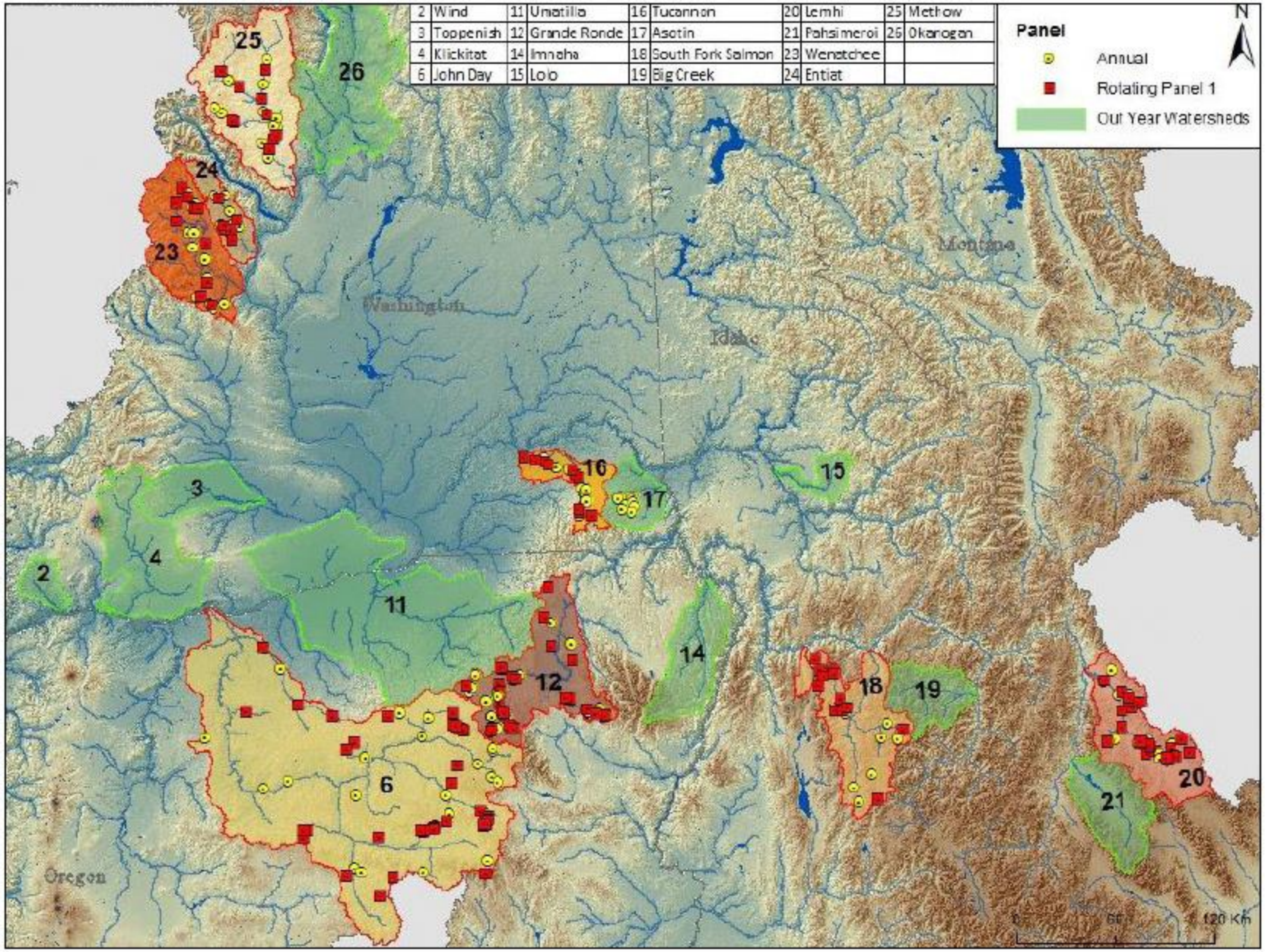
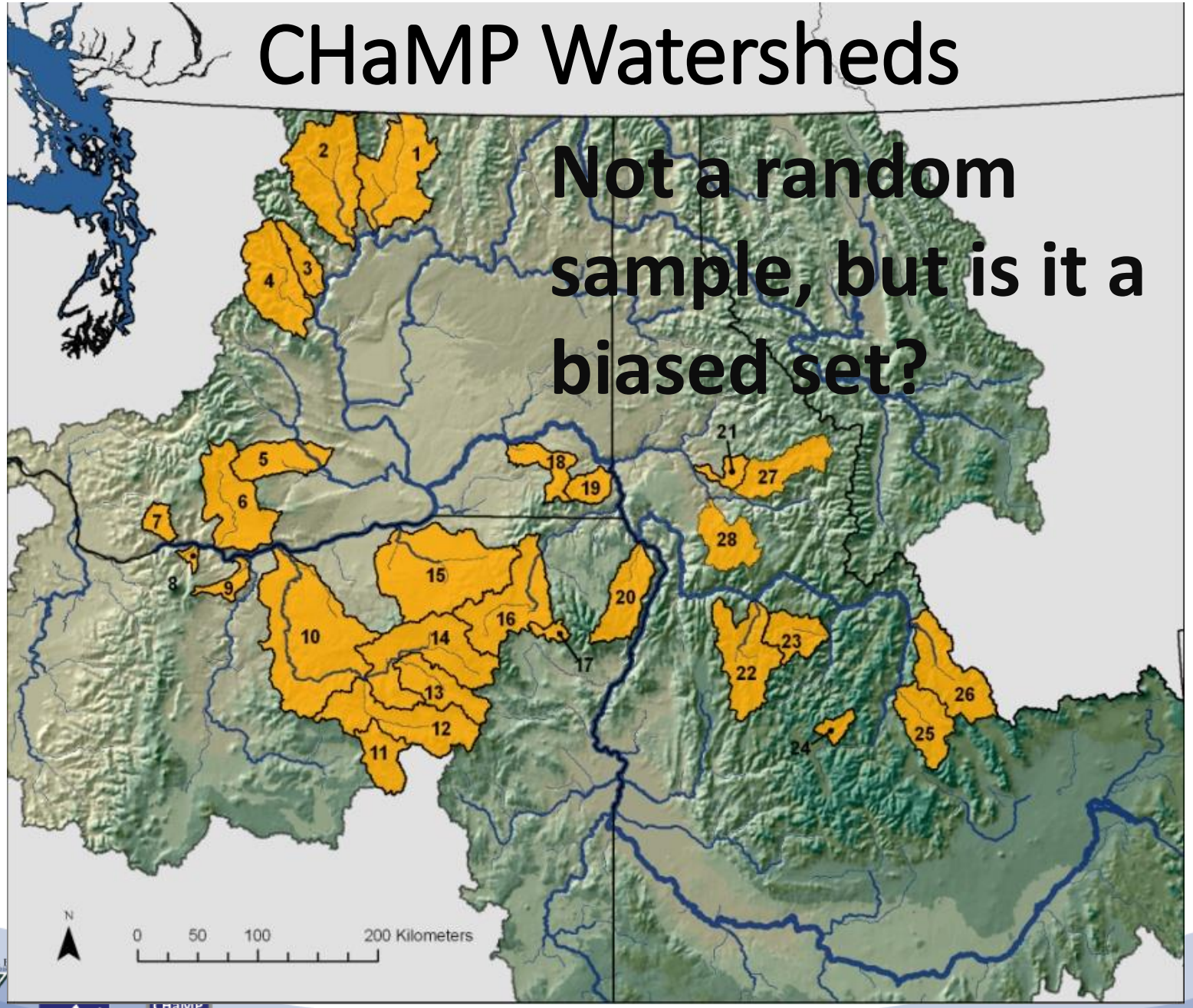
Why are we sampling where we are and what will CHaMP data be used for?

What is CHaMP's objective?

- Describe fish habitat in the Columbia River basin.
  - The CRB is actually sort of big.
  - Need to refine the question a bit.
- Describe fish habitat in some of the salmon population watersheds in the CRB.


2 Wind
3 Toppenish
4 Klickitat
6 John Day
11 Umatilla
12 Grande Ronde
14 Imnaha
15 Lolo
16 Tucannon
17 Asotin
18 South Fork Salmon
19 Big Creek
20 Lemhi
21 Pahsimeroi
23 Wenatchee
24 Entiat
25 Methow
26 Okanogan
Panel
Annual
Rotating Panel 1
Out Year Watersheds
N
Montana
Washington
Idaho
Oregon
0
60
120 Km

