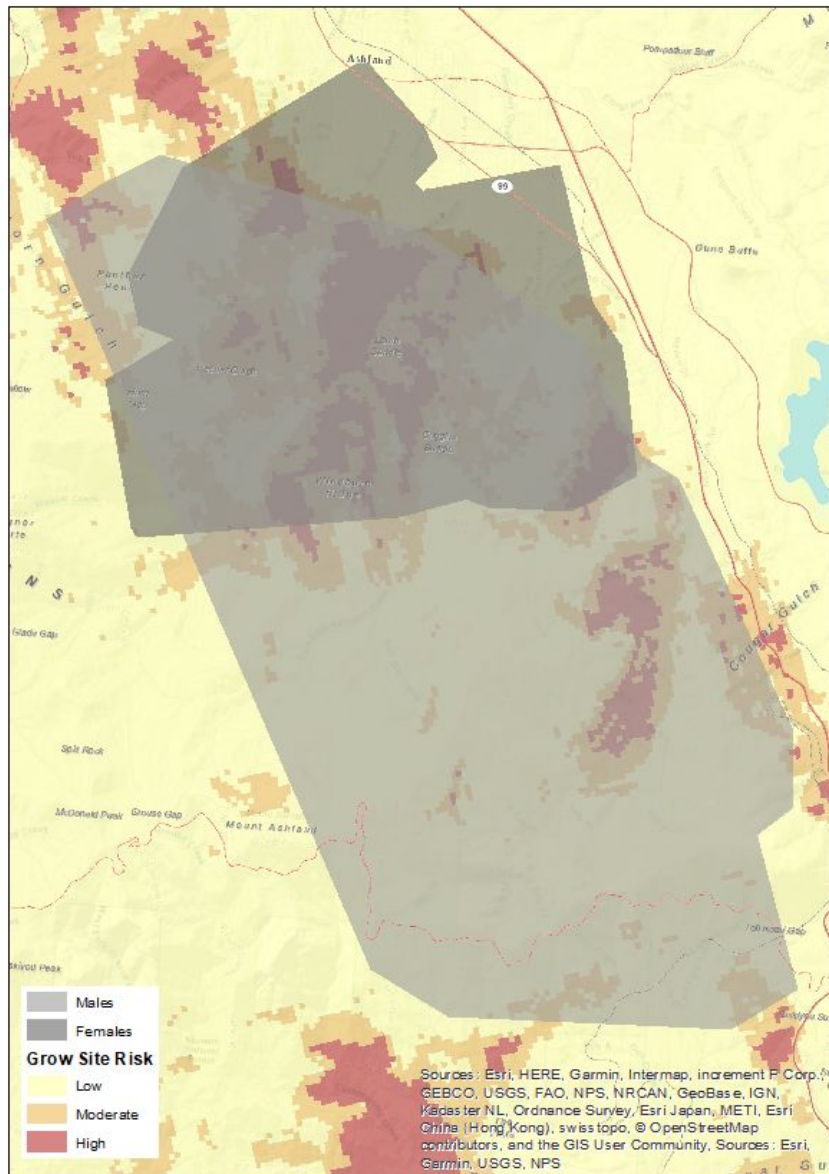
**Fisher Home Range at Grow Site risk,
SNAMP - CA**



**Fisher Home Range at Grow Site risk,
Kings River - CA**



Fisher Home Range at Grow Site risk, Ashland - OR



Overlap between fisher home ranges in the Ashland, OR watershed and grow site probability risk.

Mean percentage of home ranges, separated by study area and sex,
overlapping grow site risk

Study area	Sex	High	Moderate	Low
Kings River	Female (n=66)	39.1 \pm 27.5	21.9 \pm 11.4	39.6 \pm 26.9
	Male (n=28)	33.7 \pm 20.0	20.3 \pm 7.2	46.0 \pm 22.3
SNAMP / Sugar Pine	Female (n=68)	14.8 \pm 13.5	21.3 \pm 10.6	64.5 \pm 20.4
	Male (n=54)	19.5 \pm 13.9	20.0 \pm 8.3	60.9 \pm 20.1
Ashland, OR	Female (n=7)	23.7 \pm 12.0	41.8 \pm 8.8	36.5 \pm 20.4
	Male (n=3)	12.3 \pm 2.5	25.9 \pm 1.6	61.8 \pm 4.0

