Bull Trout Distribution

Lewis River Subbasin

USFWS-CRFPO

Vancouver, WA

August 14, 2008

Patch concept

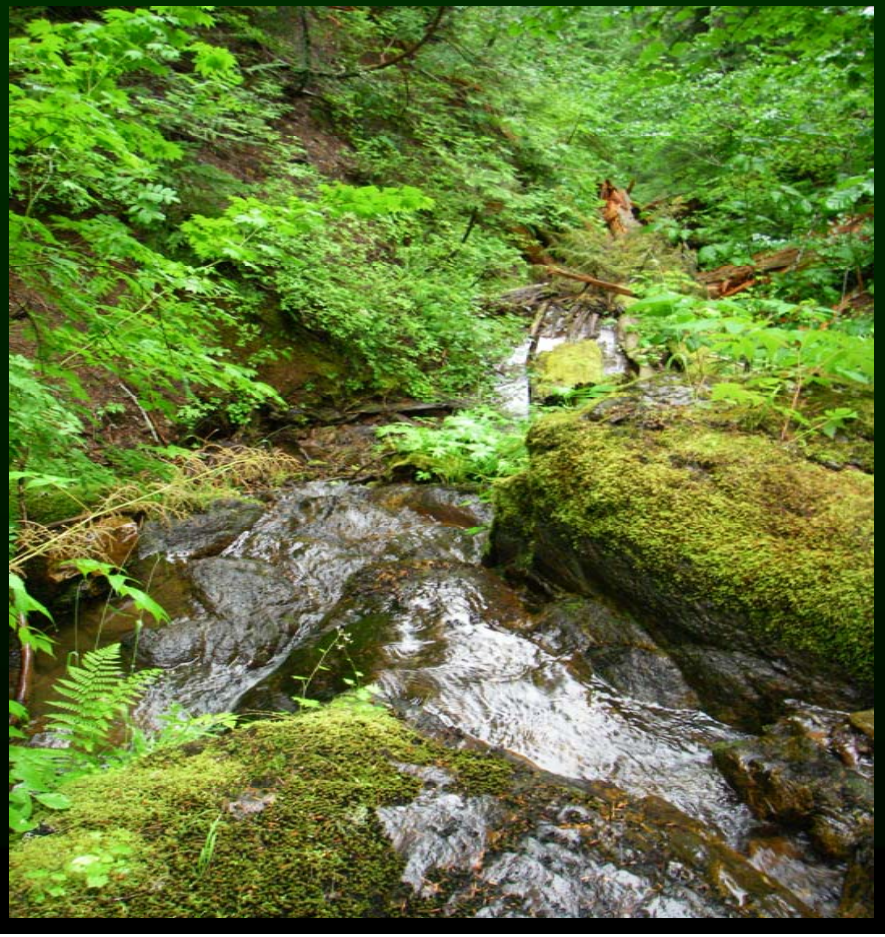
- Background
- Patch delineation
- Sample design
- Sample approach
- Results
- Review and adjustment
- Advantages to approach

Background - RMEG

- Bull Trout Recovery Monitoring and Evaluation Technical Workgroup (RMEG)
  - A multi-agency body working to overcome challenges so as to provide recommendations toward broad scale monitoring and evaluation strategies essential for evaluating progress towards bull trout recovery objectives/criteria across the region, assessing changing status, and evaluating effectiveness of specific recovery actions.

Background – BT Recovery

- Bull Trout "Recovery Objectives"
  - Distribution
  - Abundance
  - Habitat
  - Connectivity



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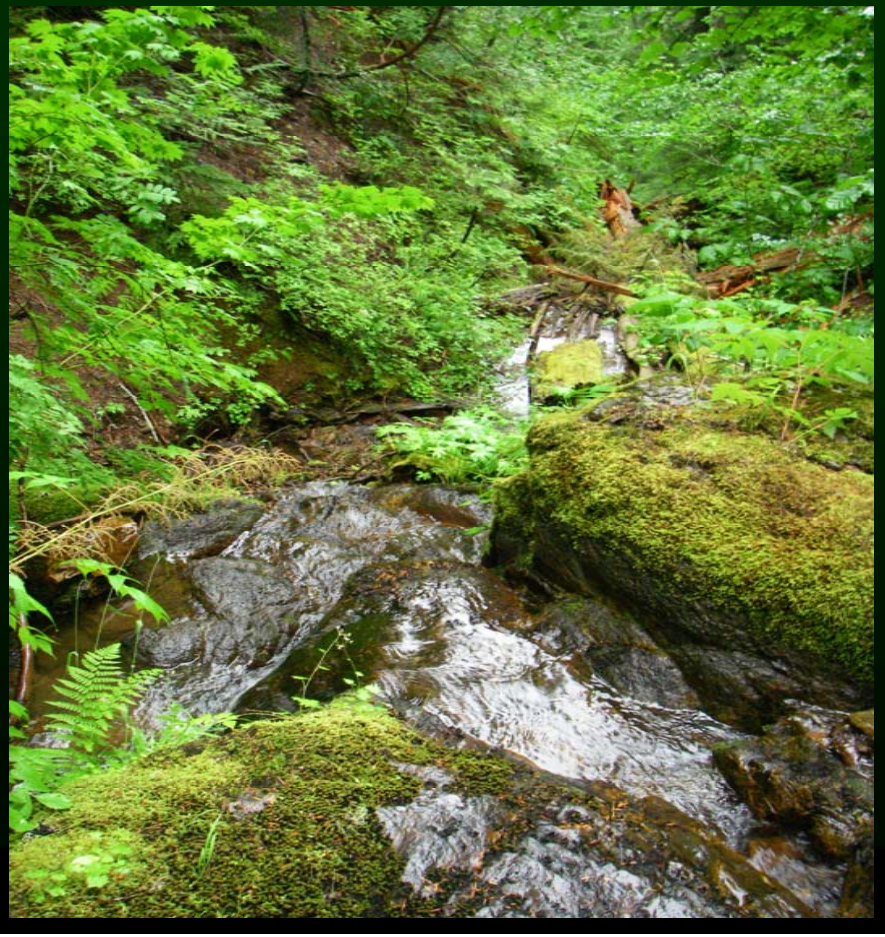