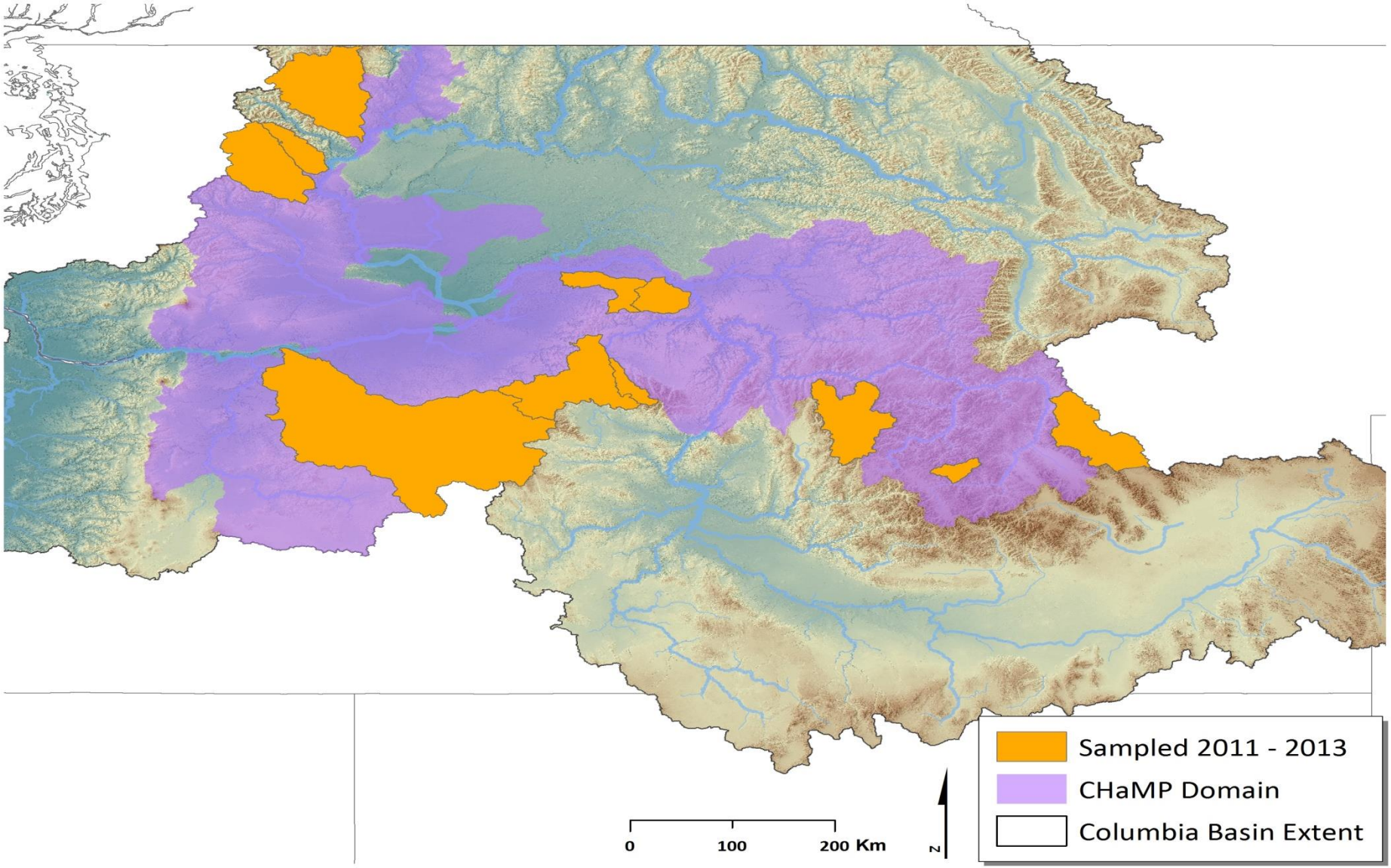
CHaMP Watersheds



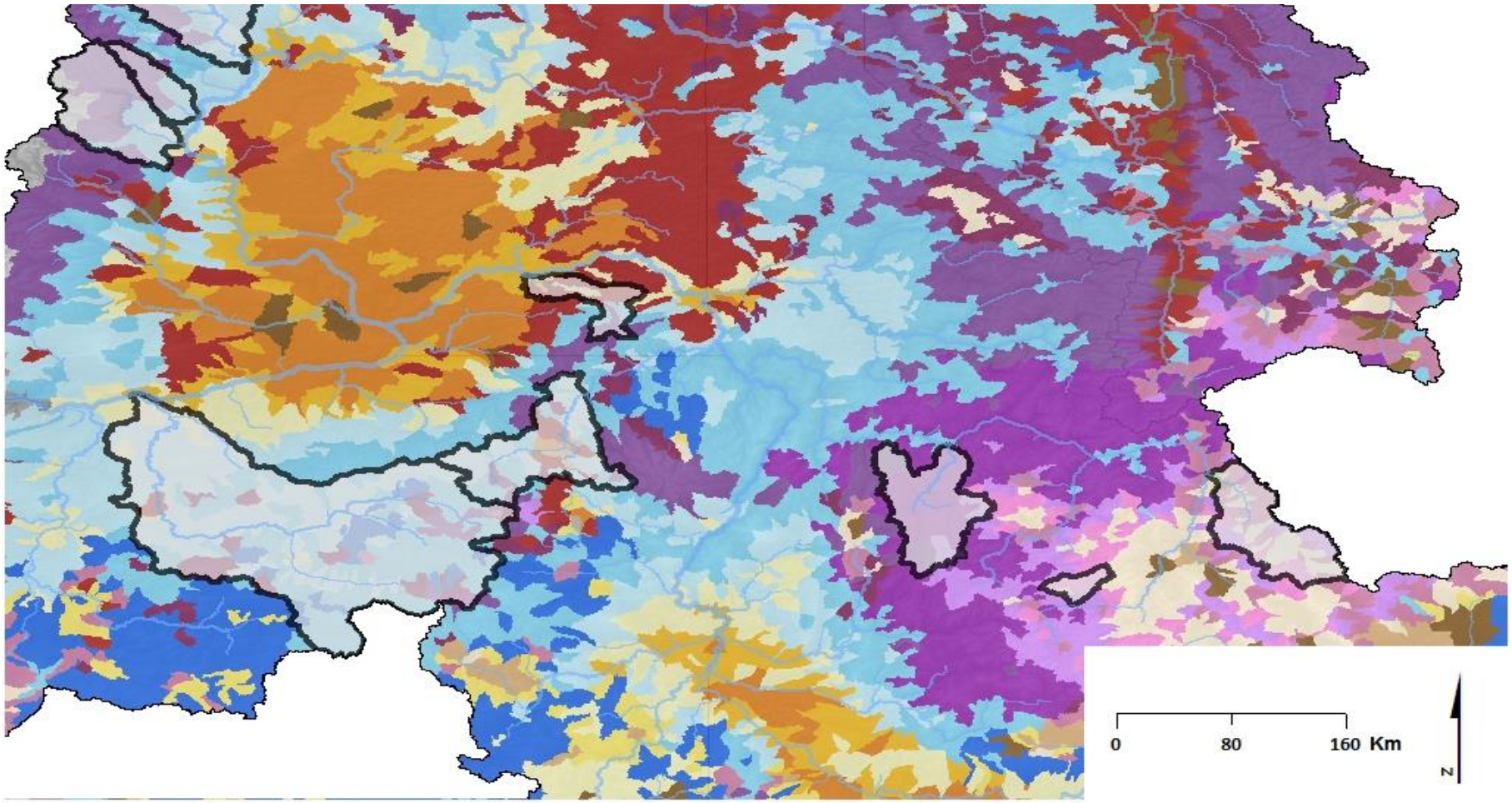
Salmon Population Watersheds in Columbia River basin

- Watersheds
  - Vary by eco-region
  - Vary in degree and type of human impact
  - Vary in extent of impacts of hatchery production

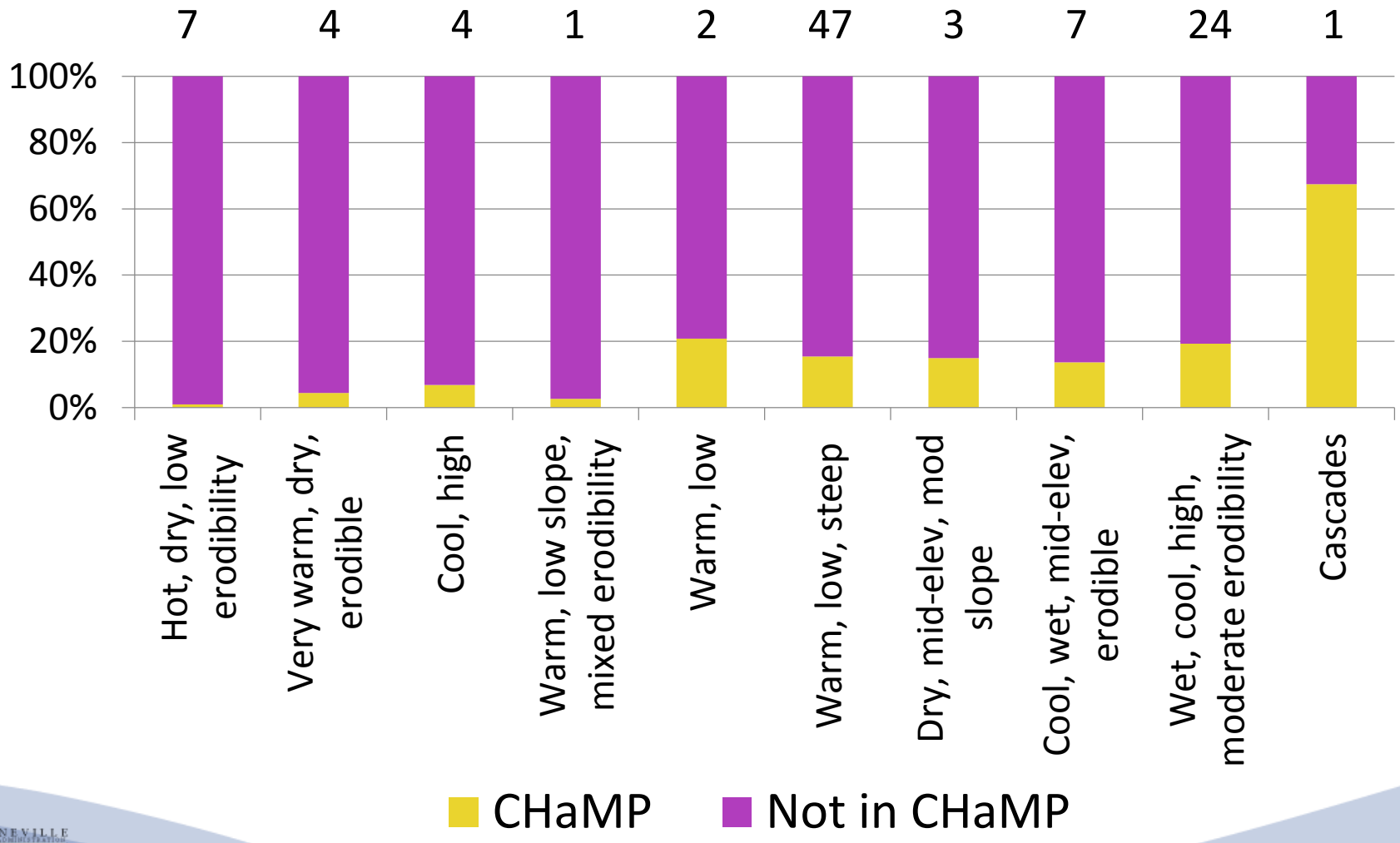
- We can compare CHaMP-watersheds to all watersheds in the CRB


Sampled 2011 - 2013
CHaMP Domain
Columbia Basin Extent
0
100
200 Km
N

Natural landscape classes within CHaMP domain



CHaMP HUC6 within steelhead domain



What is CHaMP's objective?

- Describe fish habitat in the Columbia River basin.
  - The CRB is actually sort of big.
  - Need to refine the question a bit.
- Describe fish habitat in some of the salmon population watersheds in the CRB.
  - These watersheds are actually sort of big.
  - Need to further refine the question.
- Describe fish habitat in a set of reaches in a set of salmon population watersheds in the CRB.

Methow River ~4000 km of streams

We’re going to visit 25 each year – which ones?

GRTS (Generalized Random Tessellation Stratified) Master Sample
- Spatially balanced
- Randomized

How to represent a population of 4000 with a sample of 25?