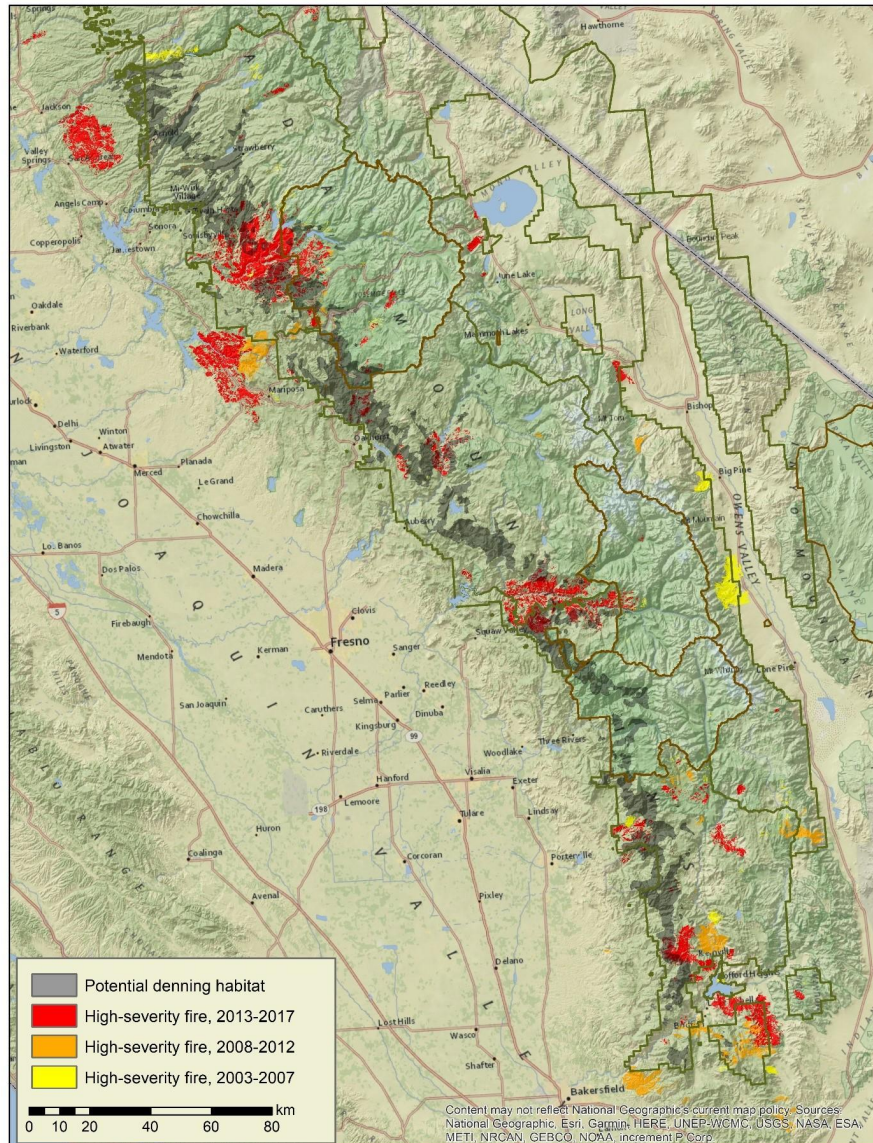
- Risk of exposure to grow site toxicants varied between study sites, with highest risk on the Kings River study site.
- Overlap between home ranges and combined high to moderate grow site risk ranged from approximately 40 to 60%

Percent of potential habitat exposed to combined canopy cover loss and grow site risk

Habitat Type	% overlap with combined Mean CC Loss = 30% (20-40) AND High Grow Site Risk	% overlap with combined mean CC Loss >19% AND High/Moderate Grow Site Risk
Denning	2.5%	24.1%
Resting	1.7%	18.0%
Foraging	1.3%	13.4%

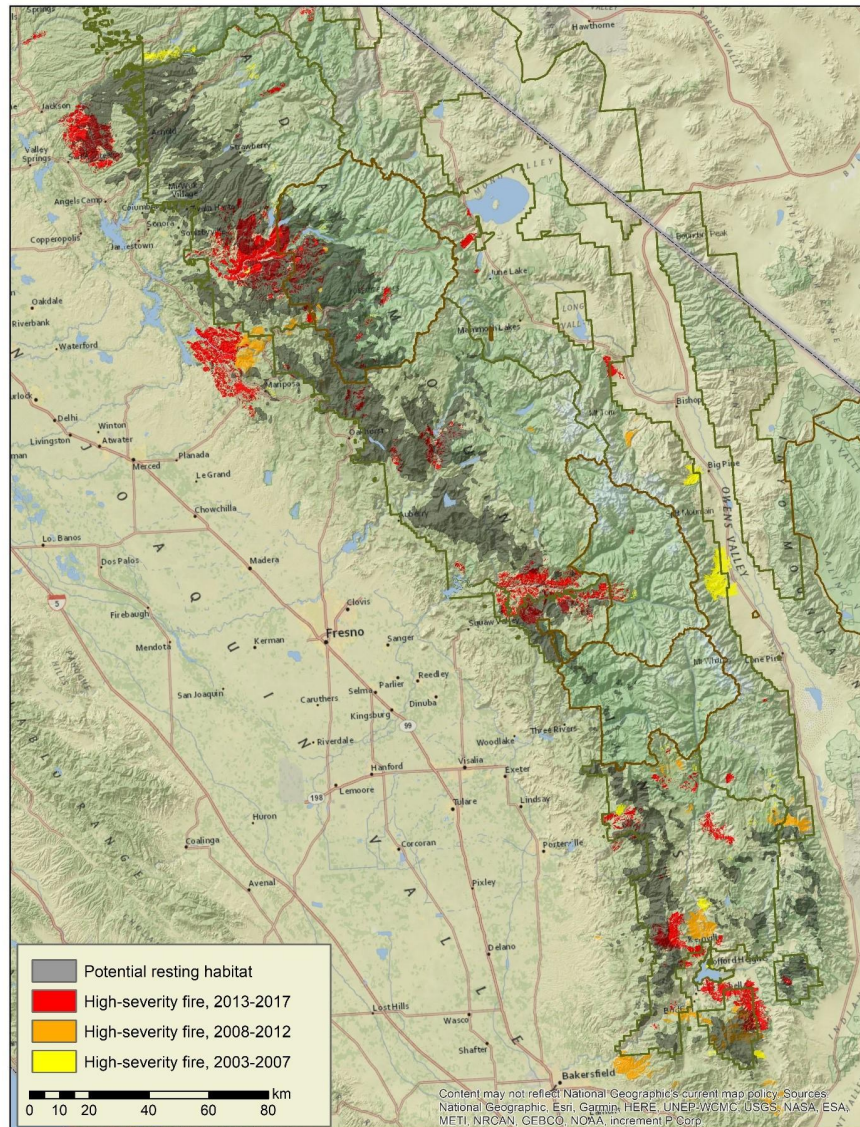
- Limited spatial overlap of risk factors, within habitat footprints
- Overlap occurs primarily within denning habitat
- Primarily an additive risk

Southern Sierra Nevada fisher denning habitat and high severity fire impacts, 2003-2017