Background – Patch concept

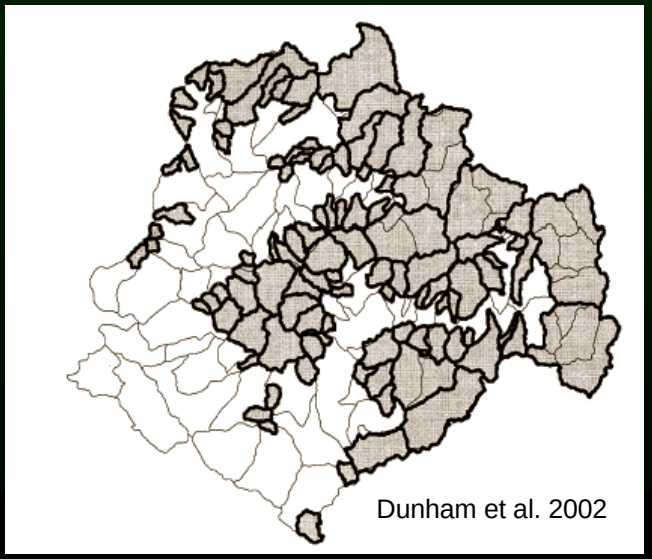
- Patch
  - "the limits or boundaries of environmental conditions that can support a biological response" – Dunham et al. 2002
- Concept rests on the observations that animal populations are not uniformly distributed across the landscape
- Distributions are tied to specific habitat features

Background – Patch concept

- Temperature/Elevation
- Catchment area
- Stream width
- Gradient
- Barriers
- Nonnative fish
- Solar radiation
- Patch isolation
- Road density
- Geology

Background – Patch concept

- Dunham and Rieman (1999) applied patch concept to Boise River basin
- "Biological Response"
  - Identified potential spawning and early life rearing habitat for bull trout
- Utilized many habitat parameters

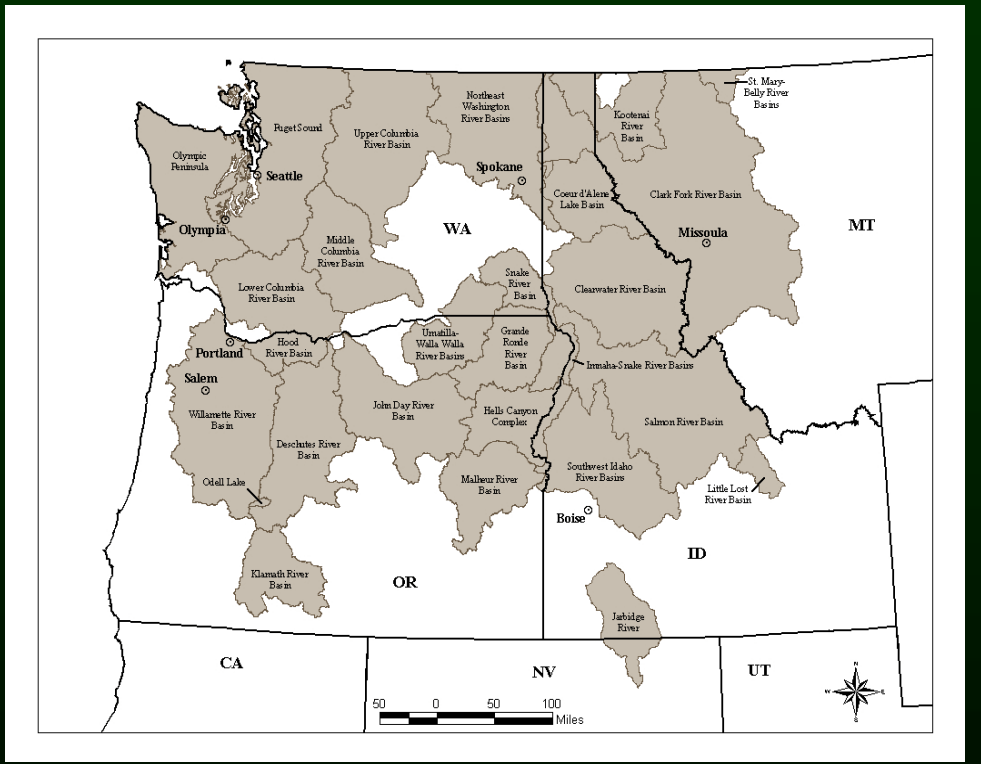

Dunham et al. 2002

Background – Patch concept

- If patches could be delineated for bull trout in core areas across the range, it potentially provides a sampling template for assessment and monitoring of distribution by modeling potential habitat and becomes a quantifiable unit toward recovery