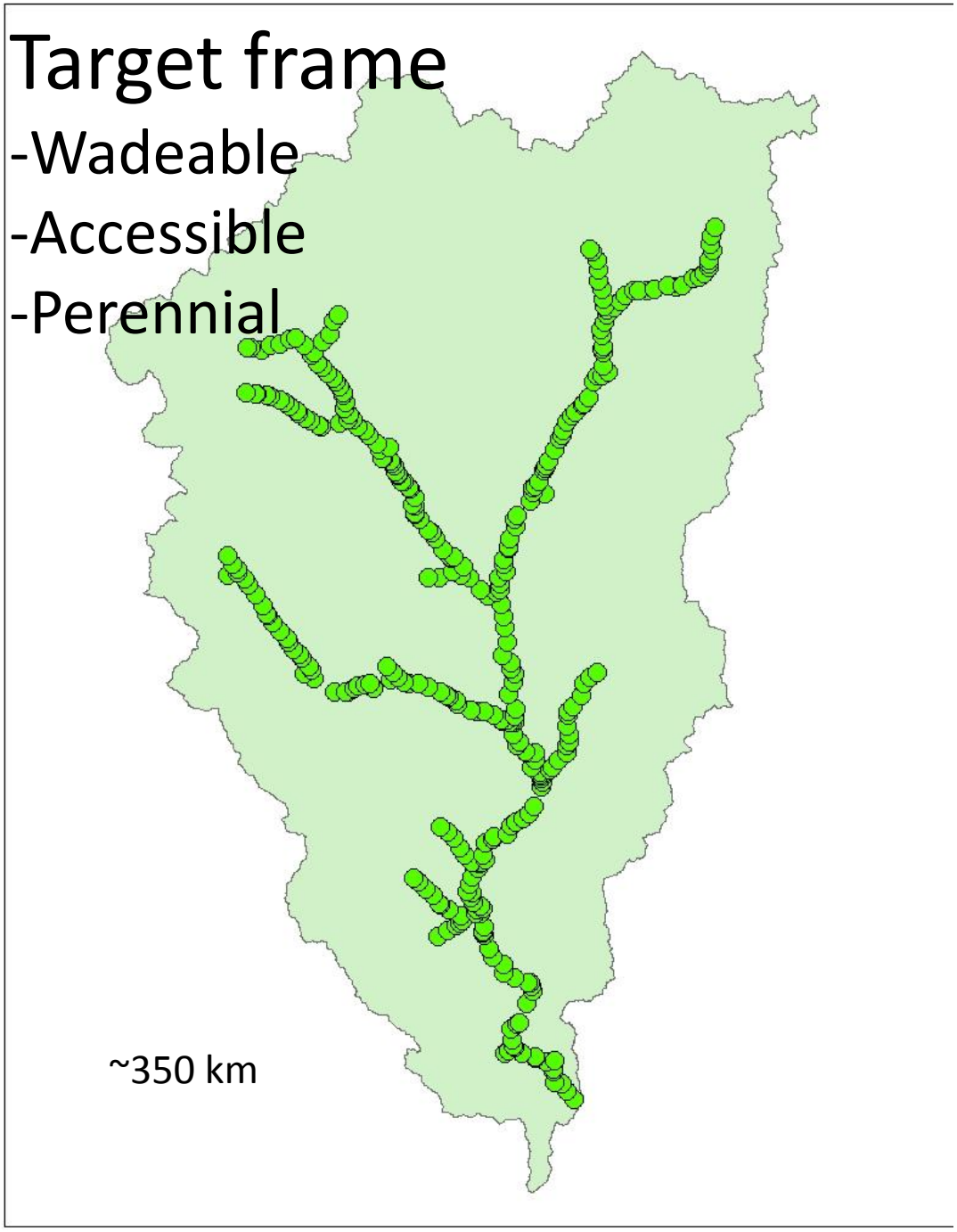
First define the population of interest

Target frame

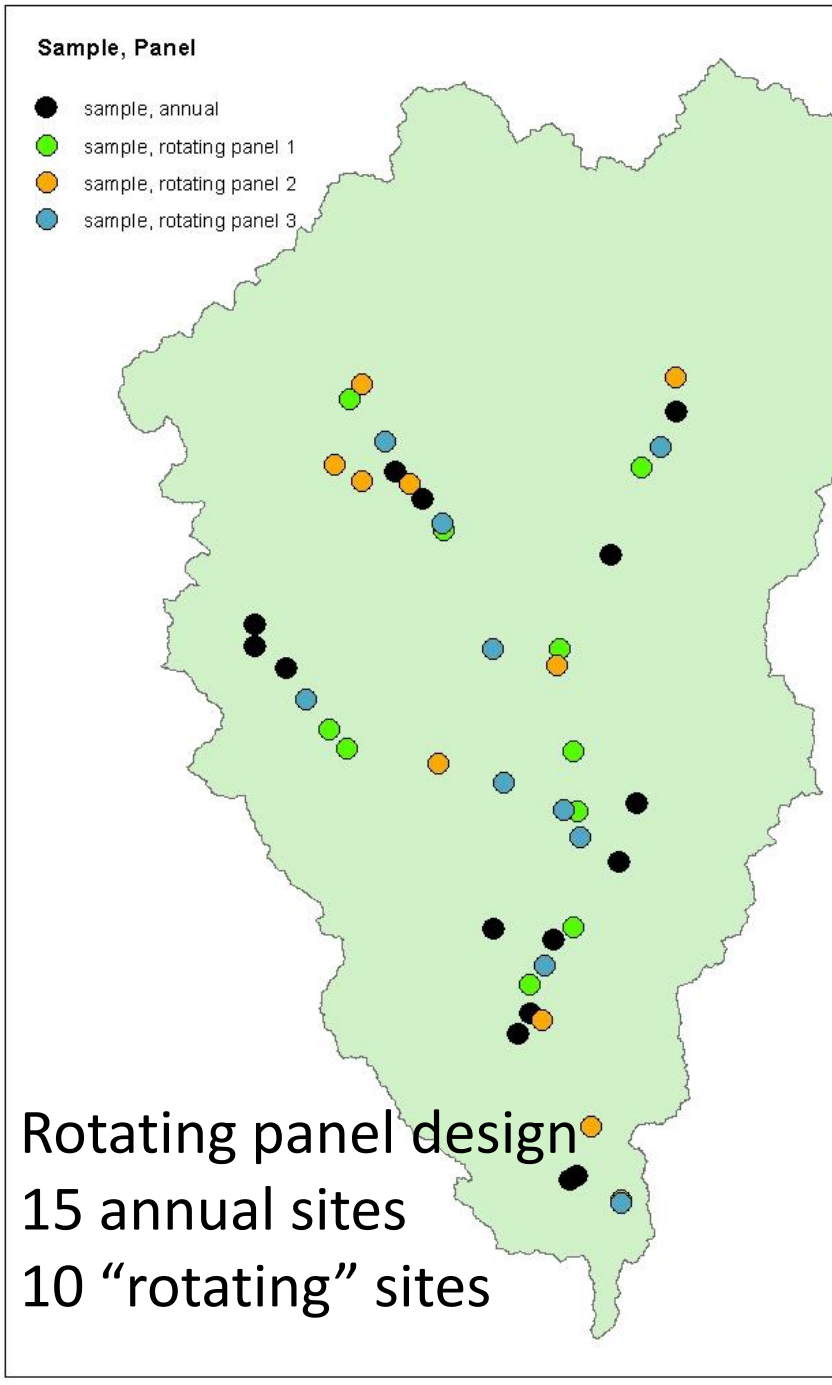
-Wadeable

-Accessible

-Perennial



~350 km



Rotating panel design

15 annual sites

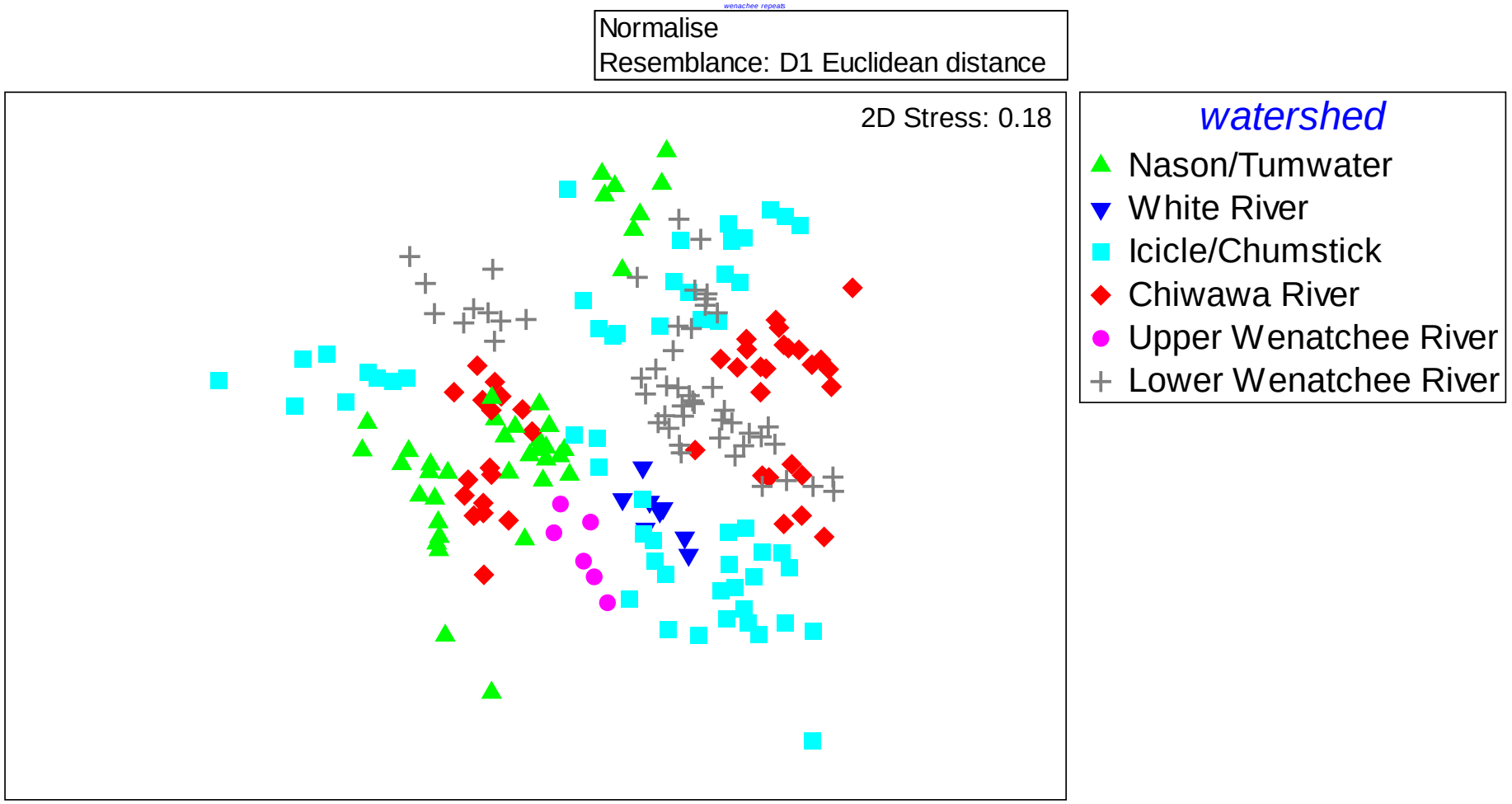
10 “rotating” sites

How and Why are sites within the target frame chosen?

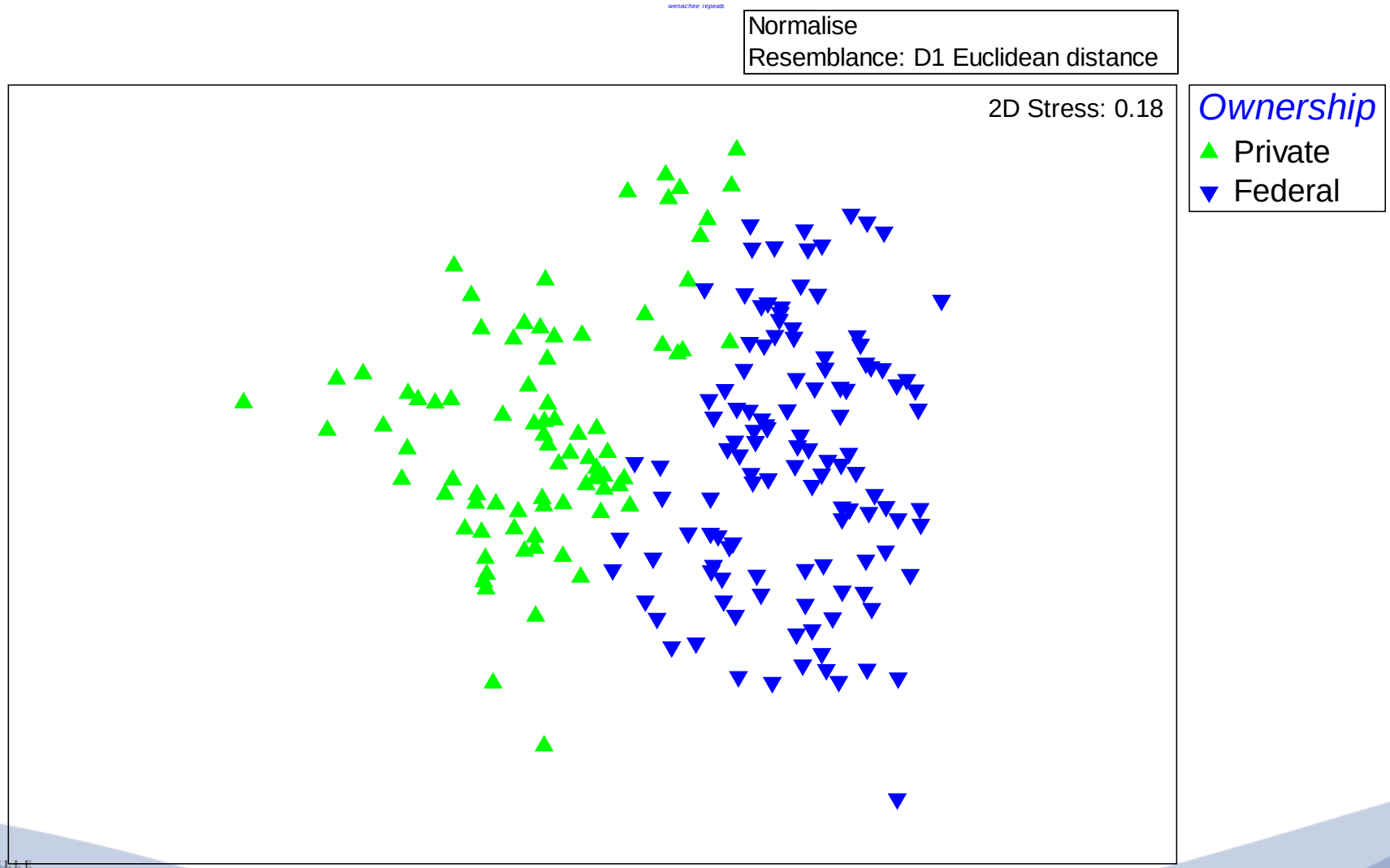
- Strata or features of interest
- Experimental designs
- Spatial pattern of natural variability