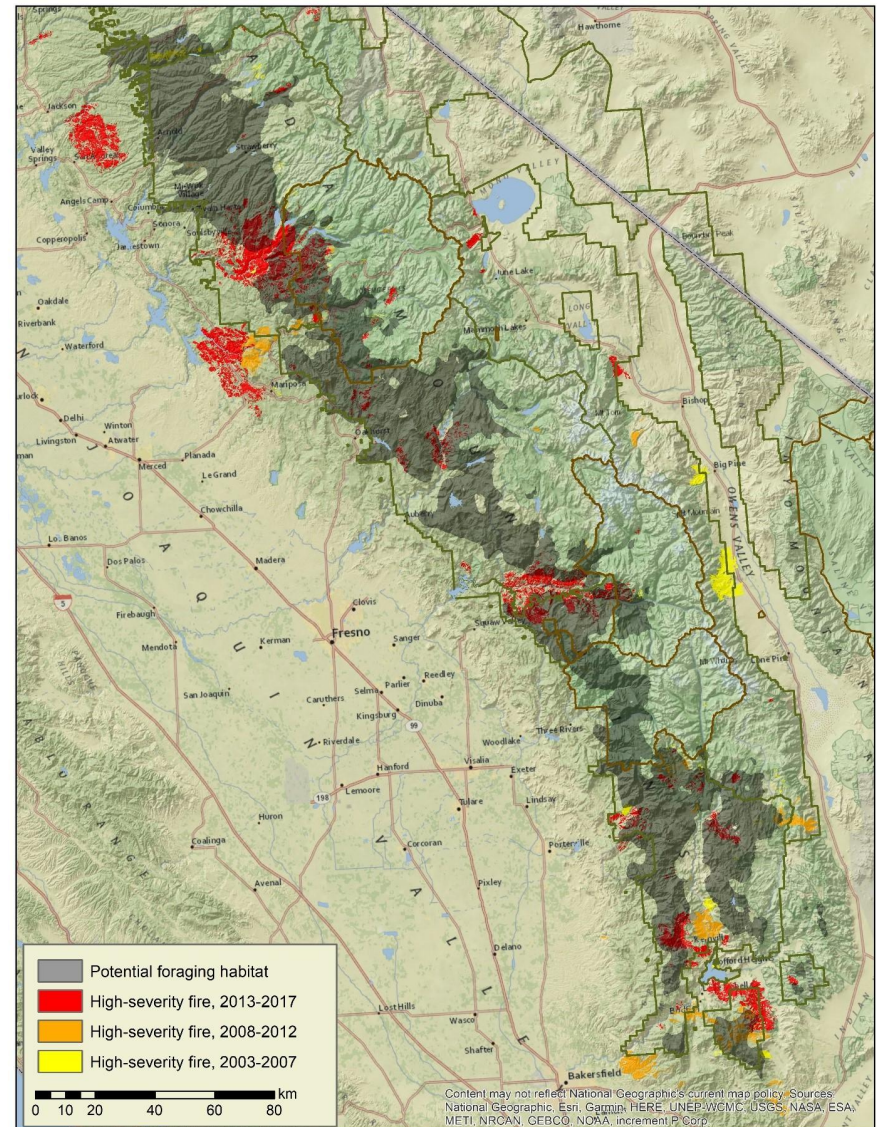


Overlay of fisher habitat models
with recent high severity fire
activity in the southern Sierra
Nevada region

Southern Sierra Nevada fisher resting habitat and high severity fire impacts, 2003-2017



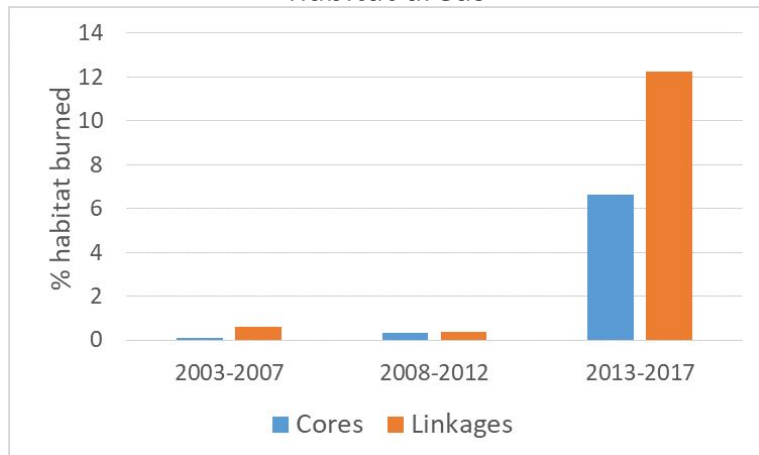
Southern Sierra Nevada fisher foraging habitat and high severity fire impacts, 2003-2017



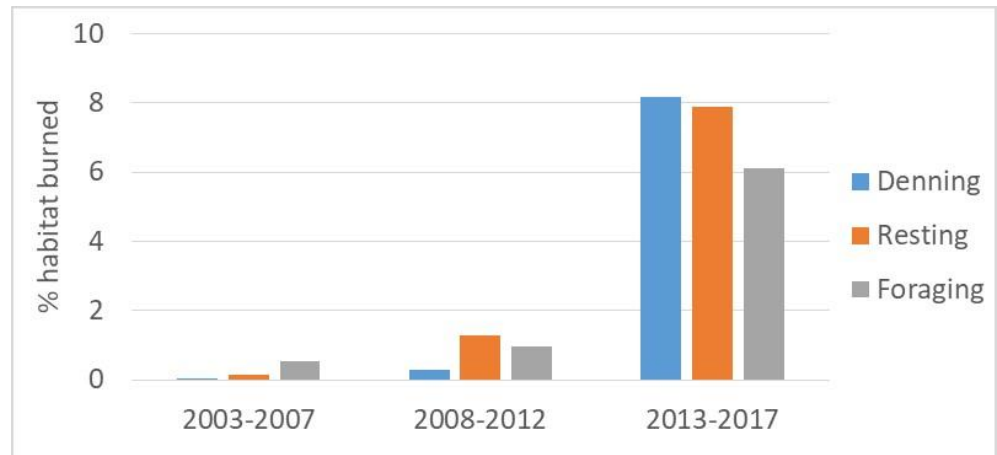
Percent of fisher habitat that burned at high severity in the Southern Sierra Nevadas during three time periods