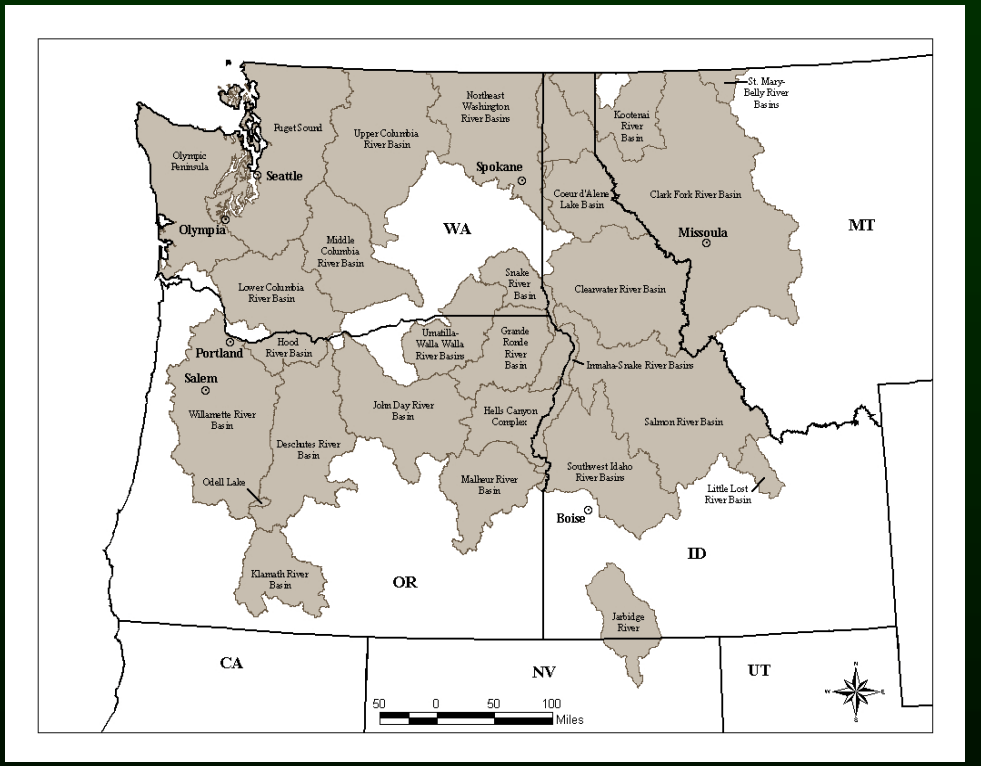
Background – Patch concept

- RMEG challenge
  - Apply patch concept across a broad geographic scale
    - Varying amounts of available information
    - Limited resources



Background – Patch concept

- RMEG challenge
  - Apply patch concept across a broad geographic scale
    - Varying amounts of available information
    - Limited resources
  - Develop sampling design within patch framework that allows a statistically sound and rigorous evaluation of current bull trout distribution among and within patches and changes over time
    - Limited resources

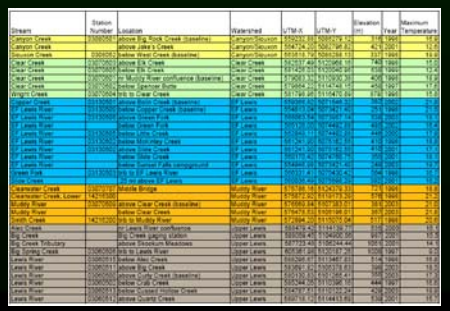


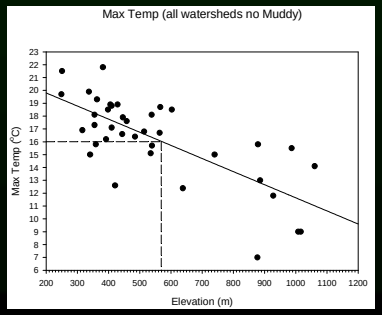
Background – Patch concept

- RMEG guidance
  - Bull trout patches should be applied as a consistent spatial template
    - Water temperature/elevation ($\leq 16^{o}$ C maximum temp)
    - Catchment area (≥ 400 hectares)
    - Stream order (no larger than 3rd order at 1:100k scale)
  - Determine the proportion of occupied patches

Patch delineation – Lewis River

- Compile available temperature data
- Develop temperature/elevation model
- Conduct GIS analyses





Patch delineation – Temperature

- Central Skill Center/Gifford Pinchot National Forest
  - 1996 Water Quality Monitoring Report
  - 1997 Water Quality Monitoring Report
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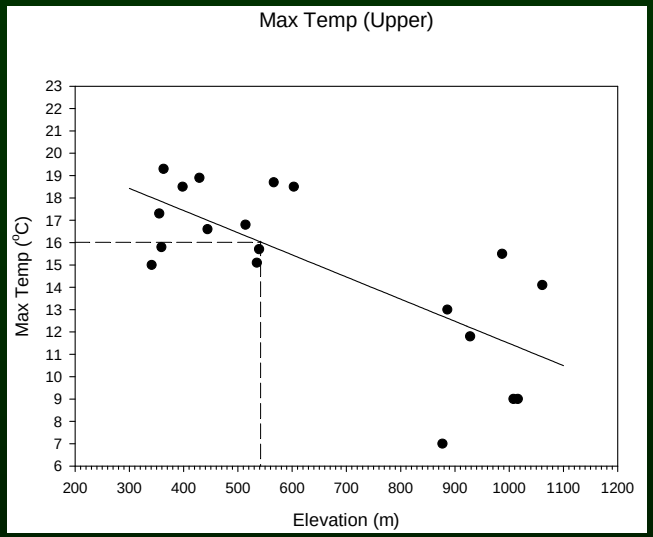
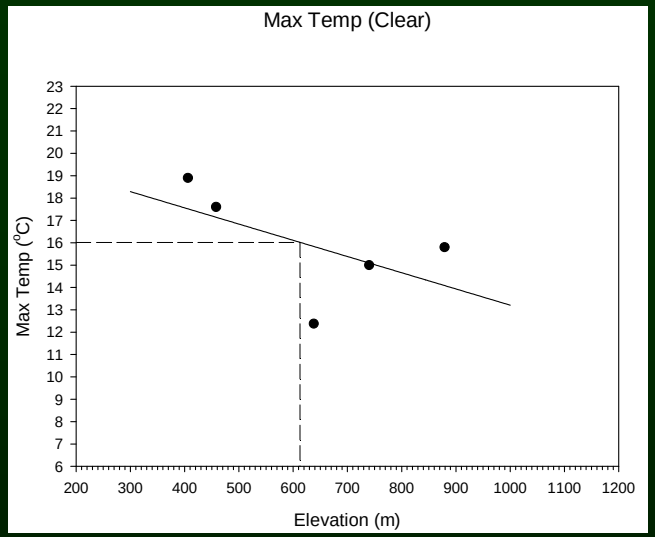
- Mt. St. Helens National Volcanic Monument/Gifford Pinchot National Forest
  - 1999 Water Quality Monitoring Report
  - 2000 Water Quality Monitoring Report
  - 2001 Water Quality Monitoring Report
  - 2002 Water Quality Monitoring Report
  - 2003 Water Quality Monitoring Report

