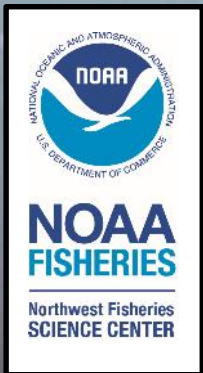


Estimating the historical and contemporary rearing capacity for spring Chinook above and below Willamette Project Dams



Morgan Bond, Tyler Nodine, Tim Beechie,
Chris Jordan, Mark Sorel, George Pess,
and Rich Zabel

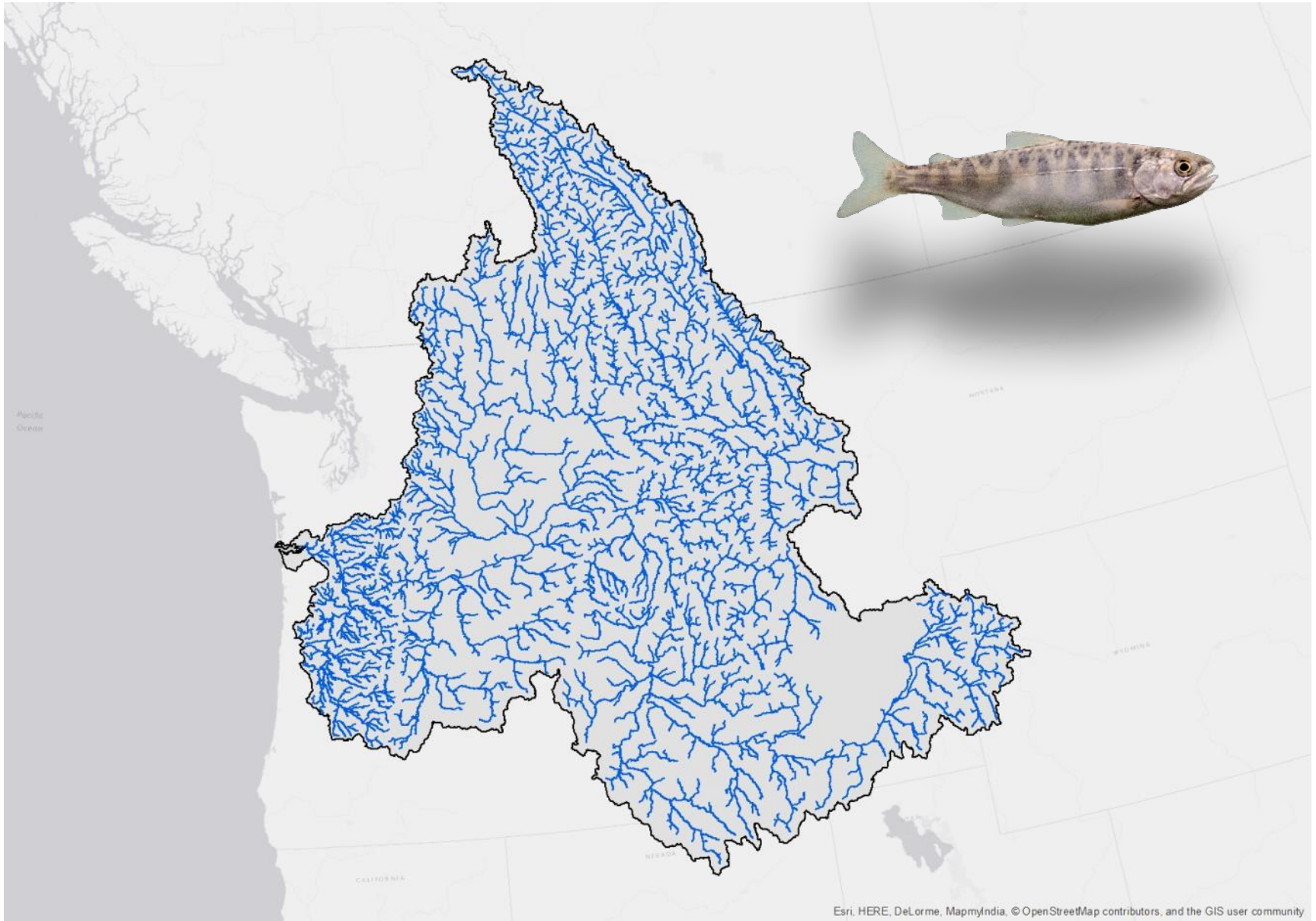


What do we mean by capacity?

- Capacity: long-term average max. abundance
- We are estimating life stage specific capacities:
 - Historical/Contemporary:
 - Spawners (George Pess)
 - Juvenile (parr) above-impoundments/unimpounded
 - Reservoir capacity (Mark Sorel)

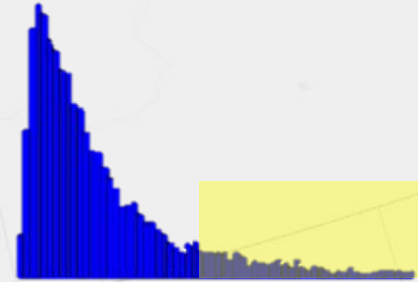


How do we estimate large scale capacity?