Habitat Type	High severity fire (2003-2007)	High severity fire (2008-2012)	High severity fire (2013-2017)	Total (2003-2017)
Denning	0.02 %	0.29 %	8.18 %	8.49 %
Resting	0.16 %	1.28 %	7.90 %	9.34 %
Foraging	0.53 %	0.95 %	6.11 %	7.59 %

Loss of fisher habitat in linkage vs. core habitat areas



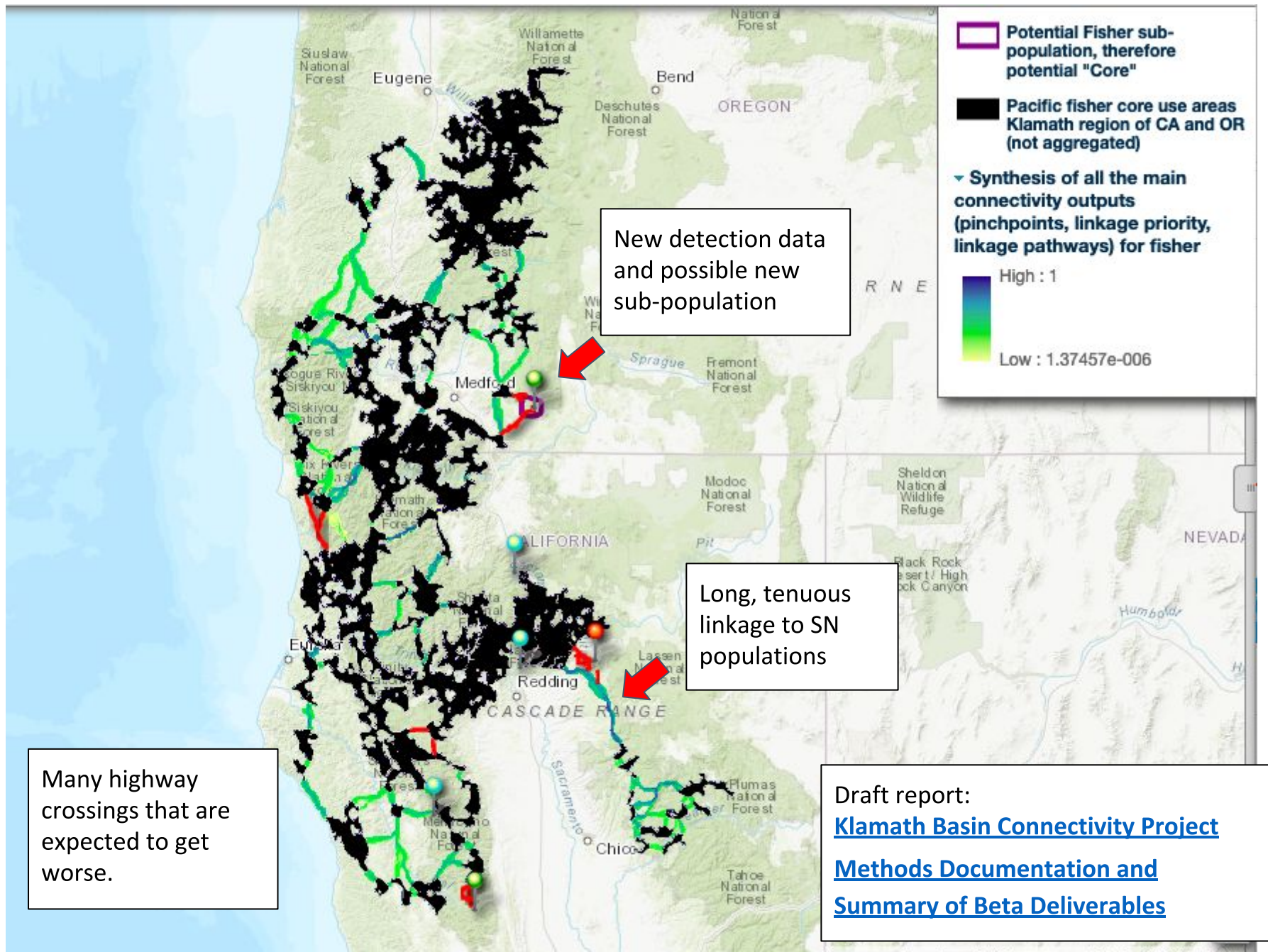
Loss of fisher habitat according to habitat type