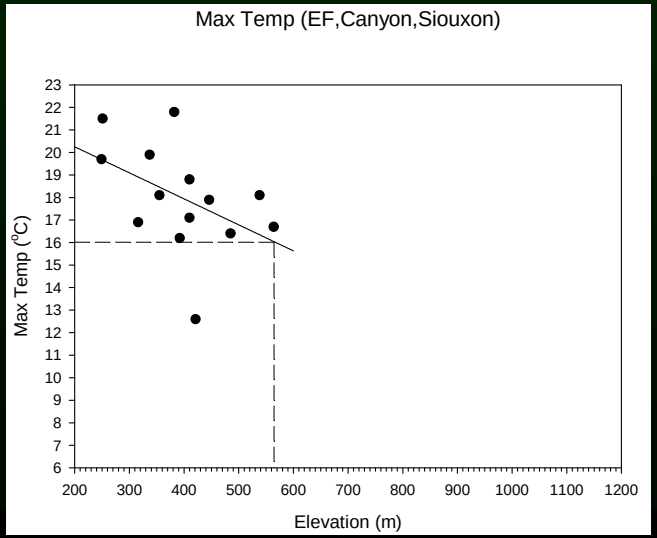
Patch delineation – Temperature

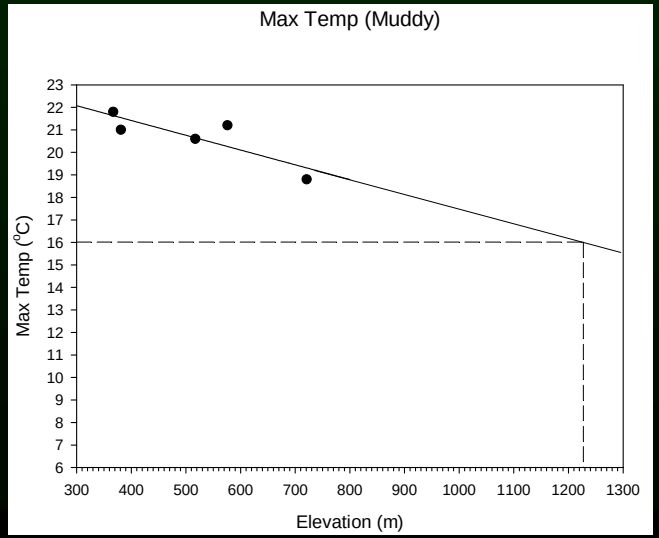
Stream	Station Number	Location	Watershed	UTM-X	UTM-Y	Elevation (m)	Year	Maximum Temperature
Canyon Creek	03080501	above Big Rock Creek (baseline)	Canyon/Siouxon	559232.88	5086279.12	316	1998	16.9
Canyon Creek		above Jake's Creek	Canyon/Siouxon	564724.20	5082796.82	421	2001	12.6
Siouxon Creek	0308052	below West Creek (baseline)	Canyon/Siouxon	563518.79	5088288.13	337	1998	19.9
Clear Creek	03070603	above Elk Creek	Clear Creek	582537.49	5120968.16	740	1998	15.0
Clear Creek	03070605	below Elk Creek	Clear Creek	581426.03	5120040.96	638	1999	12.4
Clear Creek	03070601	nr Muddy River confluence (baseline)	Clear Creek	579083.32	5110930.38	406	1998	18.9
Clear Creek	03070602	below Spencer Butte	Clear Creek	579864.22	5114748.15	458	1997	17.6
Wright Creek	03070604	trib to Clear Creek	Clear Creek	581798.96	5116470.89	879	1998	15.8
Copper Creek	03130501	above Bolin Creek (baseline)	EF Lewis	559366.82	5071546.32	382	2002	21.8
EF Lewis River	03130500	below Copper Creek (baseline)	EF Lewis	554813.04	5073421.40	251	1998	21.5
EF Lewis River	03130506	above Green Fork	EF Lewis	566063.54	5073957.14	538	2003	18.1
EF Lewis River		below Green Fork	EF Lewis	565126.00	5074492.88	485	2002	16.4
EF Lewis River	03130505	below Little Creek	EF Lewis	562849.11	5074492.88	446	2000	17.9
EF Lewis River	03130502	below McKinley Creek	EF Lewis	561241.90	5075162.55	410	1998	18.8
EF Lewis River	03130502	above Slide Creek	EF Lewis	561241.90	5075162.55	410	2001	17.1
EF Lewis River		below Slide Creek	EF Lewis	560170.42	5074760.75	356	2001	18.1
EF Lewis River		below Sunset Falls campground	EF Lewis	554946.98	5073421.40	249	2003	19.7
Green Fork	03130503	trib to EF Lewis River	EF Lewis	566331.41	5075430.42	564	1998	16.7
Slide Creek		.25 mi above EF Lewis	EF Lewis	560036.49	5075698.29	392	2001	16.2
Clearwater Creek	03070707	Middle Bridge	Muddy River	575786.16	5124379.33	721	1998	18.8
Clearwater Creek, Lower	14216300		Muddy River	575872.92	5119173.29	576	1998	21.2
Muddy River	03070509	above Clear Creek (baseline)	Muddy River	576569.84	5107383.01	381	2003	21.0
Muddy River		below Clear Creek	Muddy River	576478.53	5106196.01	367	2003	21.8
Smith Creek	14216200	trib to Muddy River	Muddy River	572894.20	5115075.04	517	1998	20.6
Alec Creek		nr Lewis River confluence	Upper Lewis	588479.42	5114139.77	535	2003	15.1
Big Creek		Big Creek gaging station	Upper Lewis	588059.45	5104900.56	987	2001	15.5
Big Creek Tributary		above Skookum Meadows	Upper Lewis	587723.48	5106244.44	1061	2001	14.1
Big Spring Creek	03060506	trib to Lewis River	Upper Lewis	605361.98	5120187.25	1008	1997	9.0
Lewis River	03060515	below Alec Creek	Upper Lewis	588296.67	5113467.83	514	1998	16.8
Lewis River	03060511	above Big Creek	Upper Lewis	583691.82	5106378.63	398	2003	18.5
Lewis River	03060500	above Curly Creek (baseline)	Upper Lewis	580130.83	5101265.41	355	2003	17.3
Lewis River	03060502	below Crab Creek	Upper Lewis	585244.05	5110396.16	444	1997	16.6
Lewis River	03060513	below Cussed Hollow Creek	Upper Lewis	584787.51	5110122.24	429	2003	18.9
Lewis River	03060512	above Quartz Creek	Upper Lewis	589718.12	5114413.69	539	2001	15.7