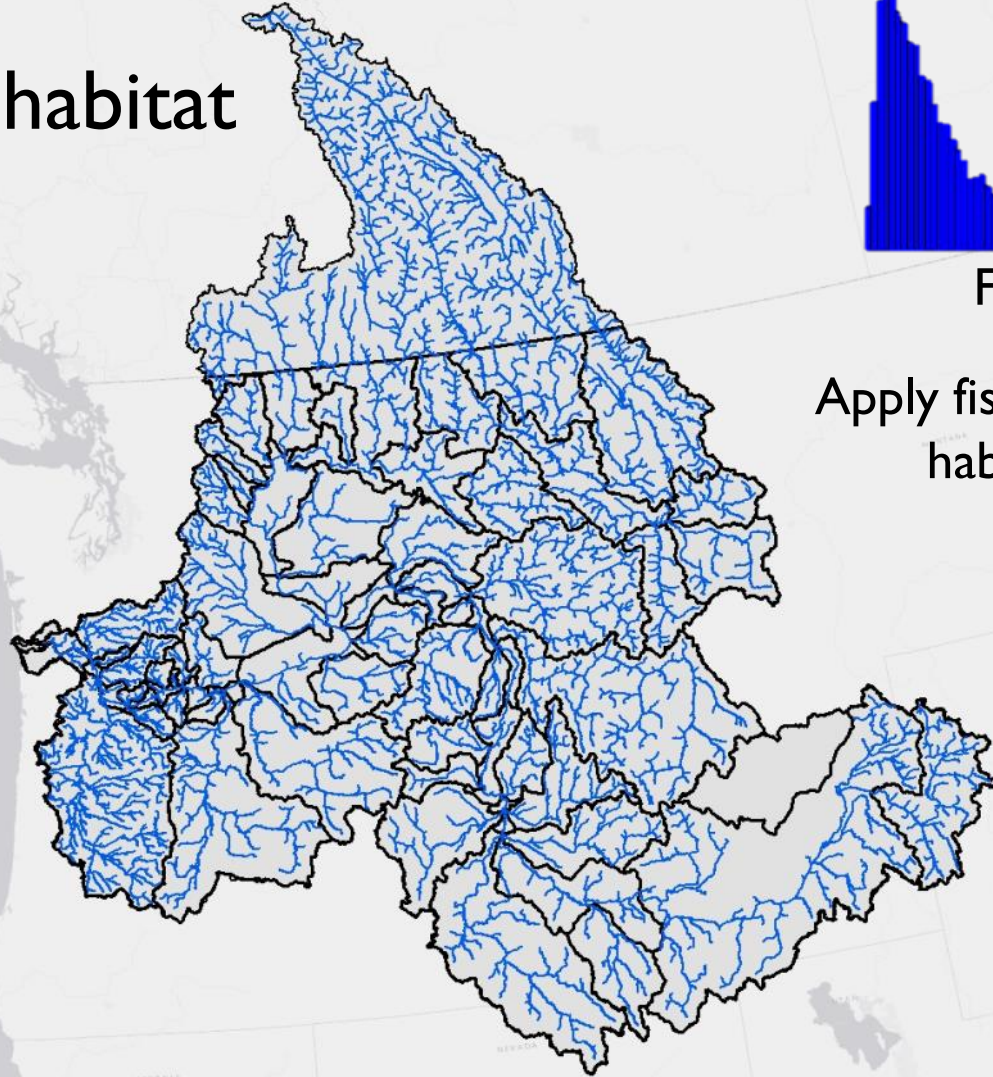
Habitat expansion approach

Estimate habitat
area



Fish/ m^2

Apply fish densities to
habitat area

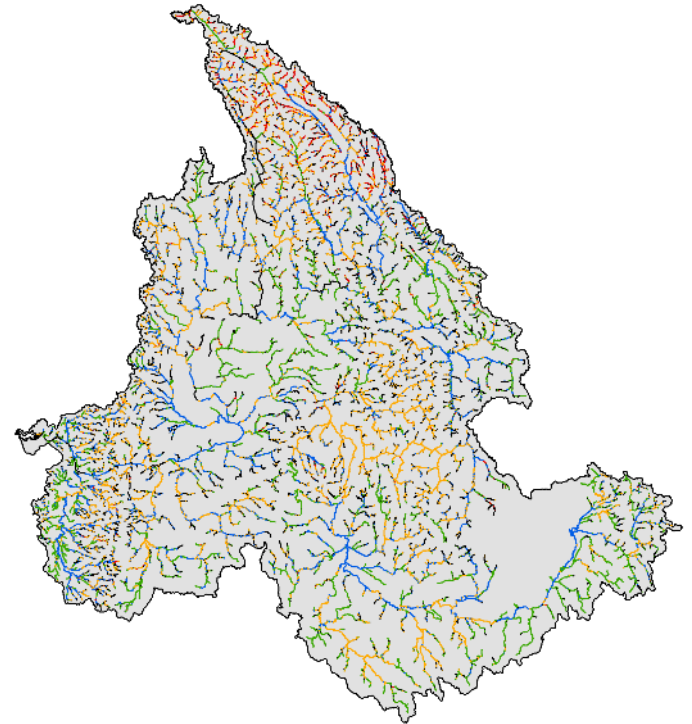


Why expansion approach?

Predicting natural channel patterns based on landscape and geomorphic controls in the Columbia River basin, USA

Tim Beechie¹ and Hiroo Imaki¹ WATER RESOURCES RESEARCH, VOL. 50, 39–57

- Common model predicting channel form throughout the CRB
- Create estimates of available habitat /capacity at different spatial scales
- Estimate of historical capacity (unmodified channel forms)
- Allows for scenarios of restoration



Incorporating parameter uncertainty into evaluation of spawning habitat limitations on Chinook salmon (*Oncorhynchus tshawytscha*) populations

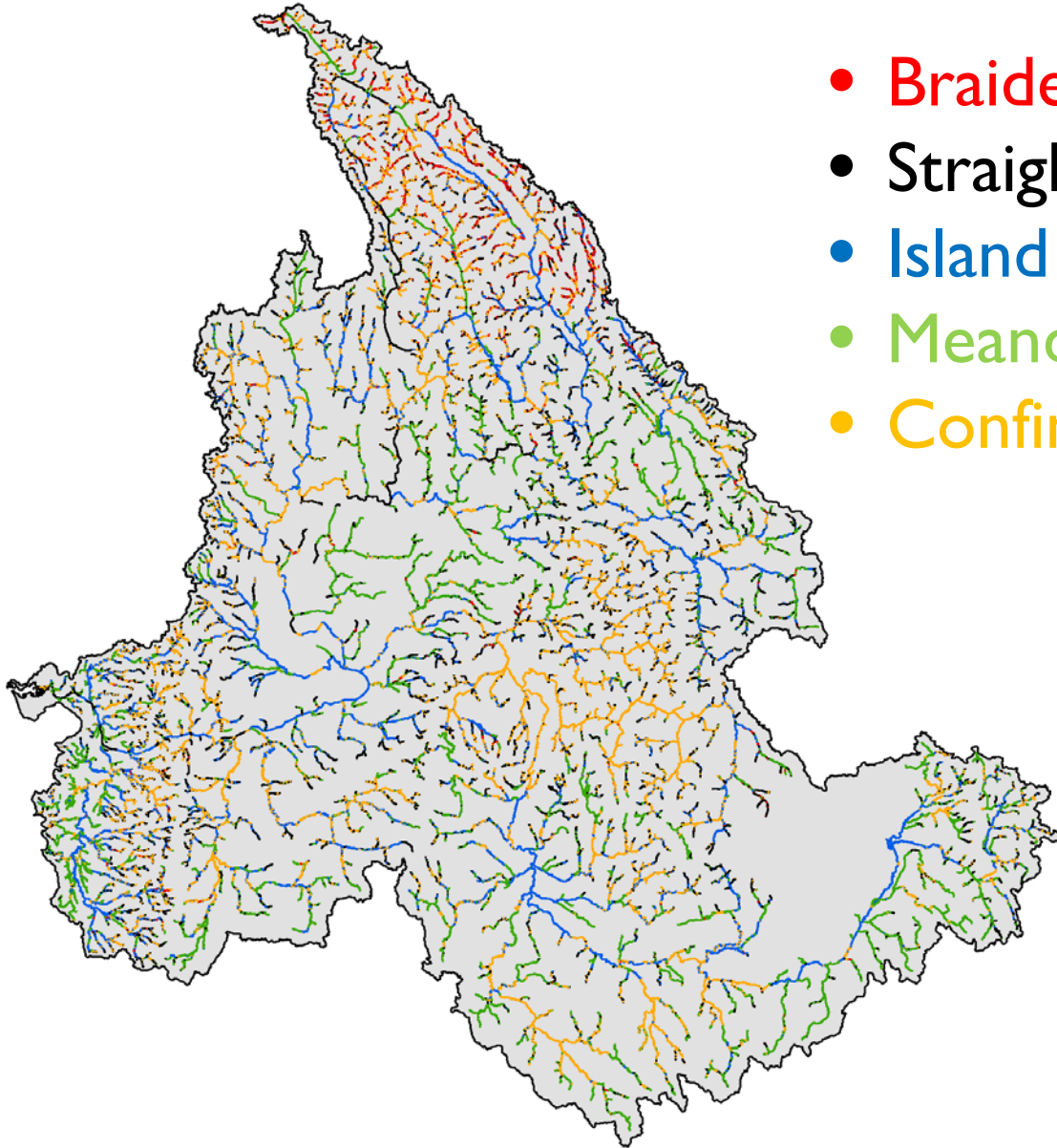
Timothy J. Beechie, Correigh M. Greene, Lisa Holsinger, and Eric M. Beamer

Can. J. Fish. Aquat. Sci. **63**: 1242–1250 (2006)

Estimated changes to Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*) habitat carrying capacity from rehabilitation actions for the Trinity River, North Fork Trinity to Lewiston Dam