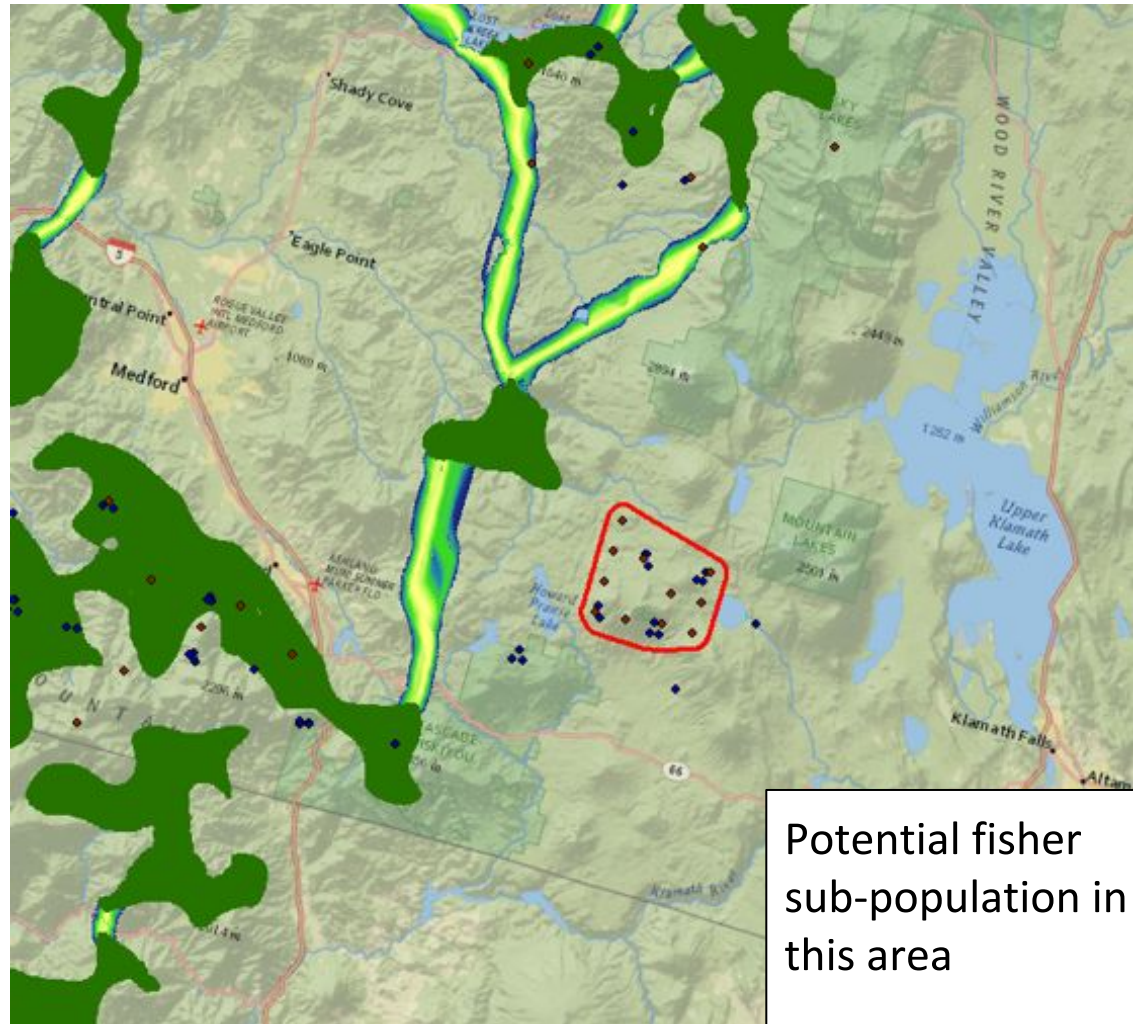
Summary of overlaying fisher data and habitat models with available risk models:

- 1) Over half the potential fisher habitat in the Sierra Nevada has been significantly impacted by canopy loss due to tree mortality.
- 2) 25-50% of the highest quality habitat appears at risk of high-severity fire in the Klamath region
- 3) 20-40% of the potential fisher habitat in the southern Sierra Nevada is at risk of contamination by trespass marijuana grows, with roughly half that area being at high risk of exposure.