Patch delineation – Temperature









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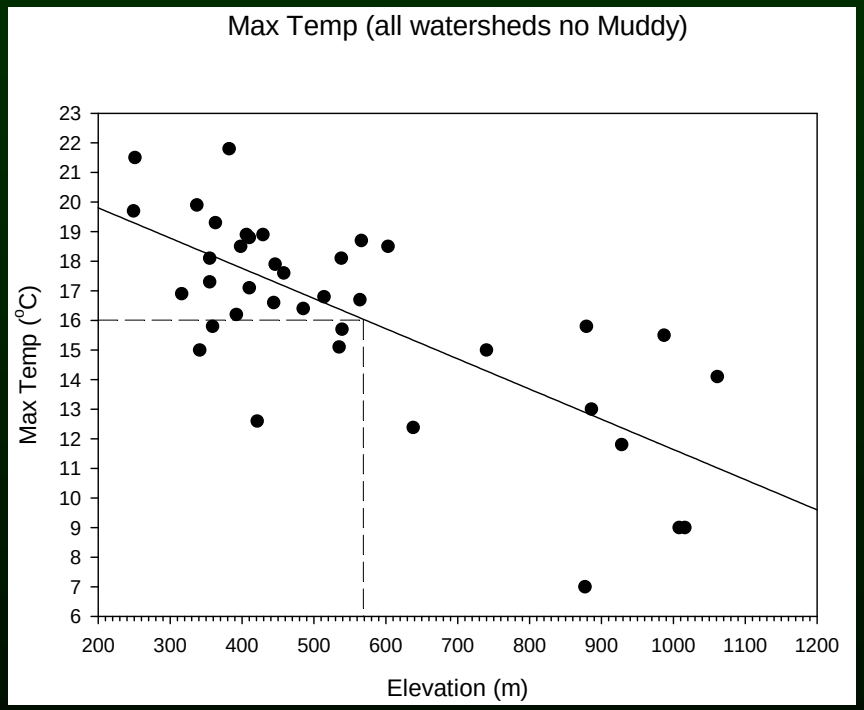
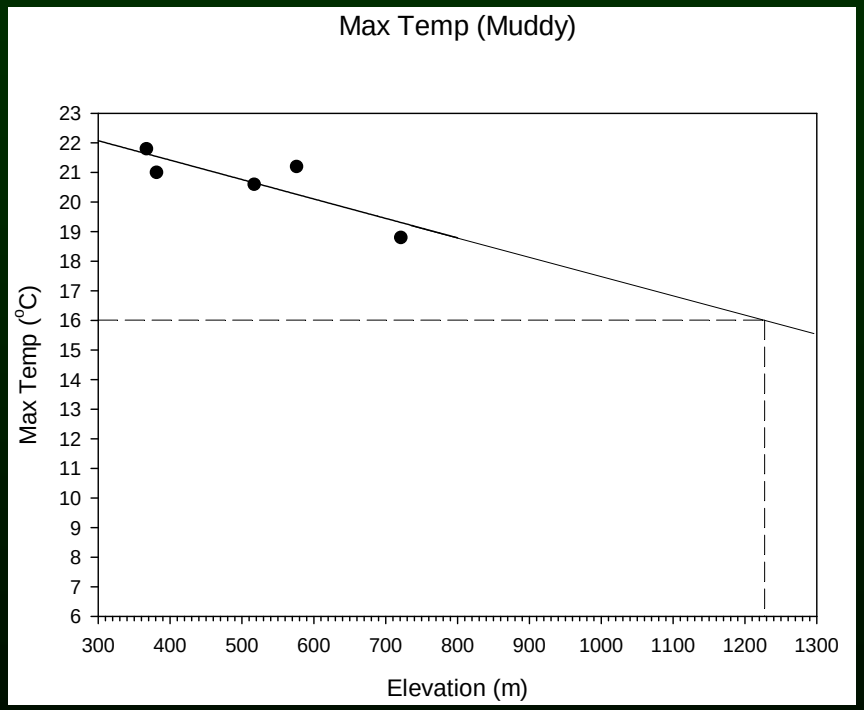
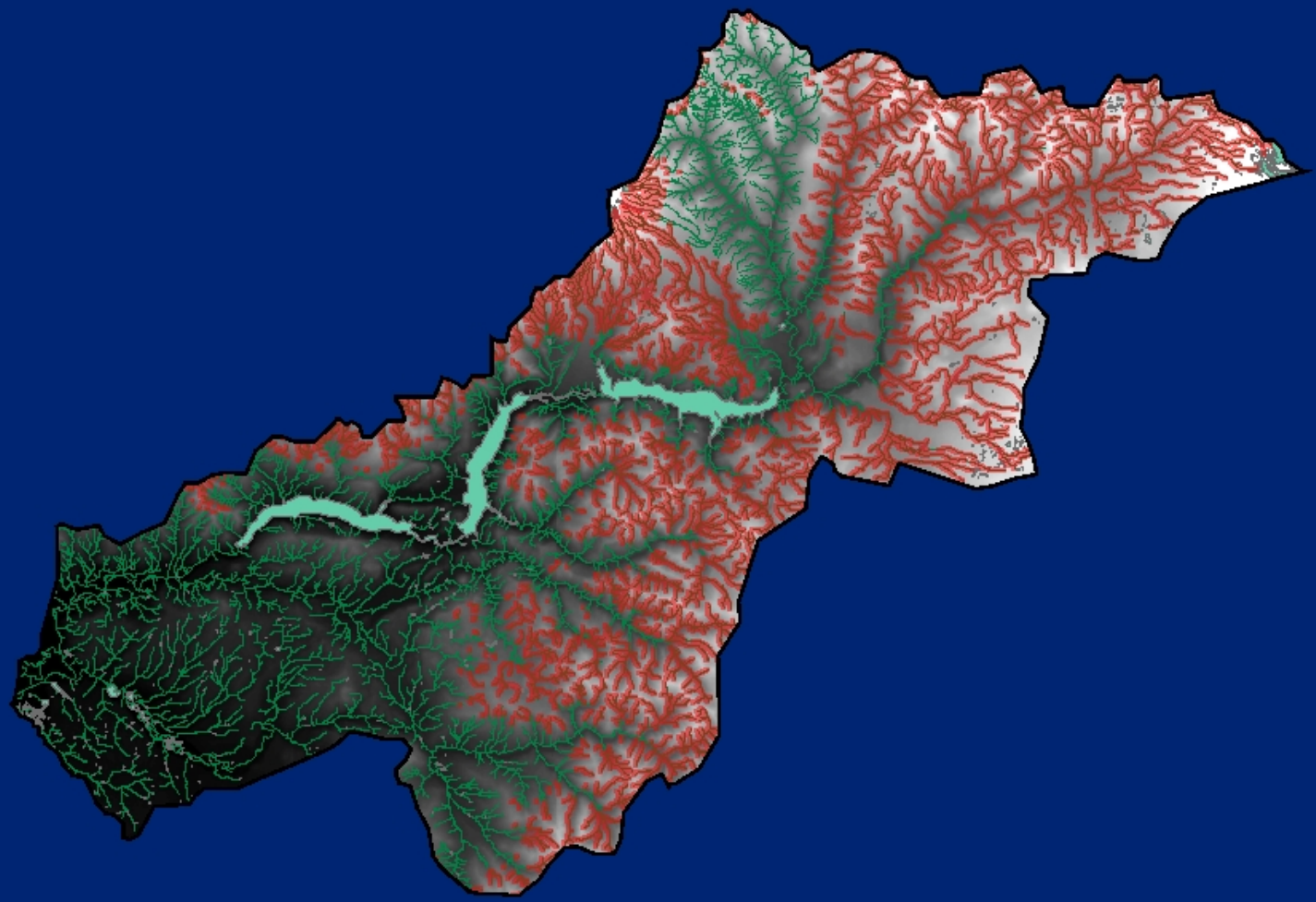