Tim Beechie, George Pess, Hiroo Imaki report for USFWS May 2012

Sum channel type lengths



- **Braided:** 2210 km
- **Straight:** 10165 km
- **Island Braided:** 12385 km
- **Meandering:** 15006 km
- **Confined:** 16046 km



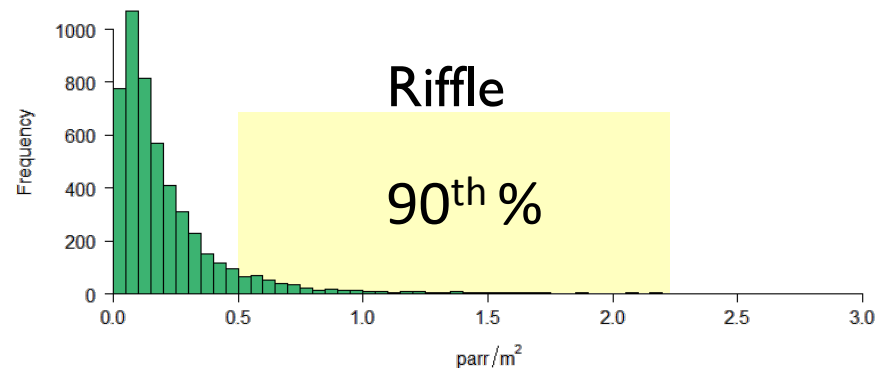
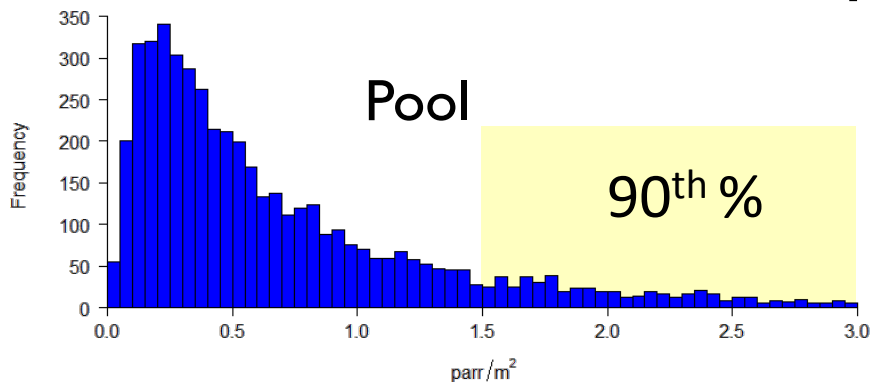
Translating modeled channel length to habitat area

- Develop functional relationships of habitat area with modeled stream size
- Measure mainstem, off channel, side channel habitats with satellite imagery:
 - Channel type
 - Over a range of stream sizes (bankfull width, discharge)
 - 130 “unmodified” sites throughout CRB



Habitat-specific fish densities

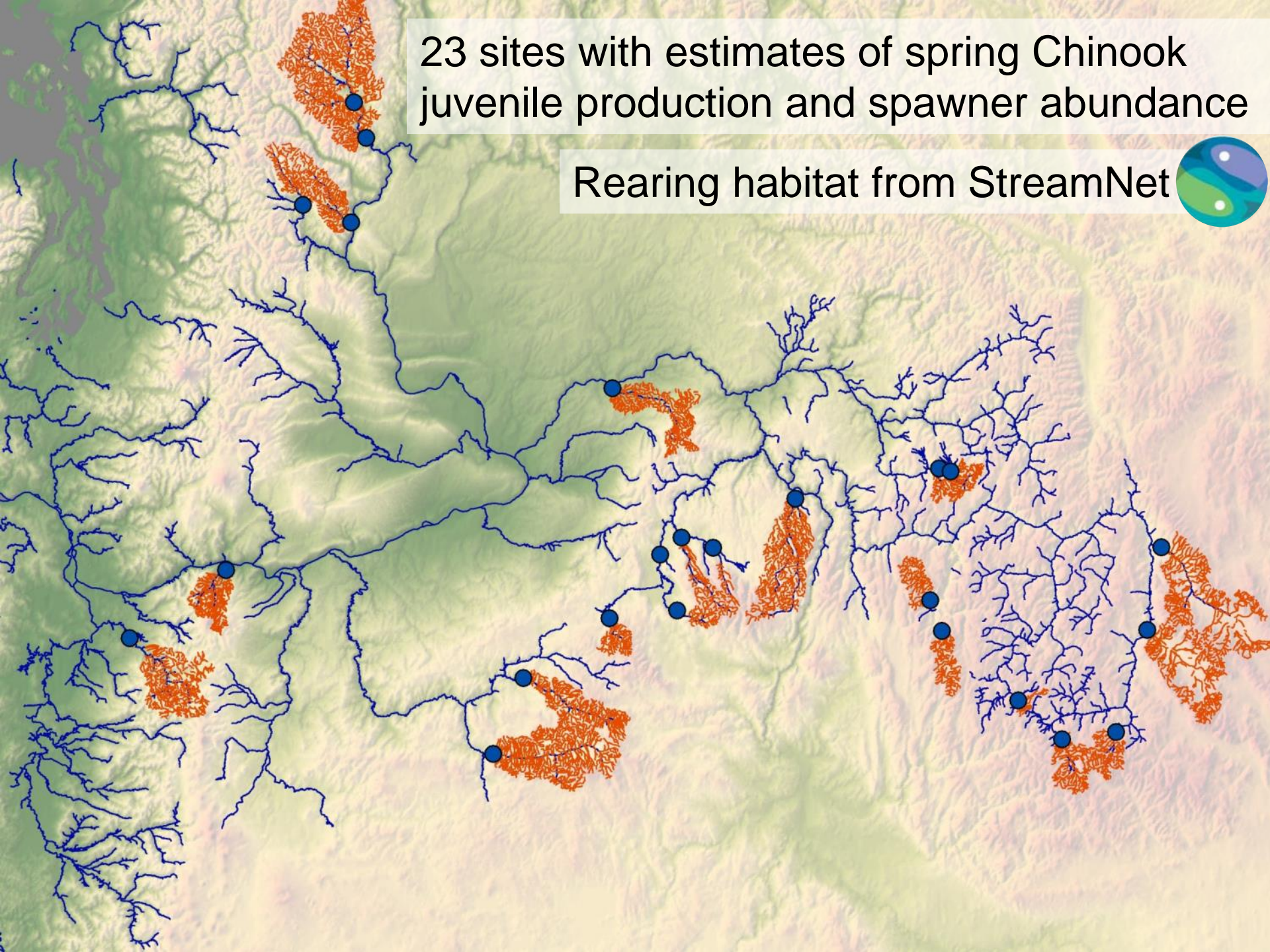
- Spring Chinook parr densities
 - CHaMP/ISEMP
 - Literature review by Beechie et al.
- >8m bankfull width: density by total useable habitat area (edge, side channel, off channel)
- <8m bankfull width: pool:riffle ratio by slope



How do we validate these estimates?