- 4) When individual home ranges are examined, 40-60% of occupied territories are at risk of contamination by grow site toxins, with 15-40% being at high risk.
- 5) The combined risk posed by tree mortality and illegal grow sites appears additive, meaning approximately 40-80% of available habitat may be compromised in some form (assuming 20% overlap in high/moderate risk categories).
- 6) Rate of fisher habitat loss to fire has increased dramatically over last 15 years, with proportionally greater impact on linkage areas

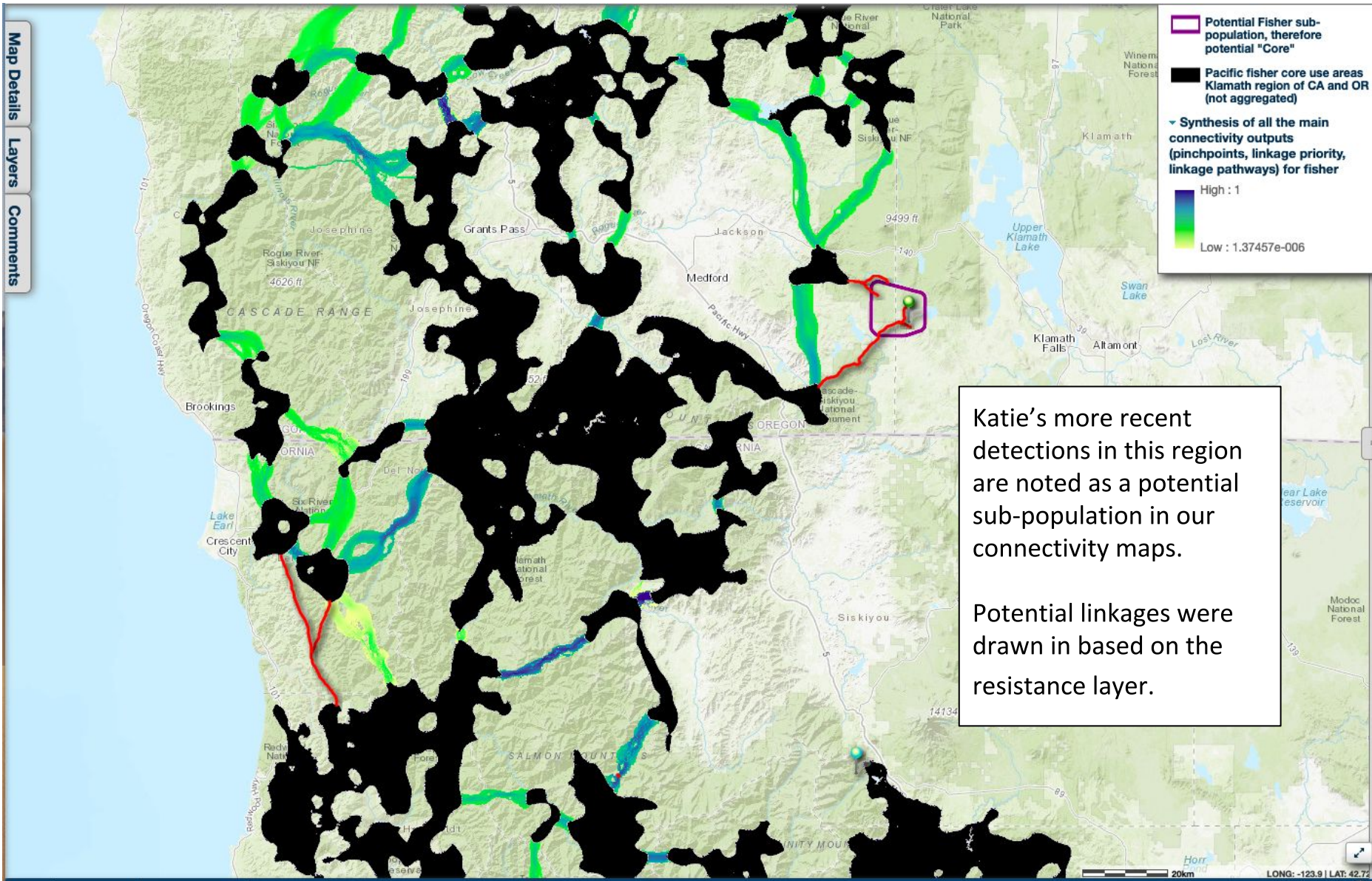
Highlights from the Klamath Connectivity Analysis