570 m

1230 m

Patch delineation – GIS



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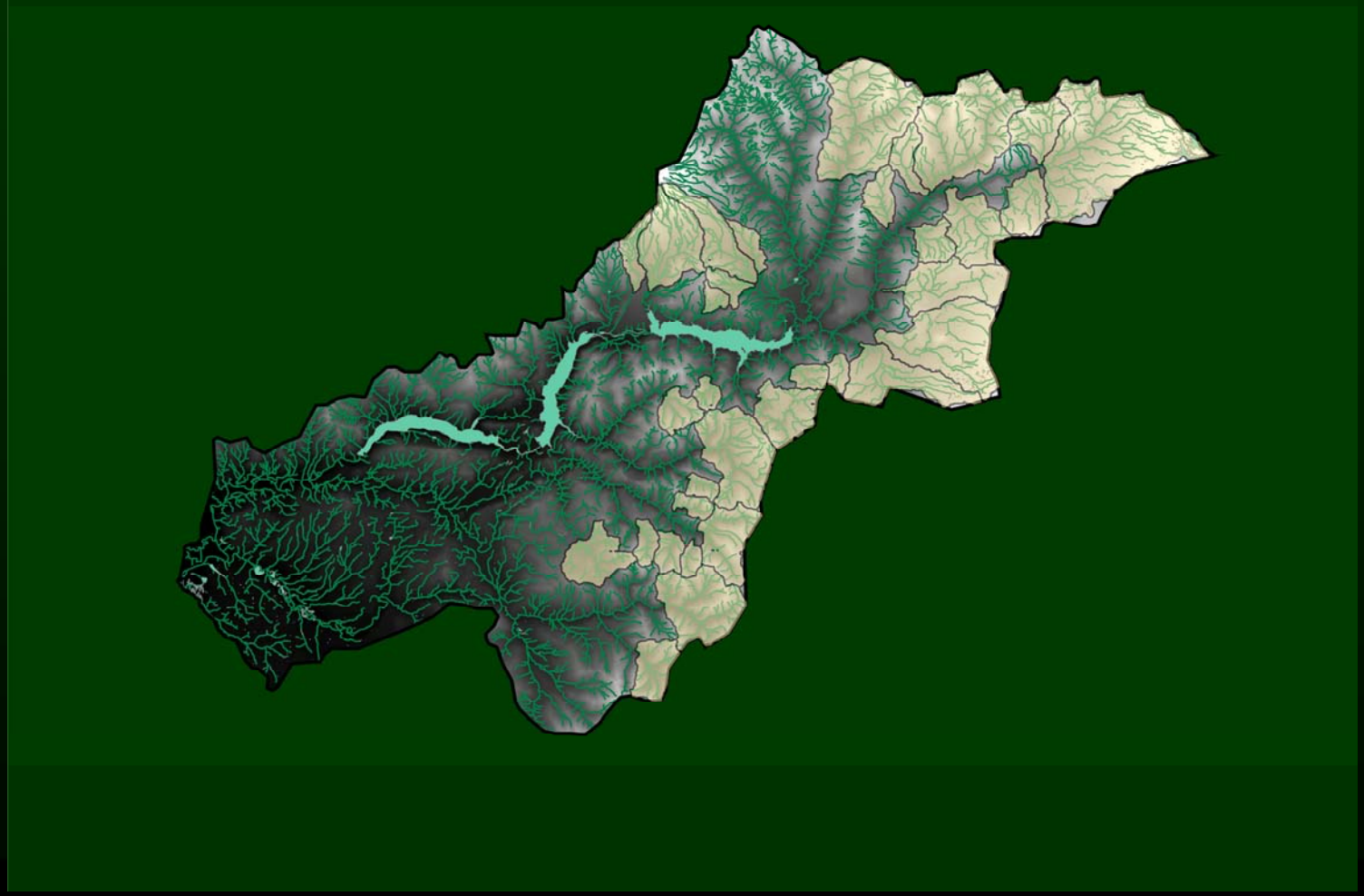
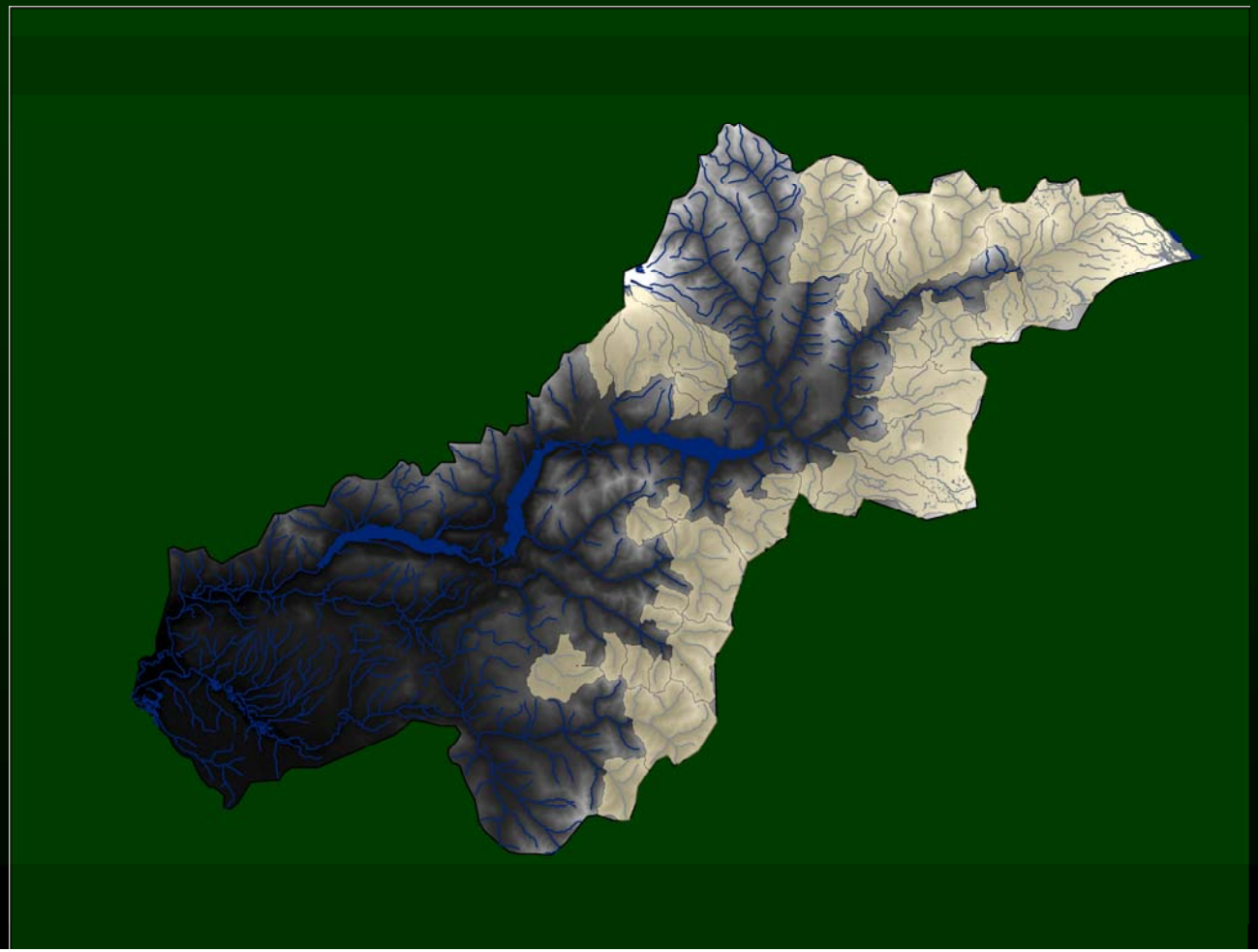


Sample design – GRTS

- Generalized Random-Tessellation Stratified (GRTS) design
  - Developed by EPA Environmental Monitoring and Assessment Program (EMAP)
  - GIS approach that lends itself to relatively broad applications
    - e.g., evaluate status of salmonid stocks in Oregon
  - Random and spatially balanced design
  - Allows one to make a statistical inference about the status and trend of stream attributes (e.g., presence/absence of bull trout) within a predefined stream network (e.g., a patch)

Sample design – GRTS

- One sample site per 500 m (4,056)