- Why does this matter?

Ordination By Watershed

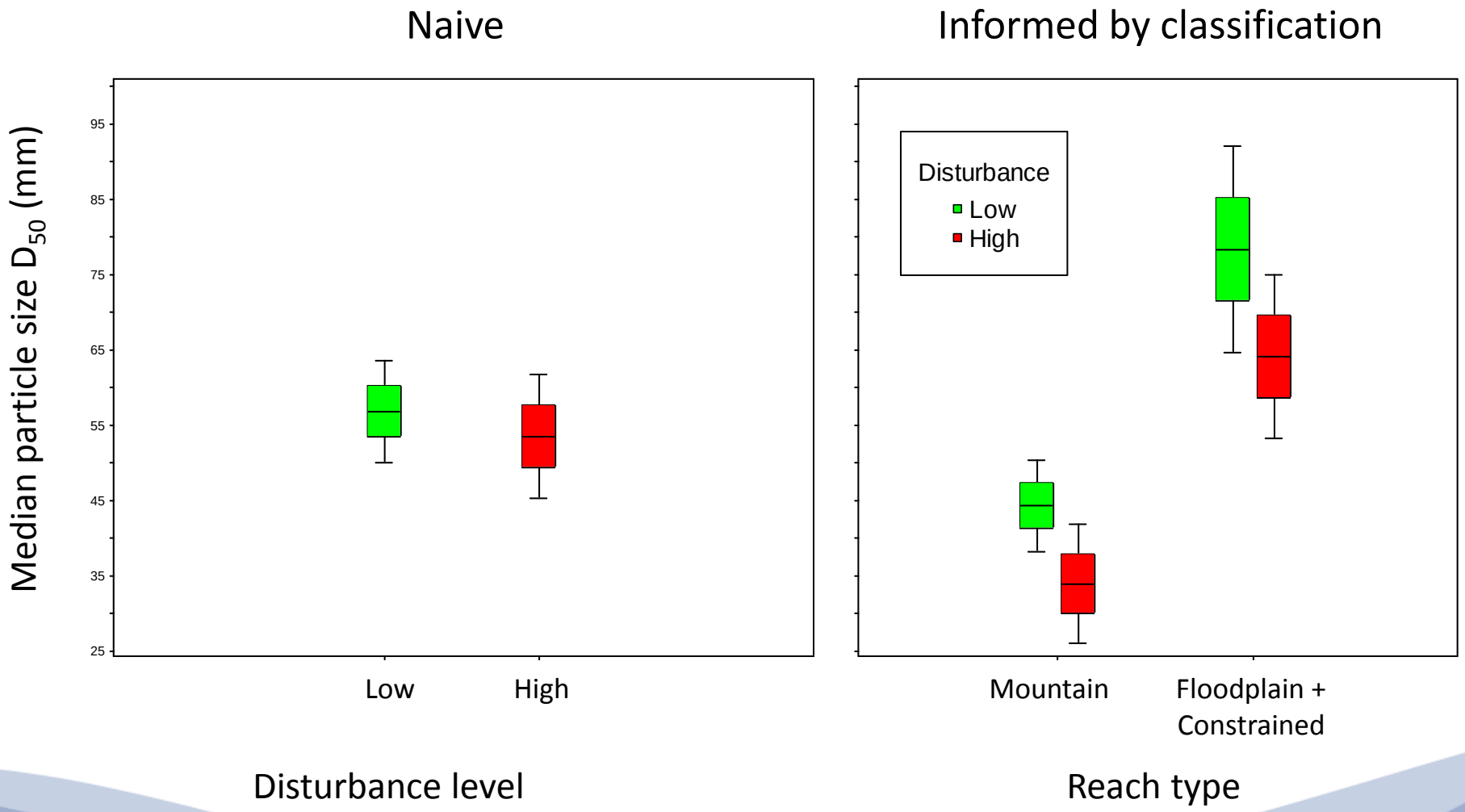


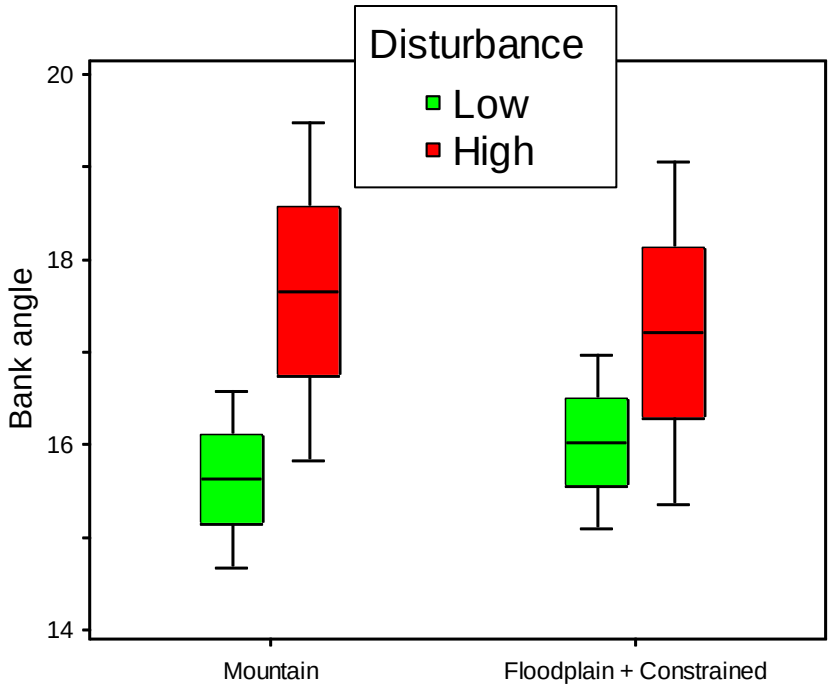
Ordination By Ownership

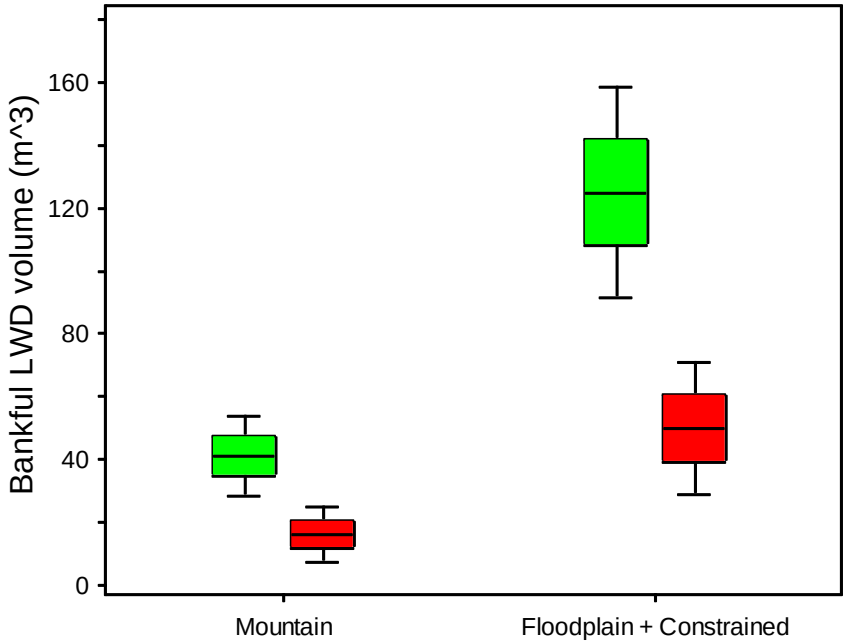


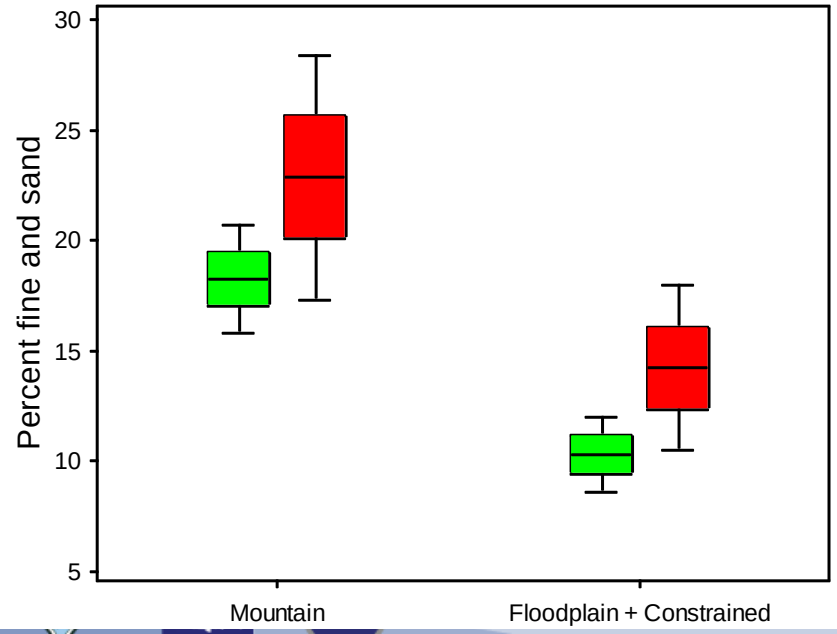
So What?