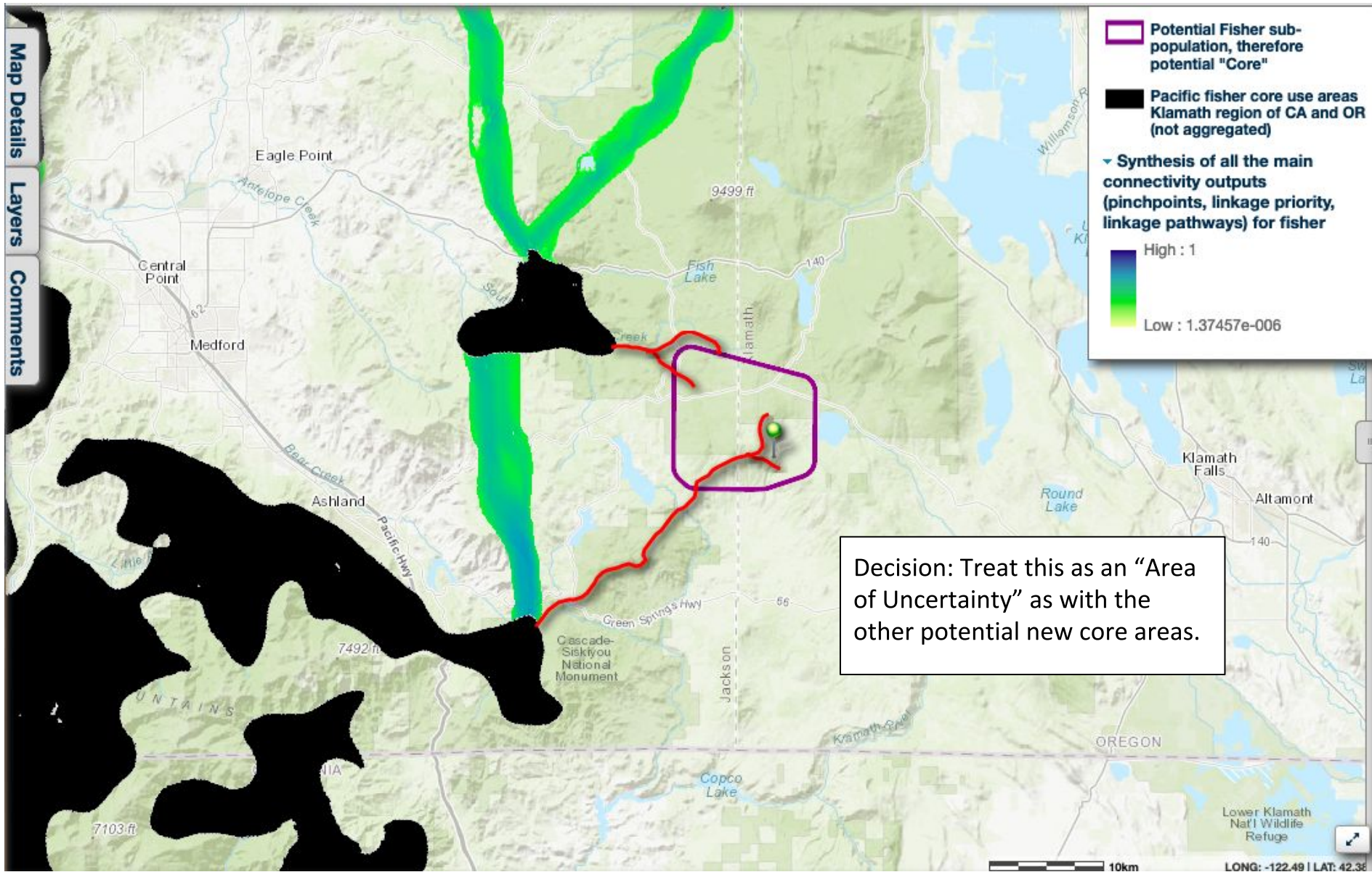
New detection data from K. Moriarty



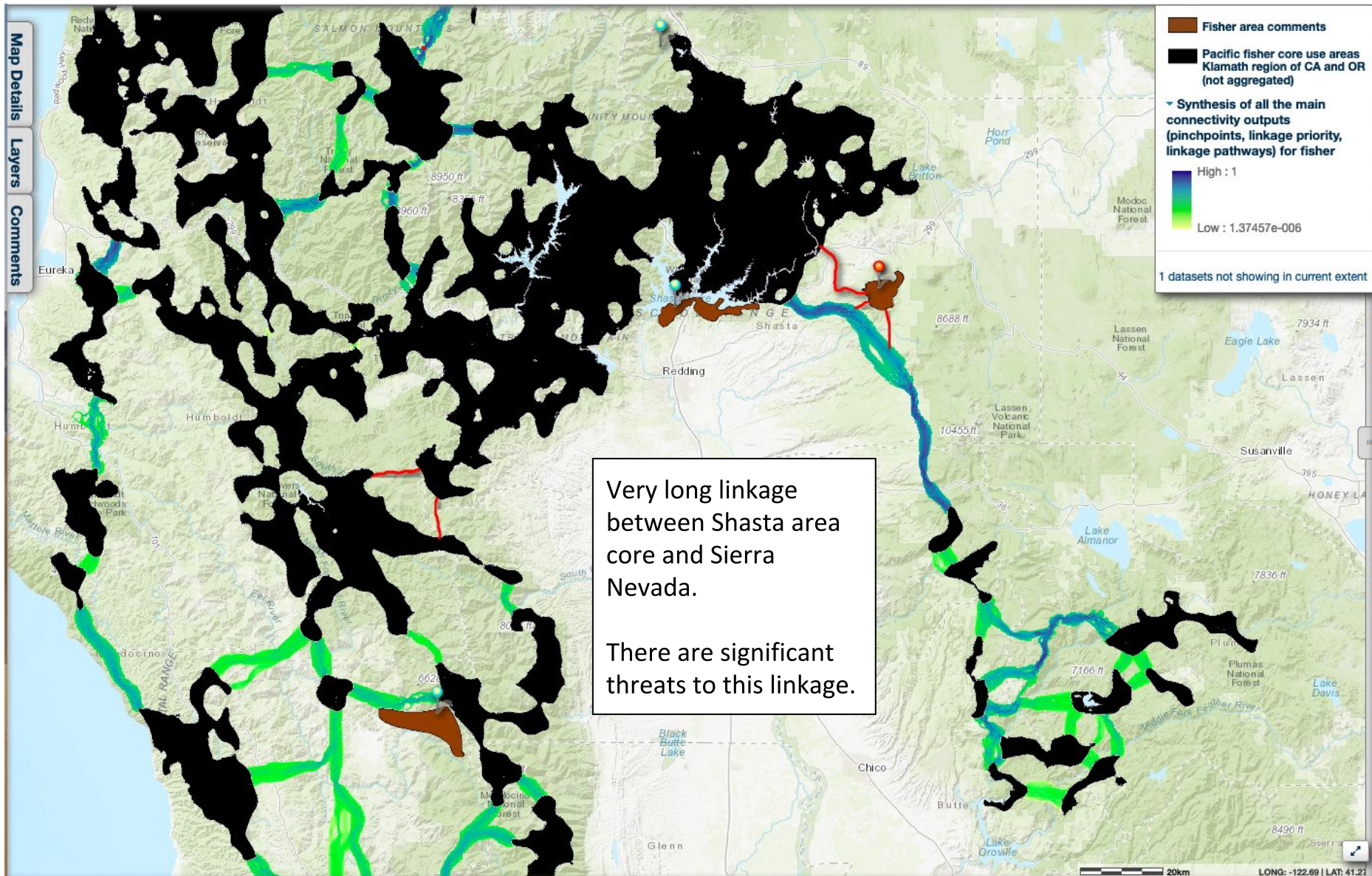
Potential fisher
sub-population in
this area