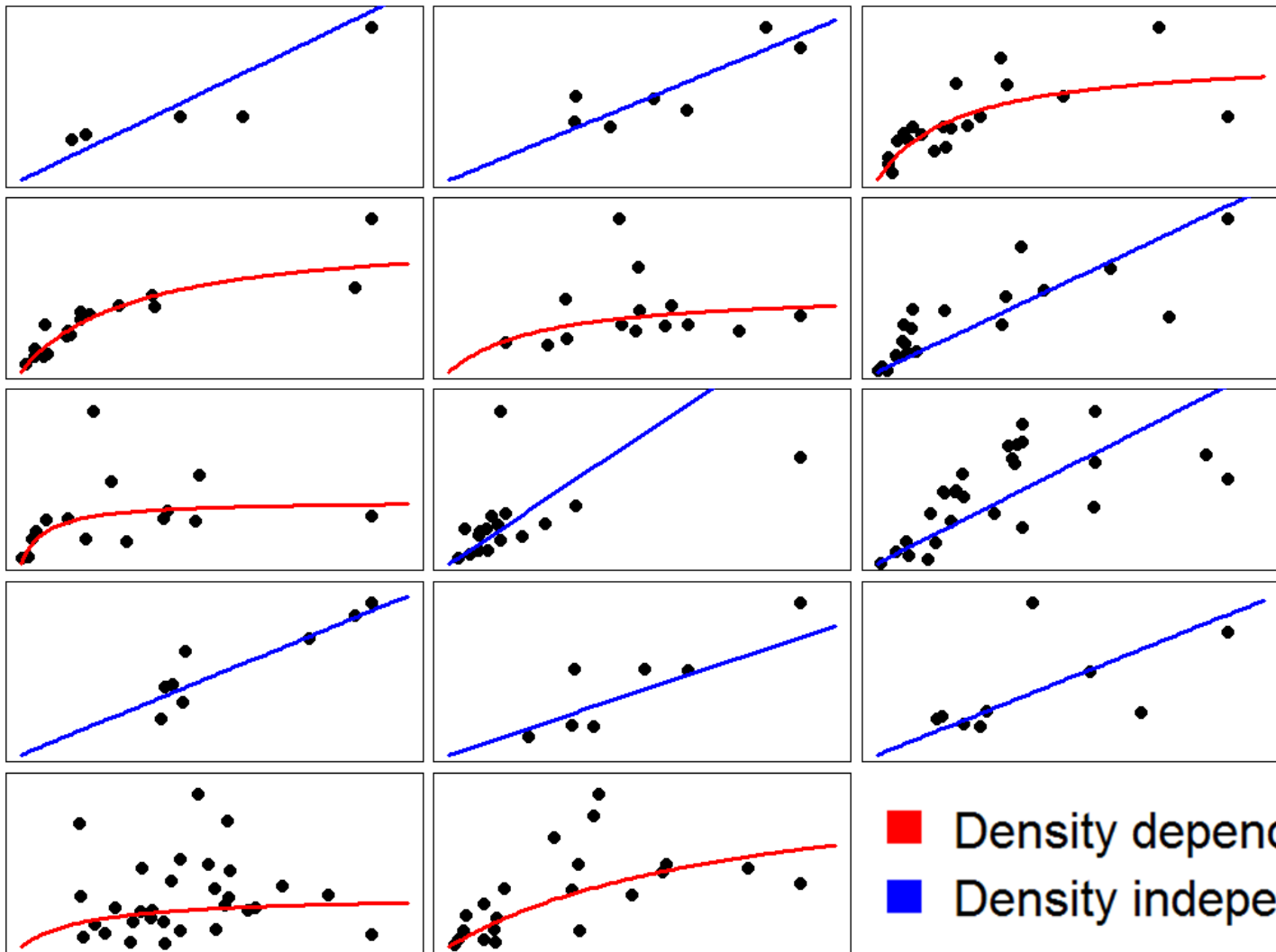
23 sites with estimates of spring Chinook juvenile production and spawner abundance