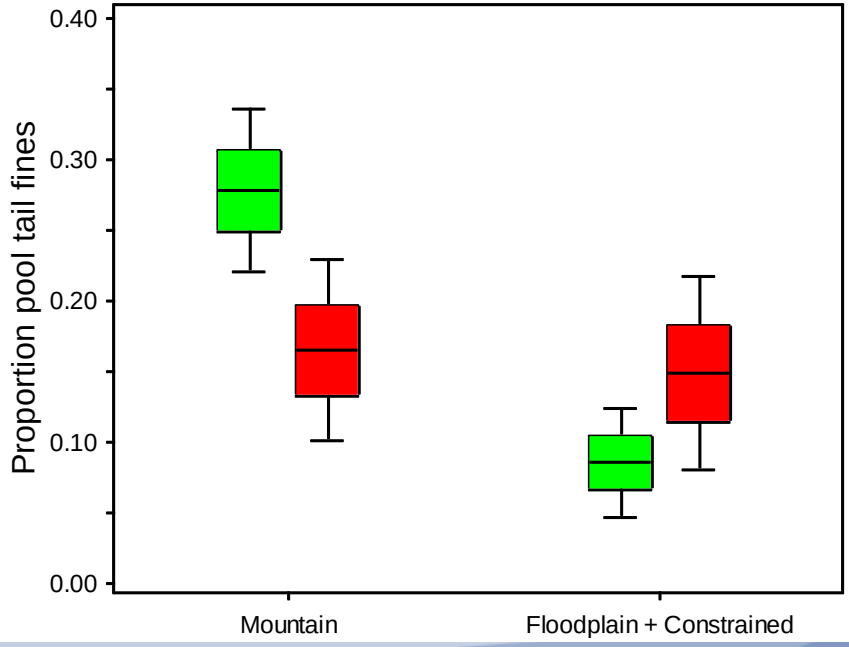
Difference between naïve vs. informed analyses




Disturbance
Low
High
Bank angle
20
18
16
14
Mountain
Floodplain + Constrained


Bankful LWD volume (m^3)
160
120
80
40
0
Mountain
Floodplain + Constrained

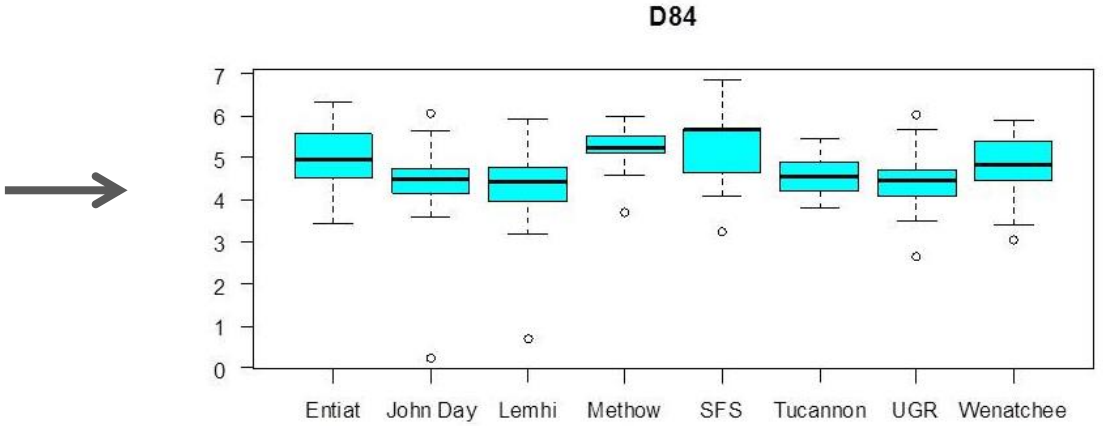

Percent fine and sand
30
25
20
15
10
5
Mountain
Floodplain + Constrained


Proportion pool tail fines
0.40
0.30
0.20
0.10
0.00
Mountain
Floodplain + Constrained

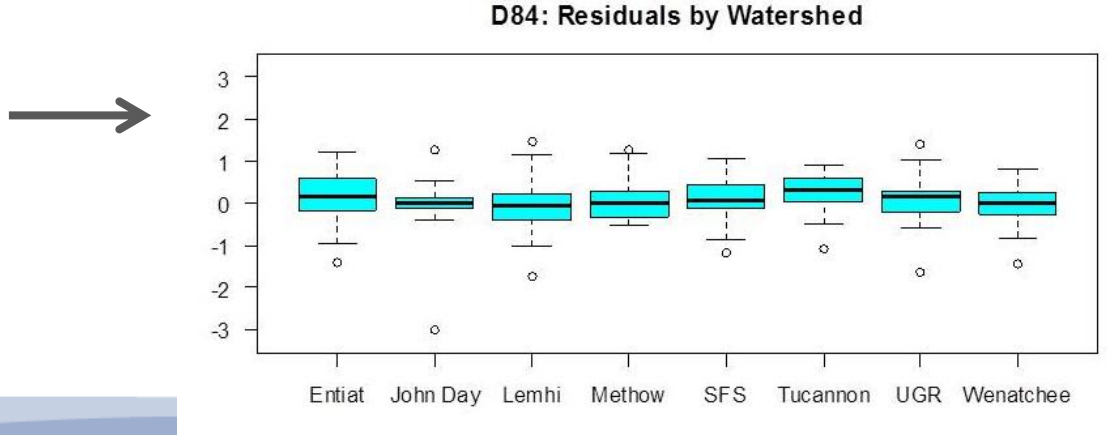
Leveraging CHaMP/ISEMP Habitat-Fish Models Across Watersheds

- CHaMP Habitat Metrics can be modeled from a small set of geomorphic attributes
  - Surface Gradient, Valley Class, Disturbed Class Name, Primary Bedform Class, Elevation, Strahler Order, Discharge
- Watershed-watershed differences are largely explained by these attributes.

- Watersheds are ***unique***
  - They're made from a different combinations of geomorphic attributes



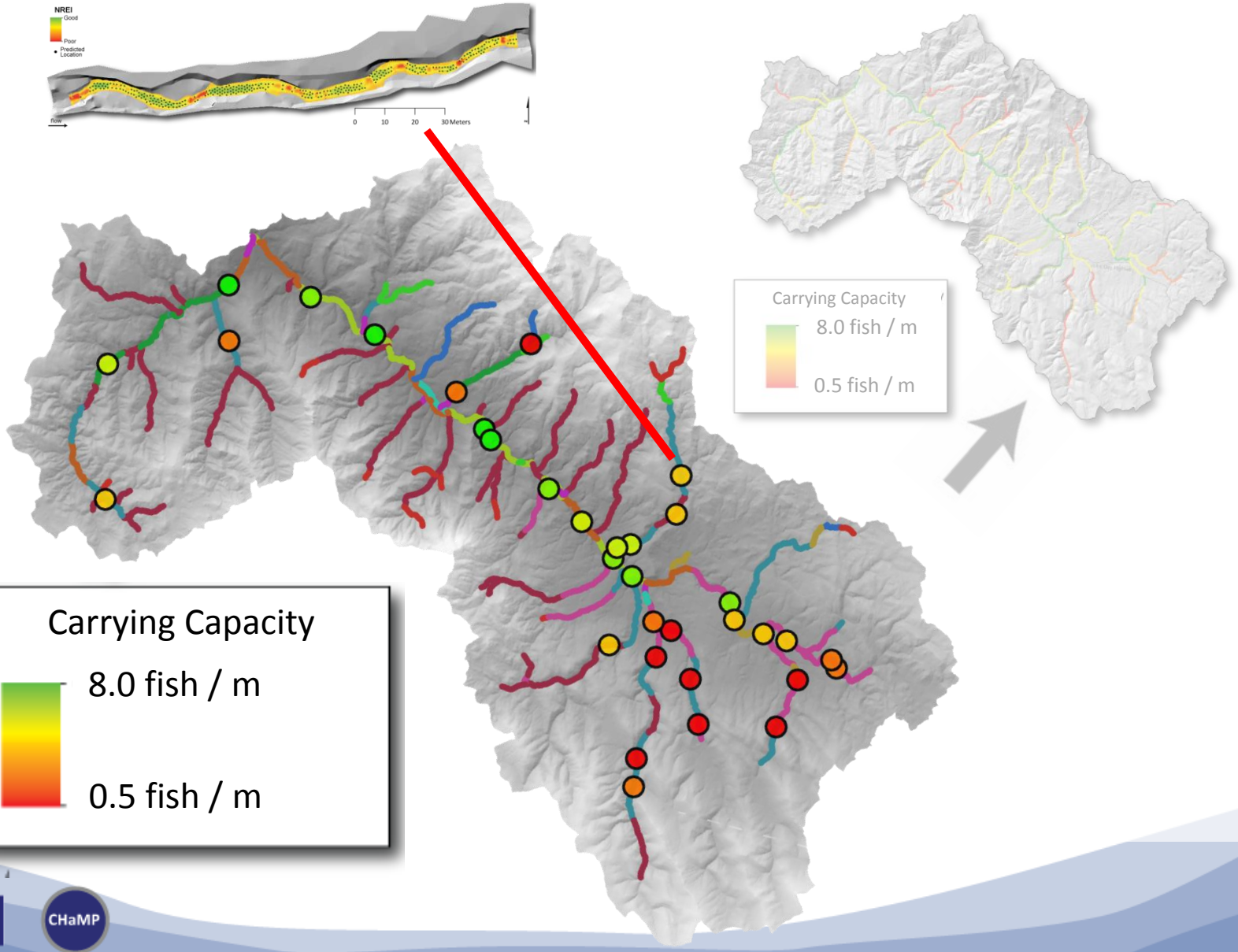
- Watersheds are not ***Special***
  - Within geomorphic attributes, things are pretty much the same this holds for a wide range of habitat metrics



Network Models

- Provide means to scale up data to watershed or sub-watershed scale
  - Uses coarse level data to fill in blanks
  - Spatially explicit predictions
- Use network models to extrapolate site level parameter estimates for watershed scale products
- Provide means to extend identified relationships to data poor or un-sampled areas