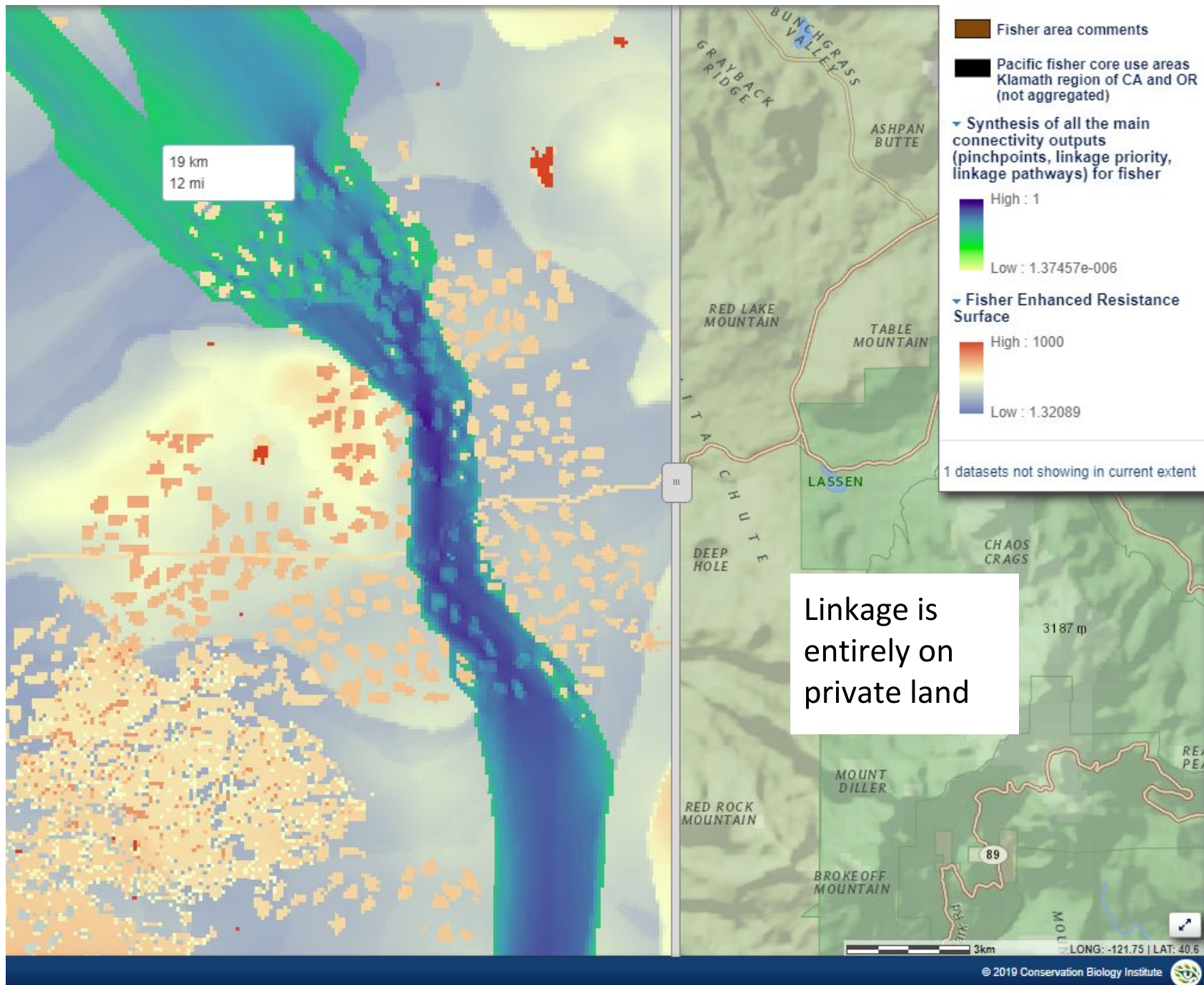




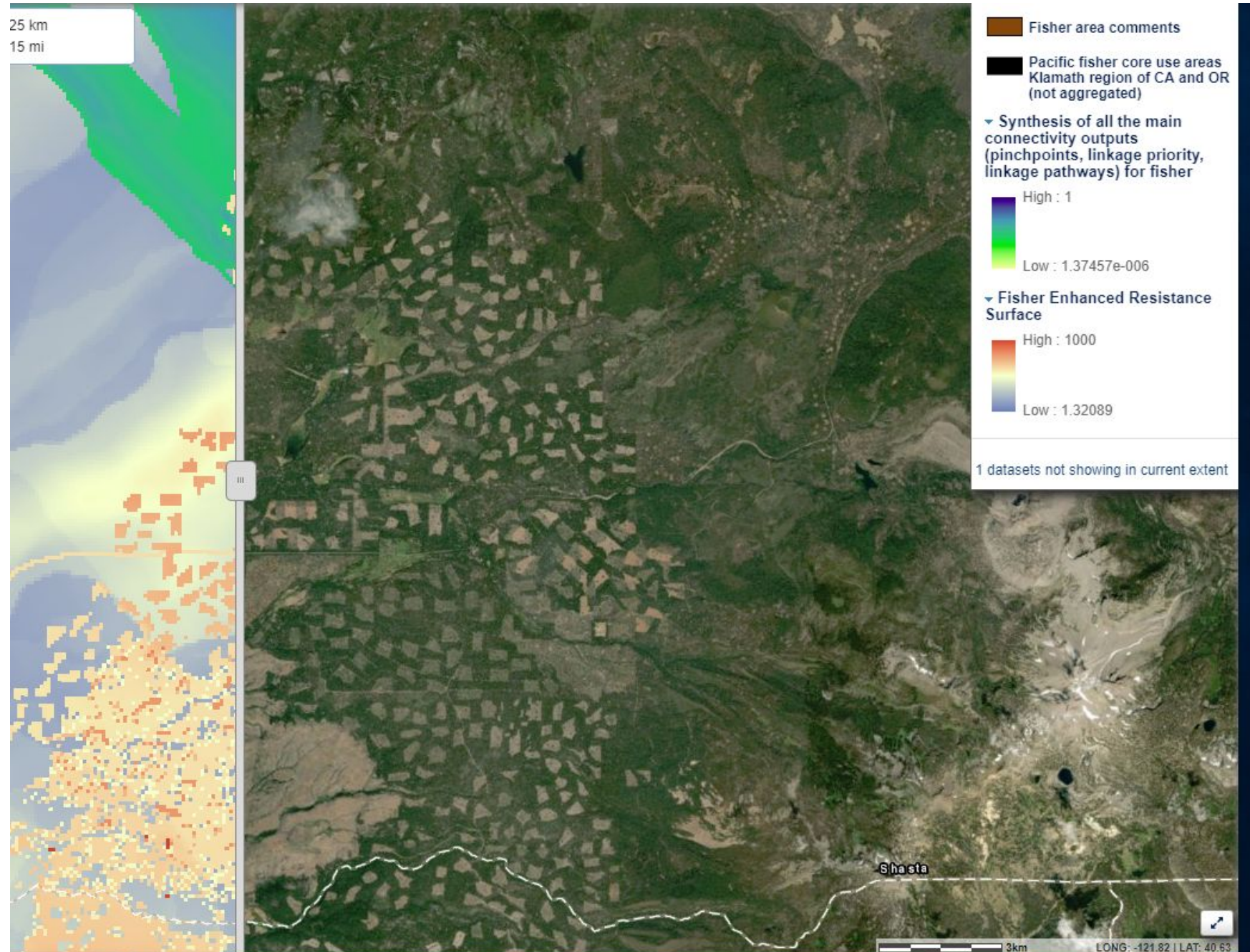


Link to this dynamic map on Data Basin: [Fisher Connectivity Map for Review](#)





25 km
15 mi



Links to Resources:

Draft connectivity report:

[Klamath Basin Connectivity Project](#)

[Methods Documentation and Summary of Beta Deliverables](#)

Link to connectivity maps on Data Basin: [Fisher Connectivity Map for Review](#)

Fire Modeling documentation (watch this space)

Some Next Steps:

- Analysis of grow site and other (urban growth) threats in Klamath linkages
- Do risk analysis for linkages in Southern Sierra Nevada, using tree mortality, grow sites, and fire.
- Heather will share fire modeling documentation
- Laura provide her questions to Deanne