Rearing habitat from StreamNet

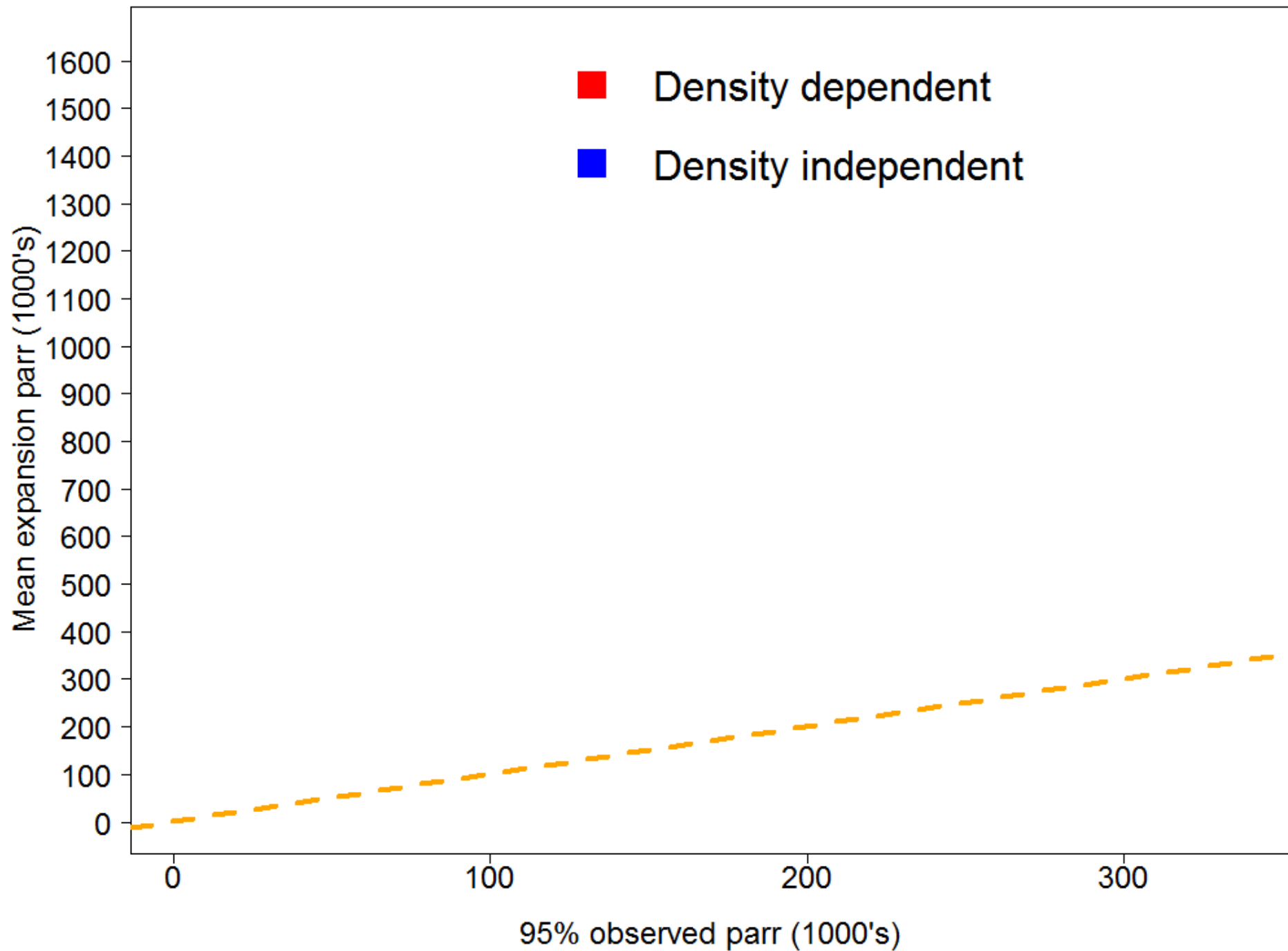


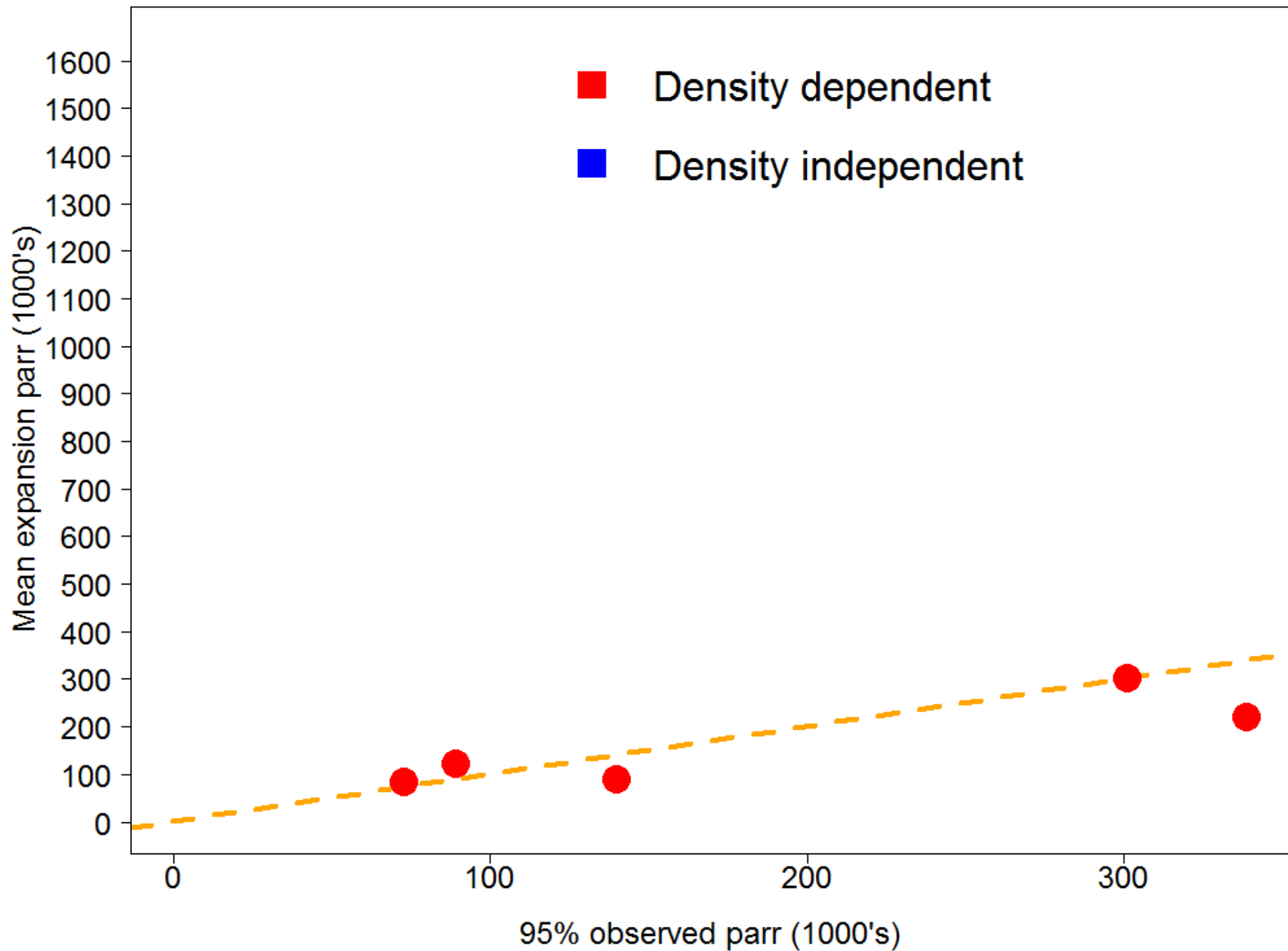
Empirical estimates of capacity

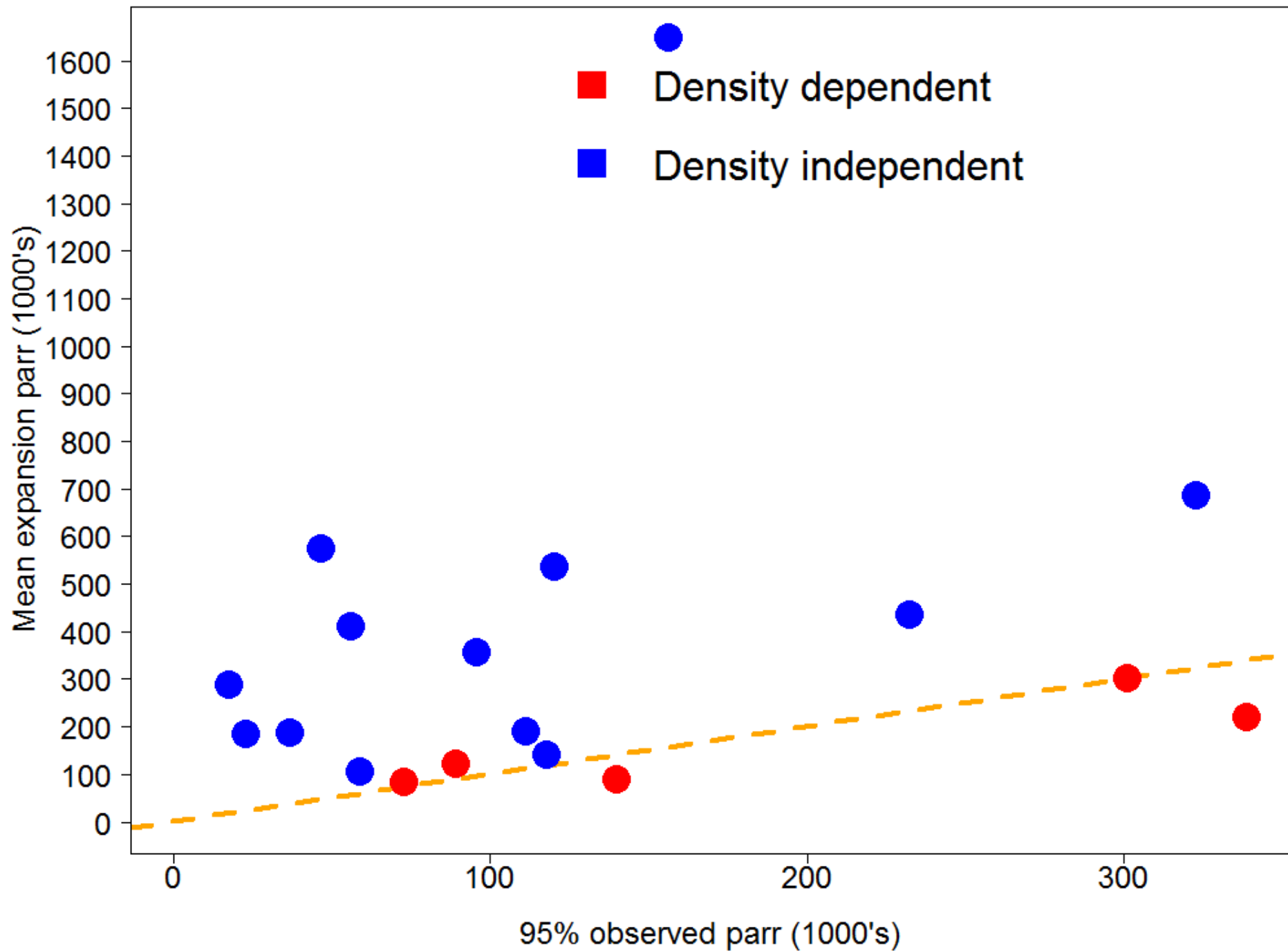