Network Model: carrying capacity



BONNEVILLE POWER ADMINISTRATION

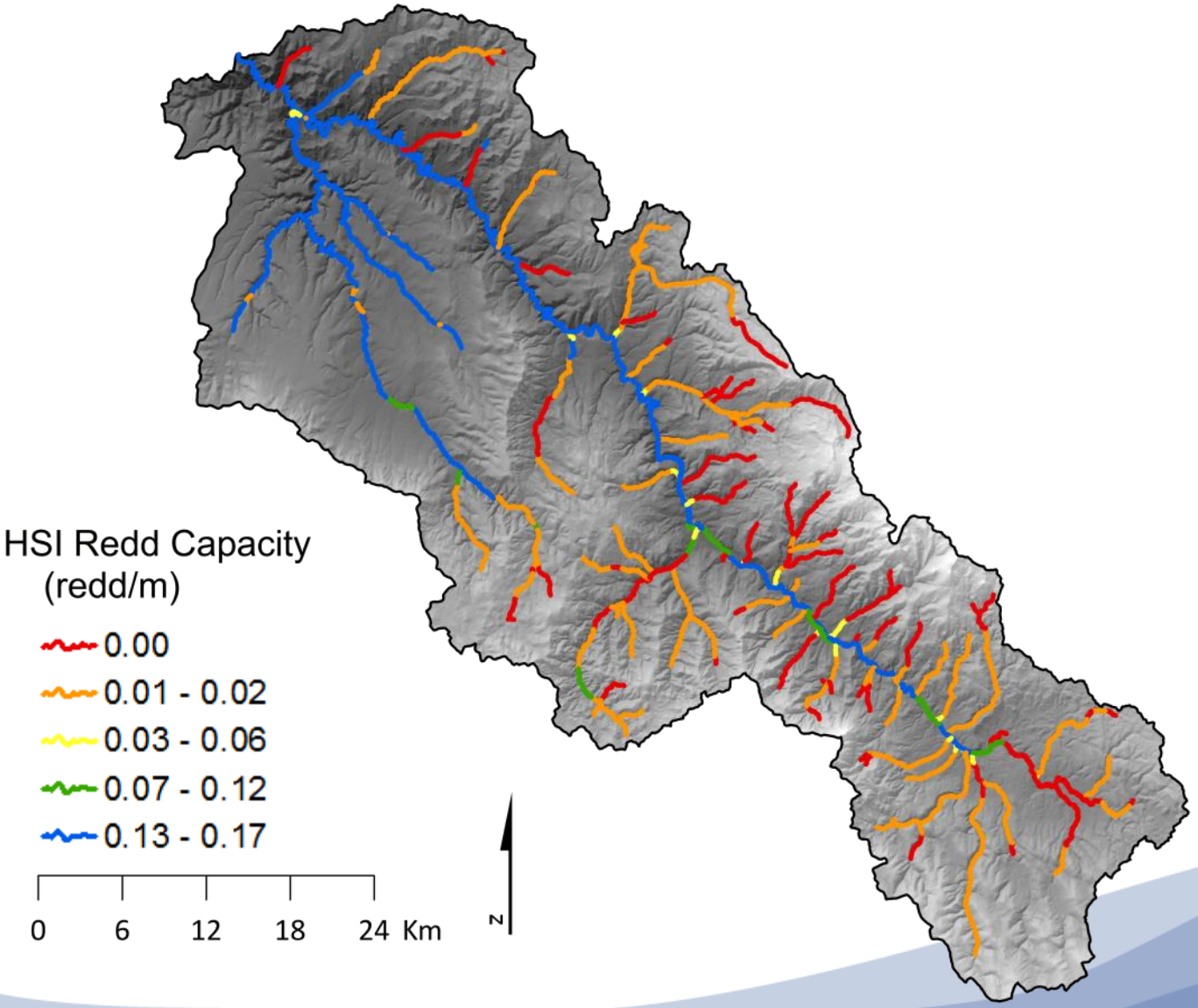
ISEMP

CHaMP

Steelhead adult capacity

Watershed capacity:

41,091 redds



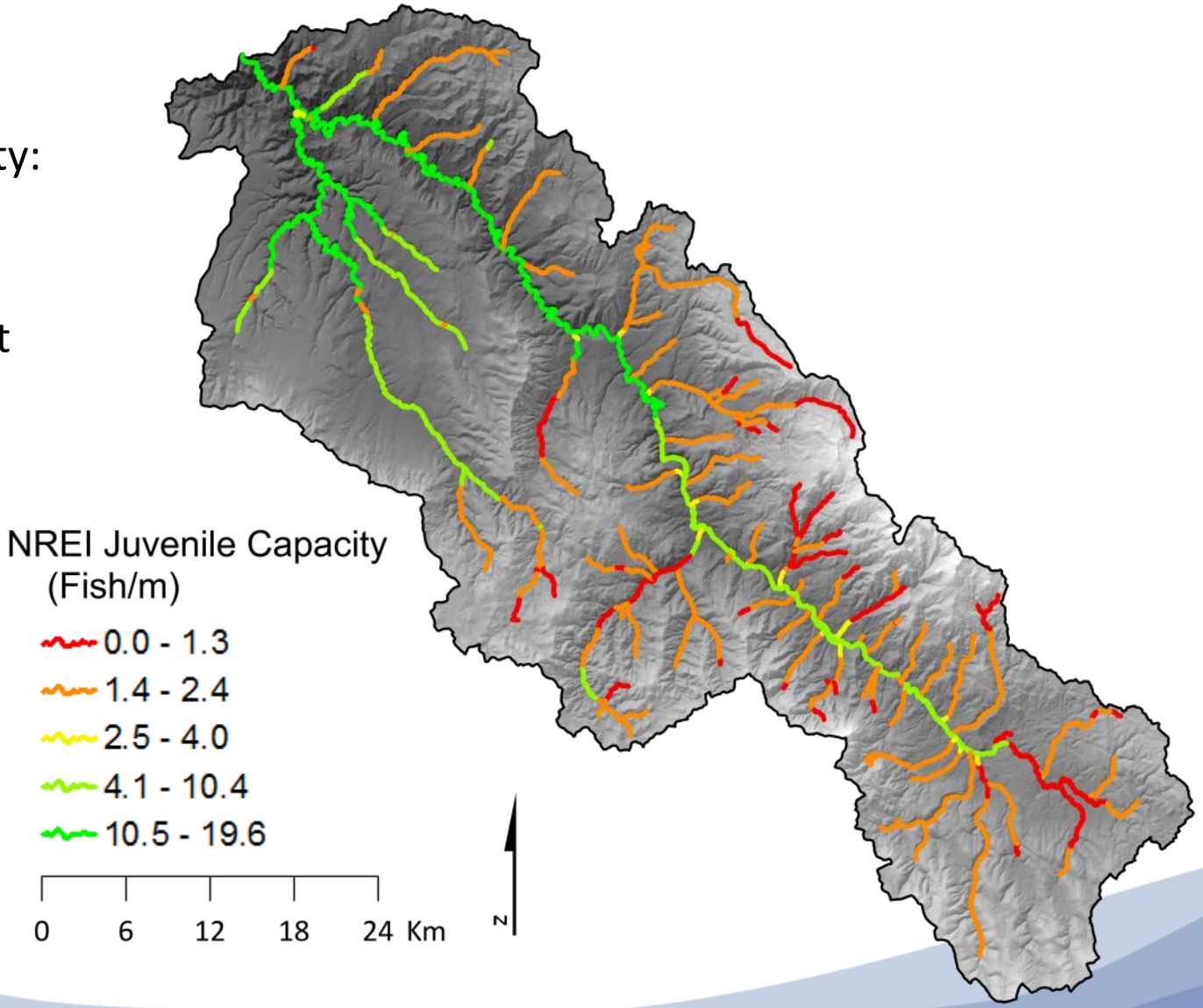
Steelhead juvenile capacity

Watershed parr
(60 – 99 mm) capacity:

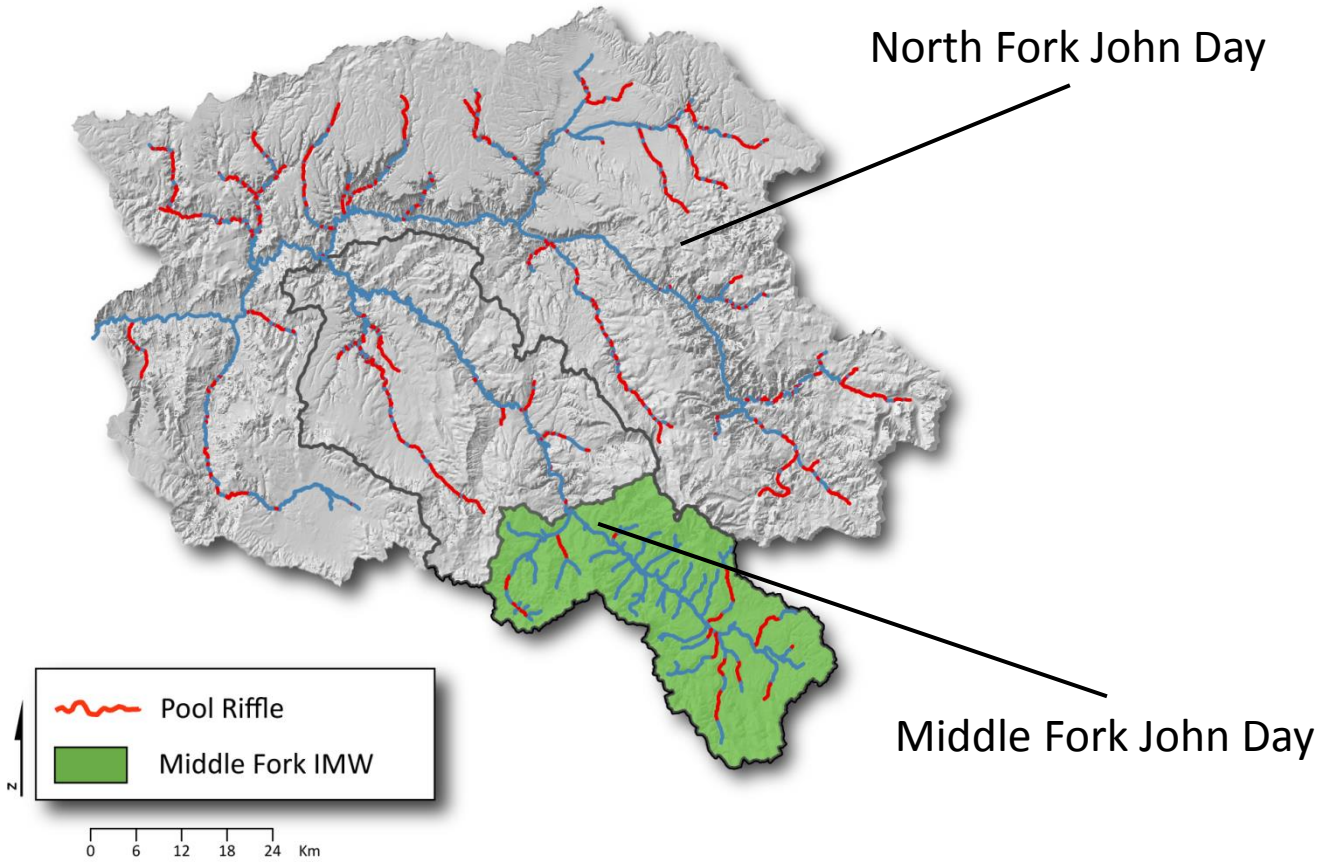
3.7 parr/m

Watershed pre-smolt
(≥100 mm) capacity:

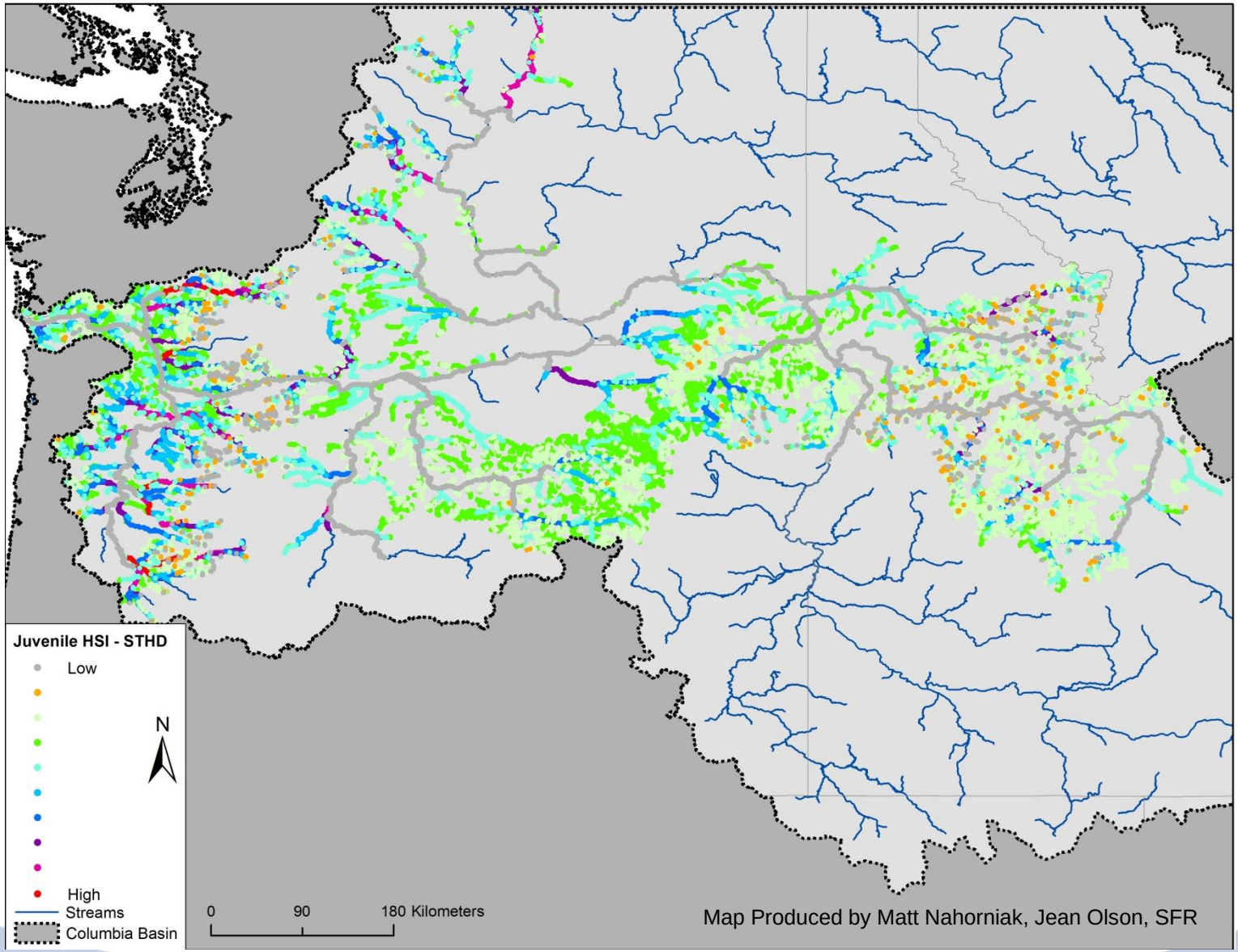
2.7 pre-smolt/m



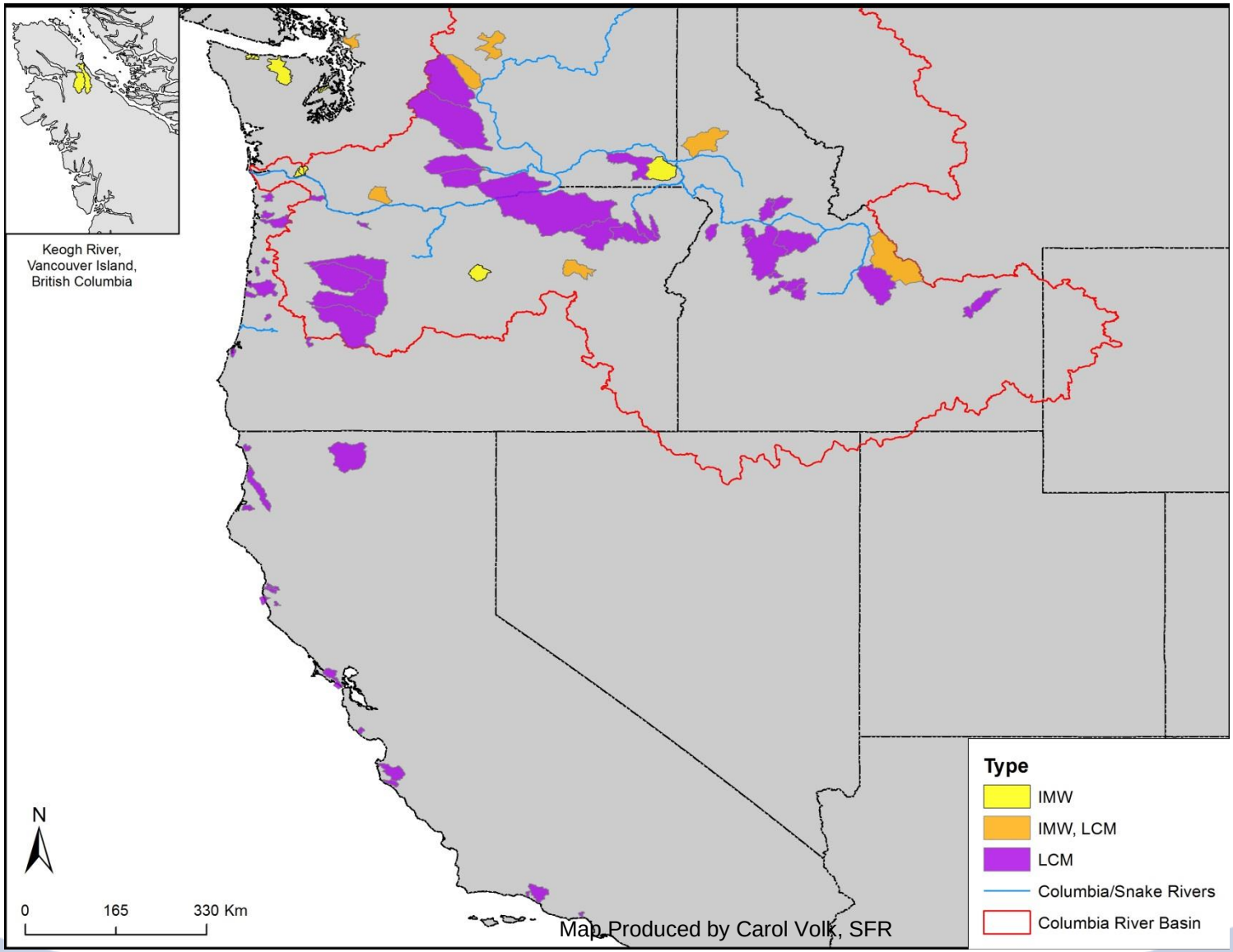
Watershed Extrapolation



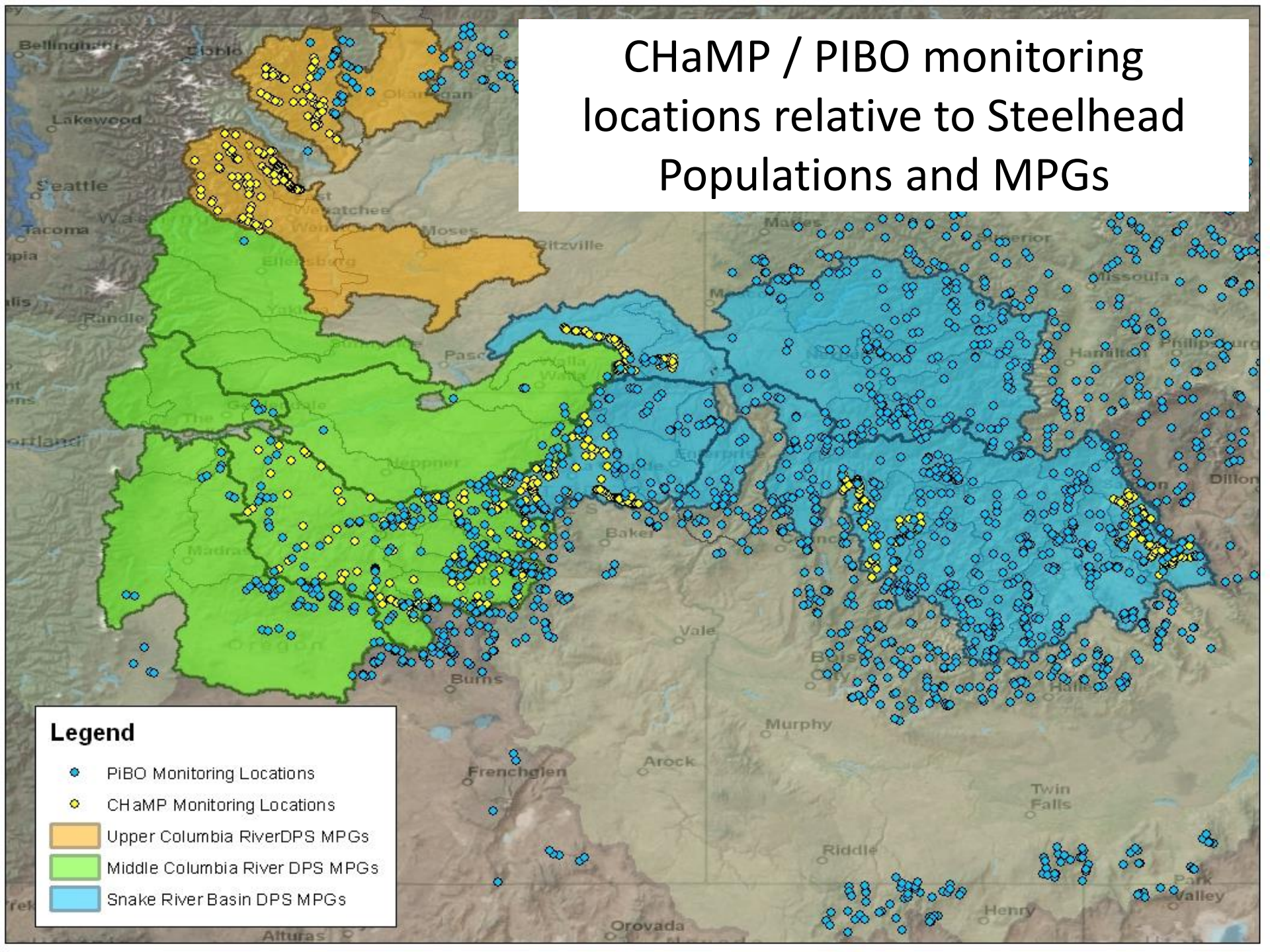
Estimated rearing capacity – juvenile O. mykiss