Summer
parr
estimate



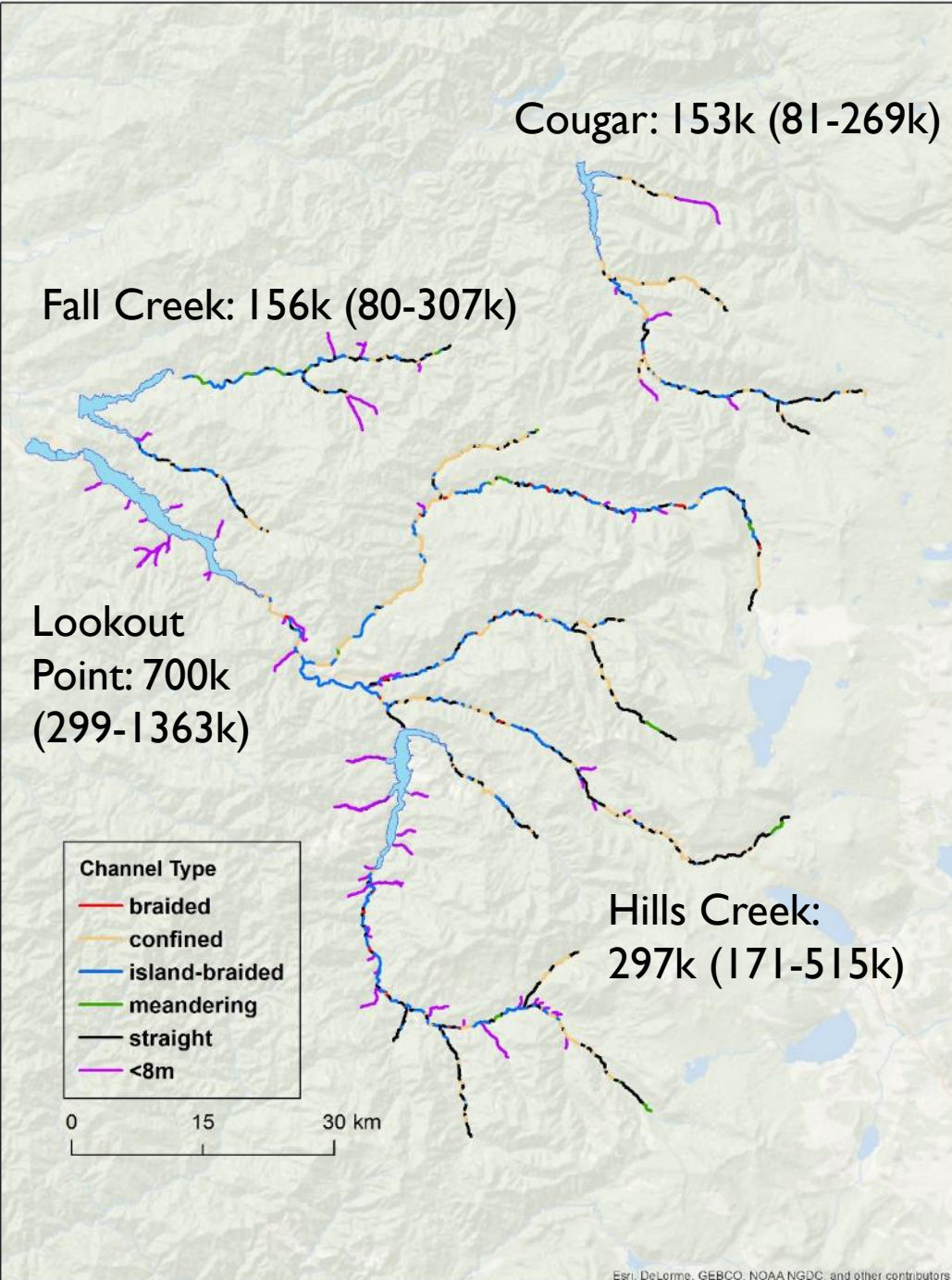
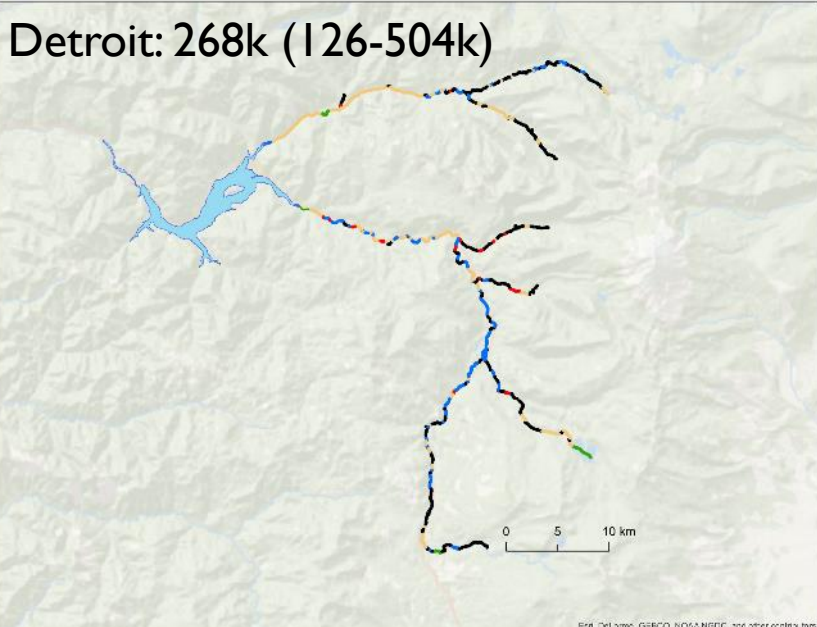
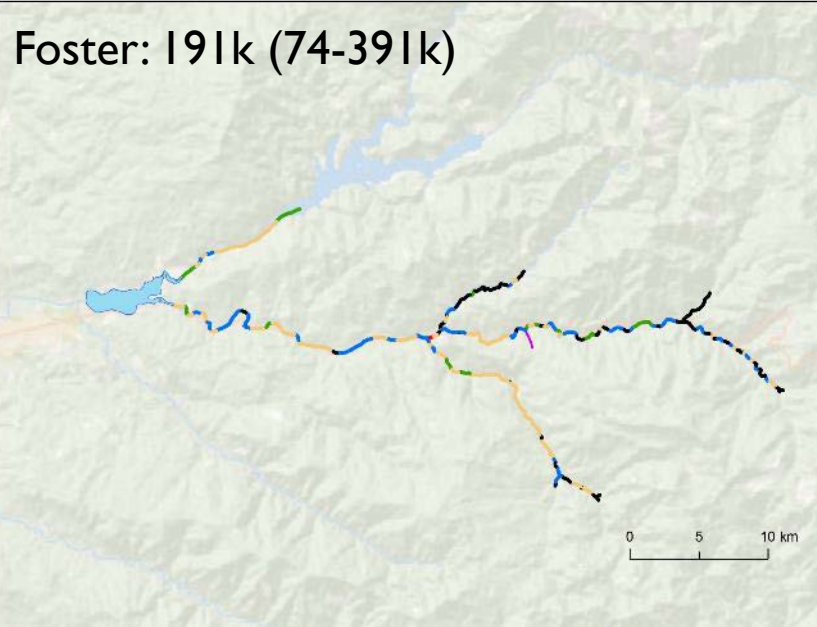
Redd count