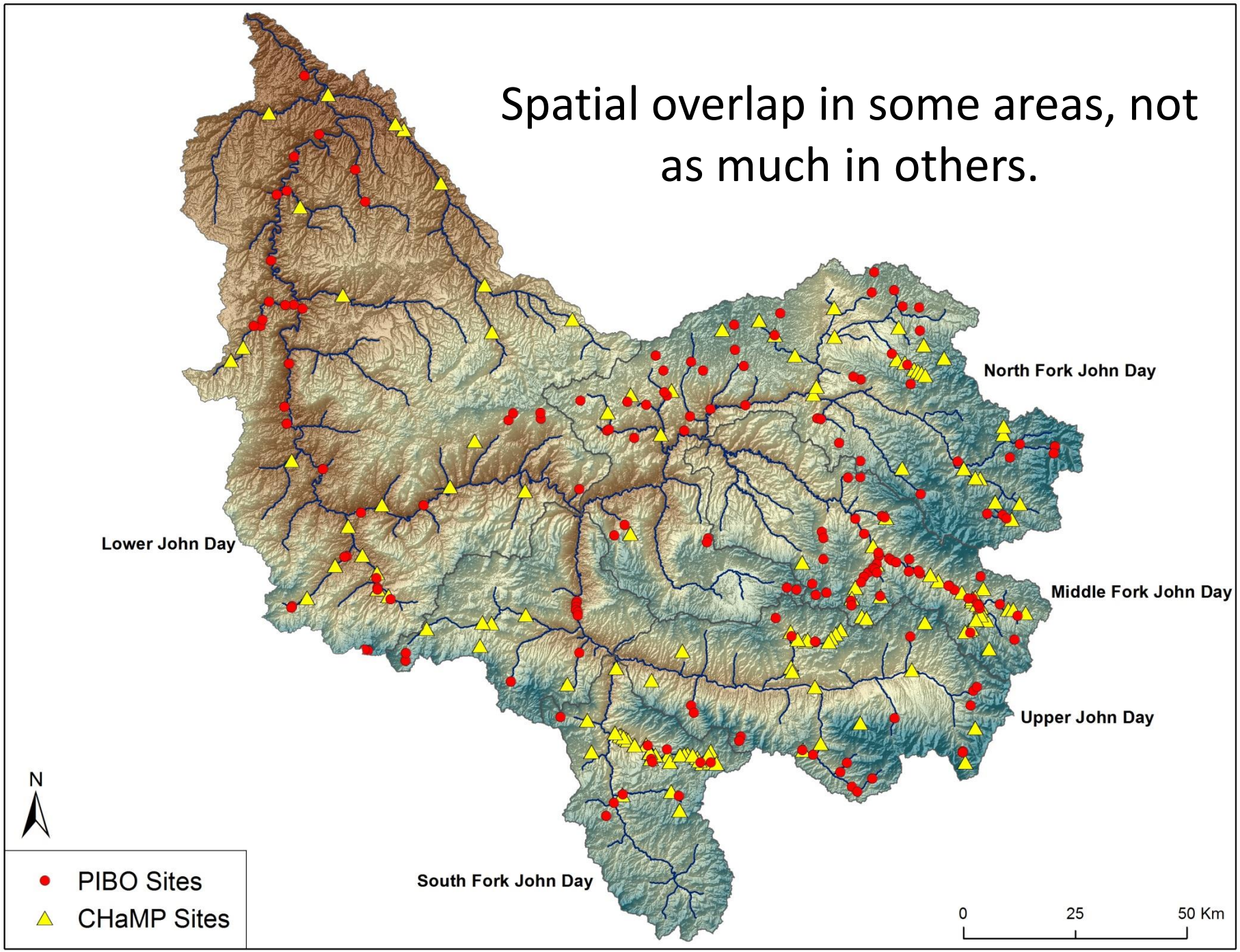


Intensively Monitored Watersheds, Life Cycle Models

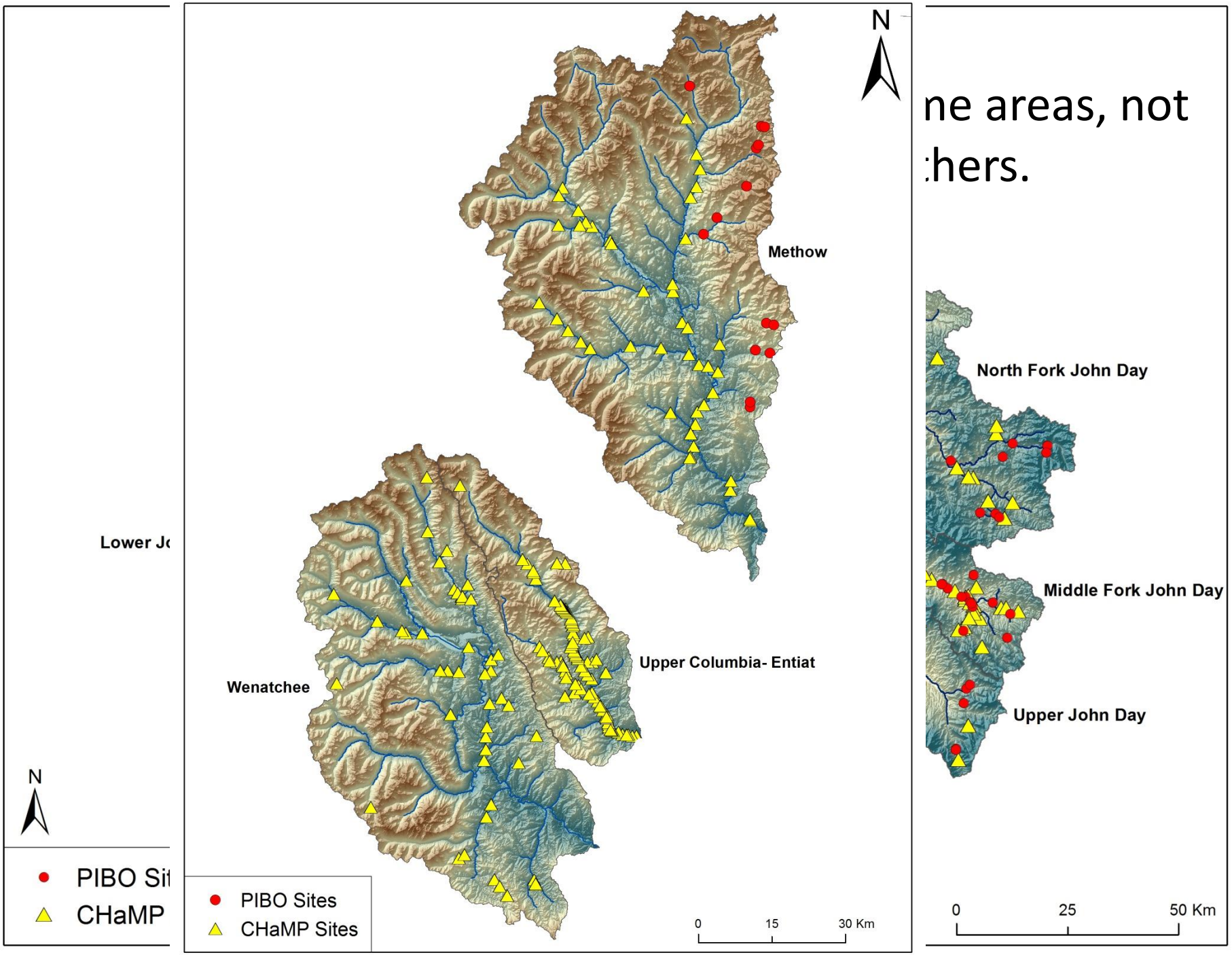


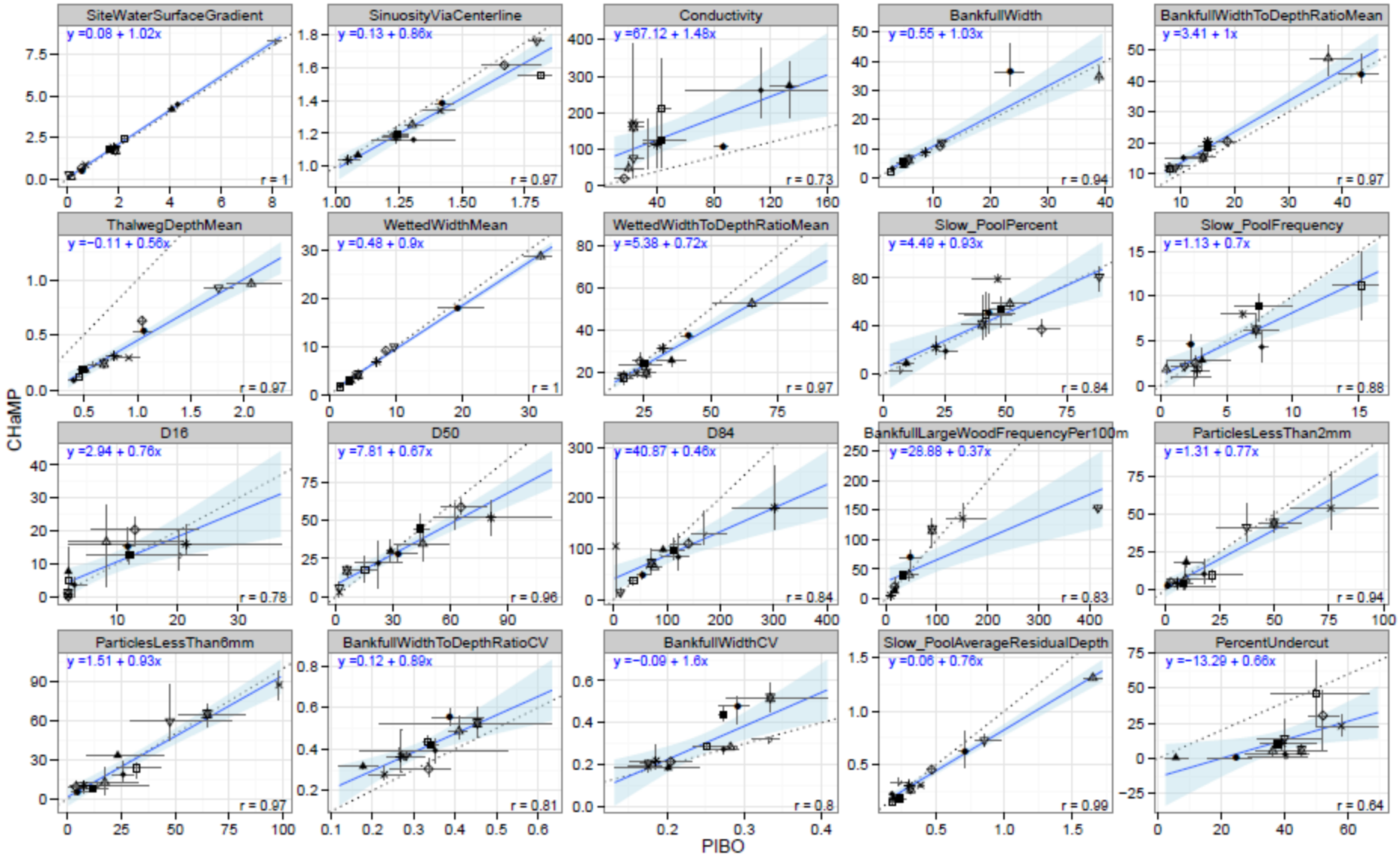
CHaMP / PIBO monitoring locations relative to Steelhead Populations and MPGs




Spatial overlap in some areas, not as much in others.
North Fork John Day
Lower John Day
Middle Fork John Day
Upper John Day
South Fork John Day
N
PIBO Sites
CHaMP Sites
0
25
50 Km

ne areas, not
:hers.




SiteWaterSurfaceGradient
y =0.08 + 1.02x
r = 1
SinuosityViaCenterline
y =0.13 + 0.86x
r = 0.97
Conductivity
y =67.12 + 1.48x
r = 0.73
BankfullWidth
y =0.55 + 1.03x
r = 0.94
BankfullWidthToDepthRatioMean
y =3.41 + 1x
r = 0.97
ThalwegDepthMean
y =−0.11 + 0.56x
r = 0.97
WettedWidthMean
y =0.48 + 0.9x
r = 1
WettedWidthToDepthRatioMean
y =5.38 + 0.72x
r = 0.97
Slow_PoolPercent
y =4.49 + 0.93x
r = 0.84
Slow_PoolFrequency
y =1.13 + 0.7x
r = 0.88
D16
y =2.94 + 0.76x
r = 0.78
D50
y =7.81 + 0.67x
r = 0.96
D84
y =40.87 + 0.46x
r = 0.84
BankfullLargeWoodFrequencyPer100m
y =28.88 + 0.37x
r = 0.83
ParticlesLessThan2mm
y =1.31 + 0.77x
r = 0.94
ParticlesLessThan6mm
y =1.51 + 0.93x
r = 0.97
BankfullWidthToDepthRatioCV
y =0.12 + 0.89x
r = 0.81
BankfullWidthCV
y =−0.09 + 1.6x
r = 0.8
Slow_PoolAverageResidualDepth
y =0.06 + 0.76x
r = 0.99
PercentUndercut
y =−13.29 + 0.66x
r = 0.64
CHaMP
PIBO
Stream
Dewey Creek
East Fork Bohannon Creek
Entiat River
Grande Ronde River
Lake Creek
Little French Creek
Middle Fork Weiser River
Rattlesnake Creek
Sheep Creek
Tucannon River
West Fork Brownlee Creek
West Fork Lick Creek

Why CHaMP Camp?

2009: Within Site Variability

- In 2009, sites were surveyed multiple times (mostly 3 times) to get at observation error