Above impoundment estimates

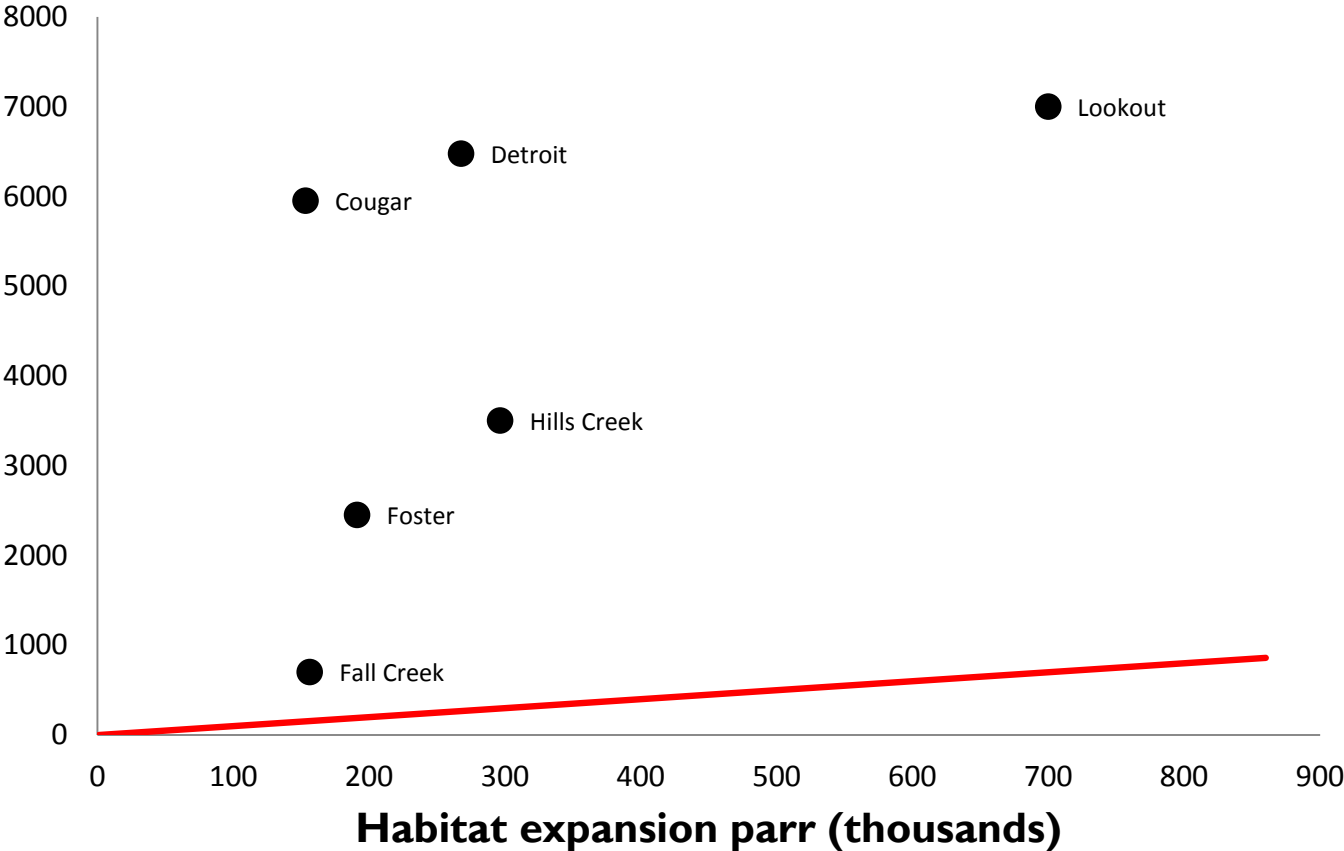


Esri, DeLorme, GEBCO, NOAA/NGDC, and other contributors

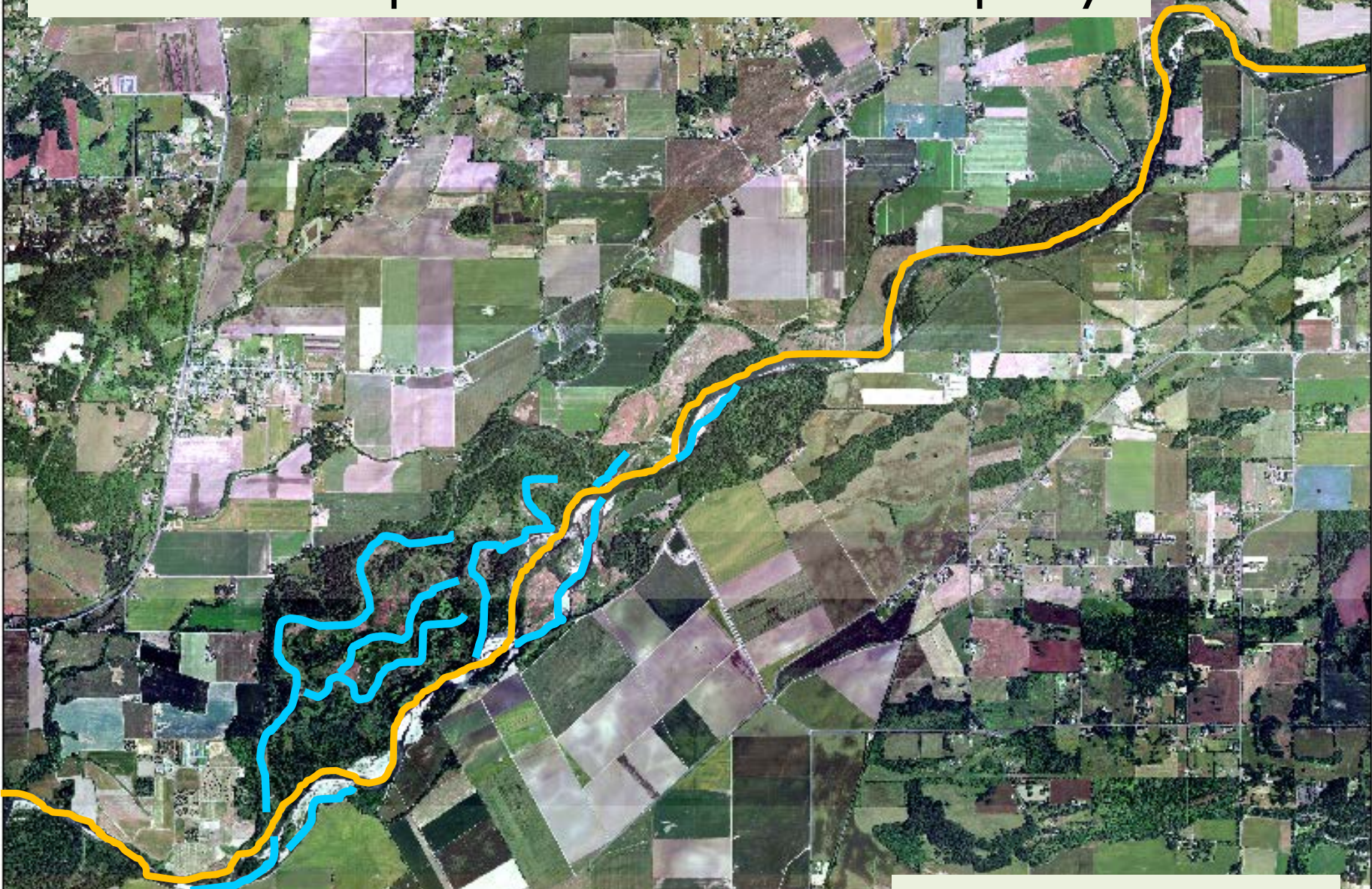
Esri, DeLorme, GEBCO, NOAA/NGDC, and other contributors

Compared to previous estimates

**Parkhust parr
est. from gravel
(thousands)**



Is the model representative of current capacity?

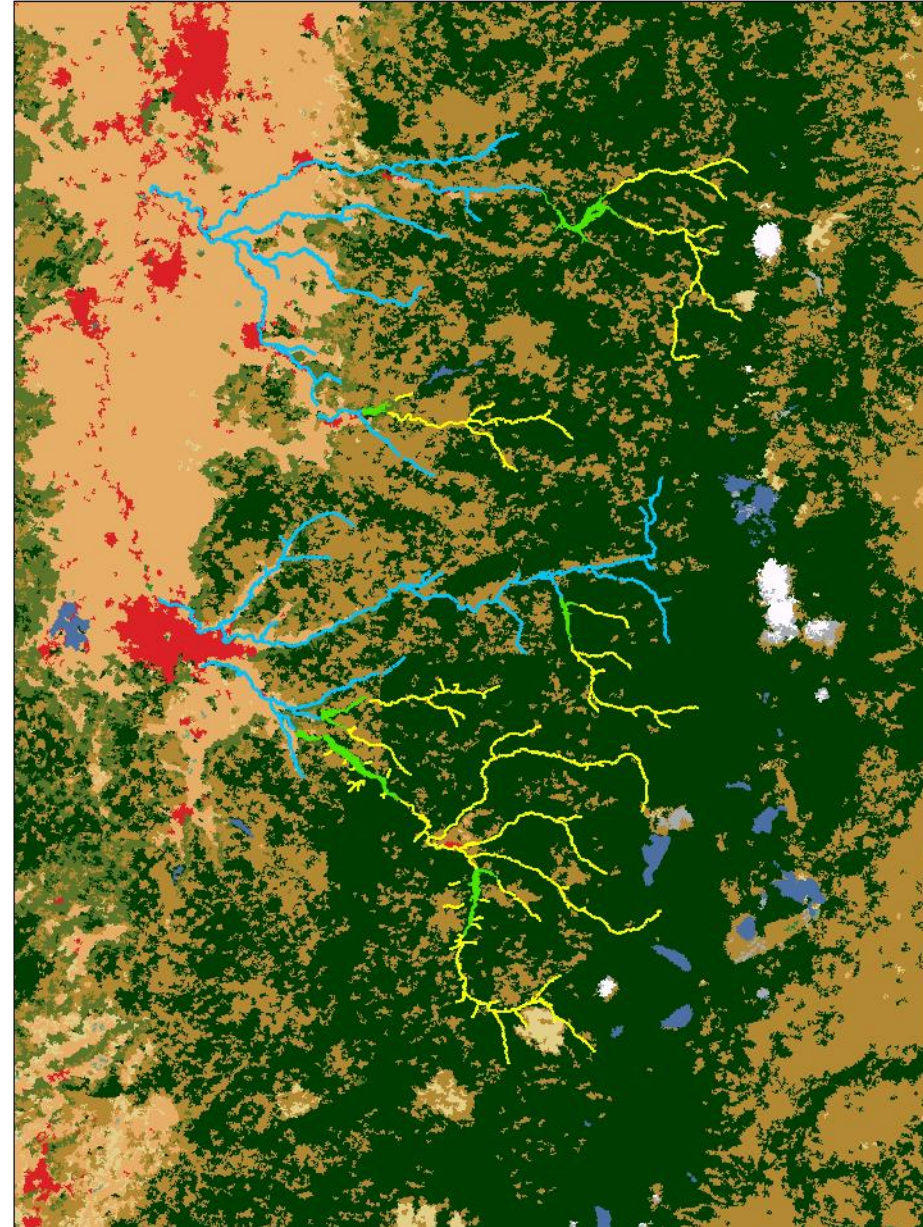


e.g. North Santiam R.

Land use varies above and below Projects

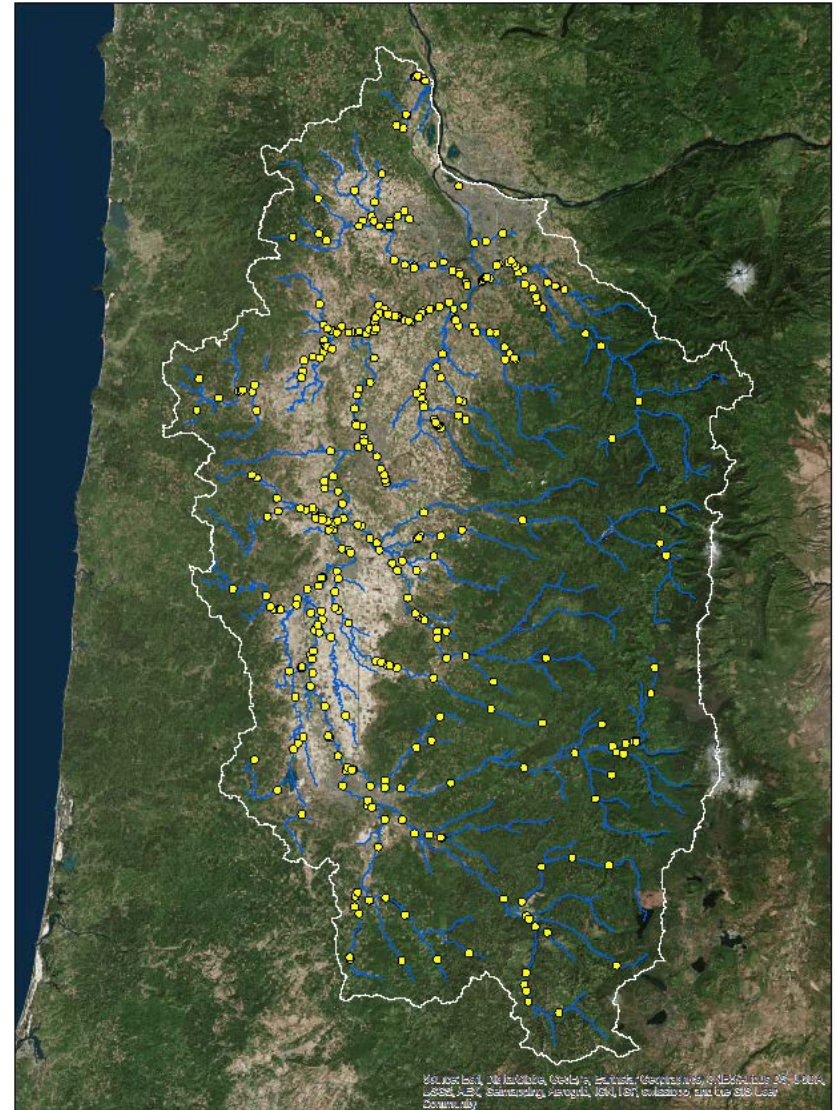
	Impounded			
	Island-braided	Meandering	Straight	Confined
Urban	0%	0%	0%	0%
Crop	0%	0%	0%	0%
Grassland	0%	0%	0%	1%
Shrubland	20%	19%	13%	12%
Forest	80%	81%	86%	88%

	Unimpounded			
Urban	12%	2%	0%	7%
Crop	35%	75%	13%	16%
Grassland	0%	0%	0%	0%
Shrubland	18%	8%	37%	25%
Forest	35%	14%	50%	52%



How to estimate changes in side/off channel habitat?

- Spatially balanced design (GRTS) to sample sites with satellite imagery
- Compare measurements of:
 - Historic floodplain
 - Active channel width
 - Mainstem/off/ side channel area
 - Modified/unmodified
- Stratified on:
 - Predicted channel type
 - Land use





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- Portland General Electric: Nick Ackerman
- Nez Perce Tribe: Devin Olsen
- Shoshone Bannock Tribes
- BioAnalysts, Inc: Tracy Hillman
- NWFSC: Damon Holzer, Tom Cooney, Jim Myers, Jeff Jorgensen, Michael Beakes, Corey Phillis, Kevin See
- BPA: 1989-098-00, 1997-015-01
- Funding: USACOE



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