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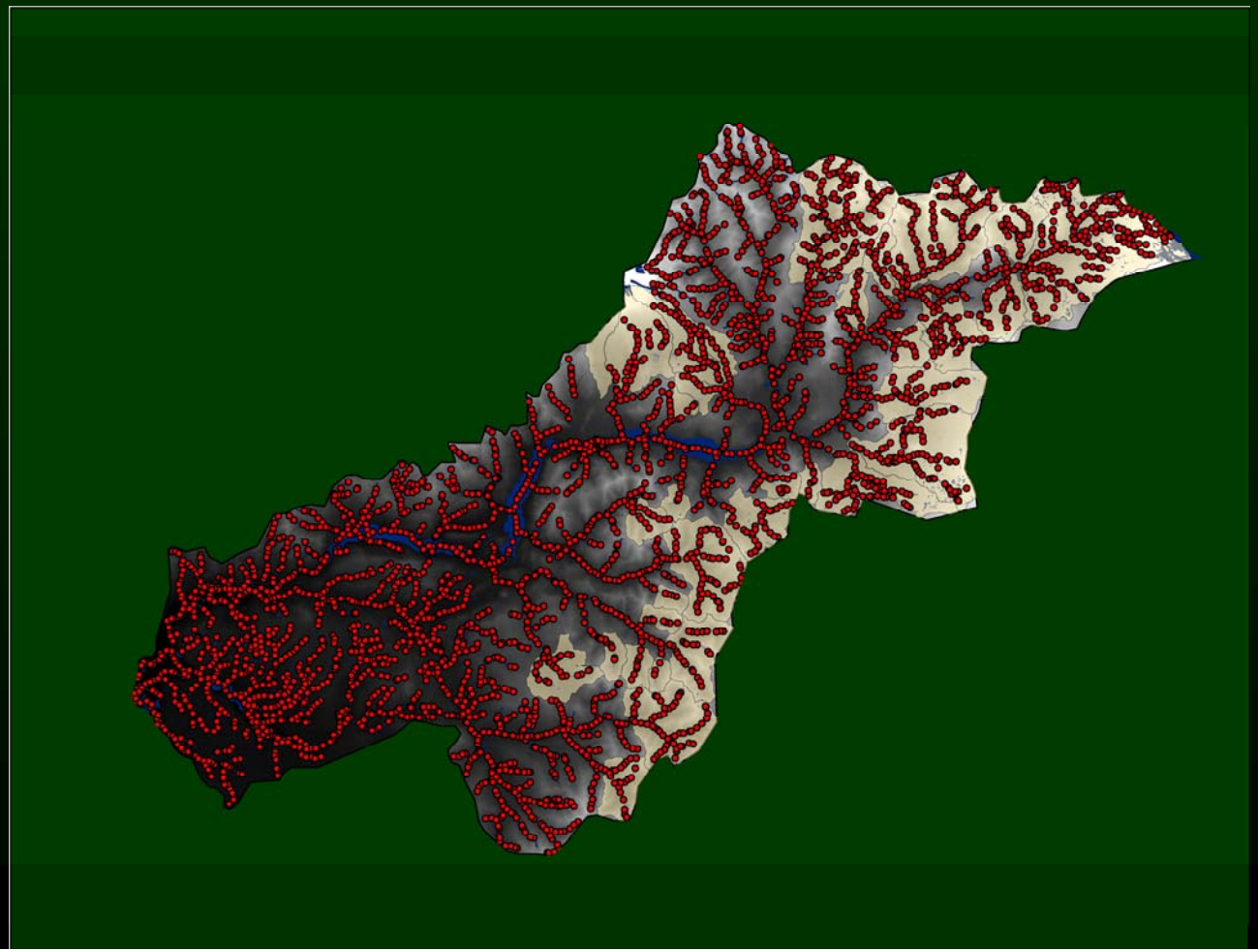
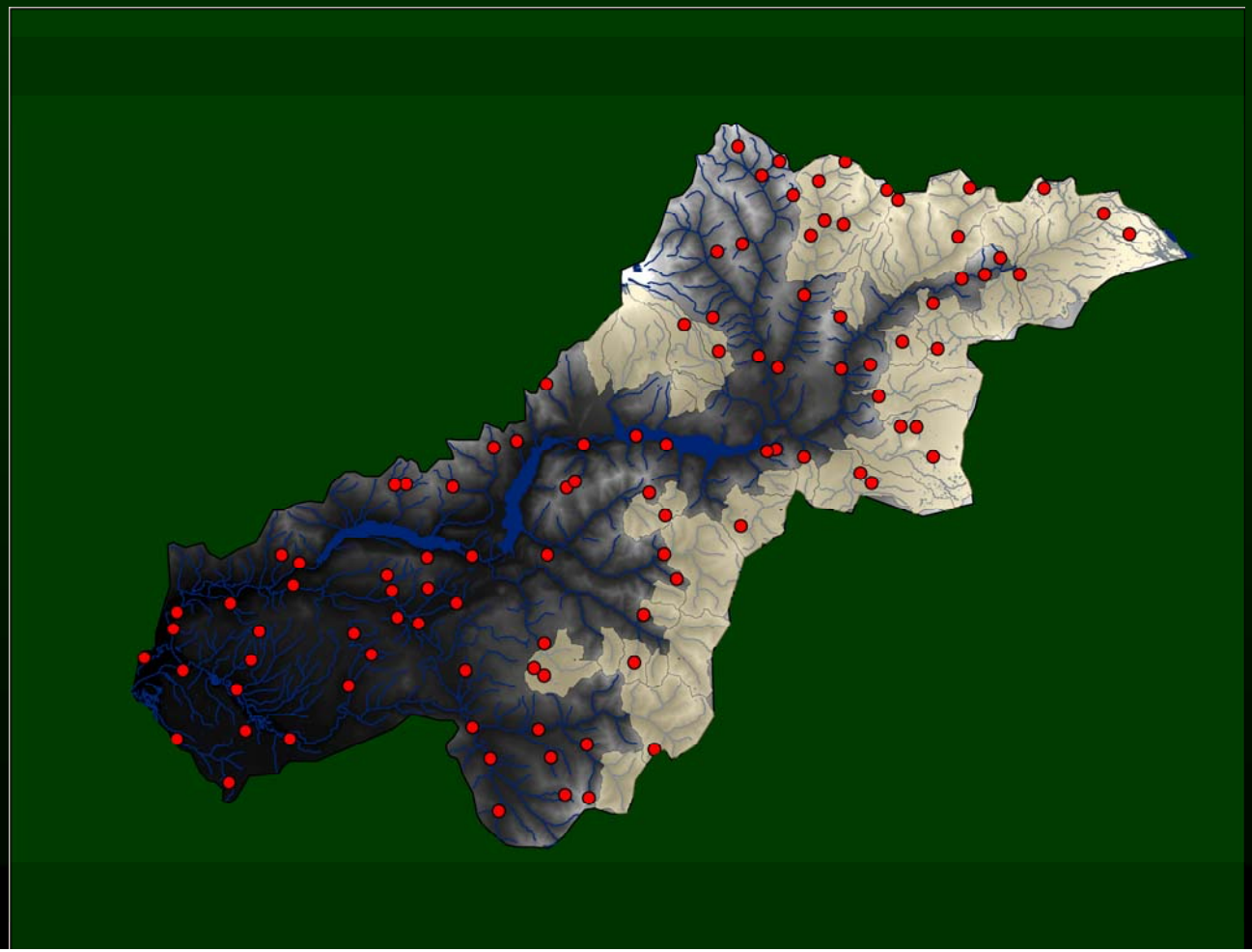


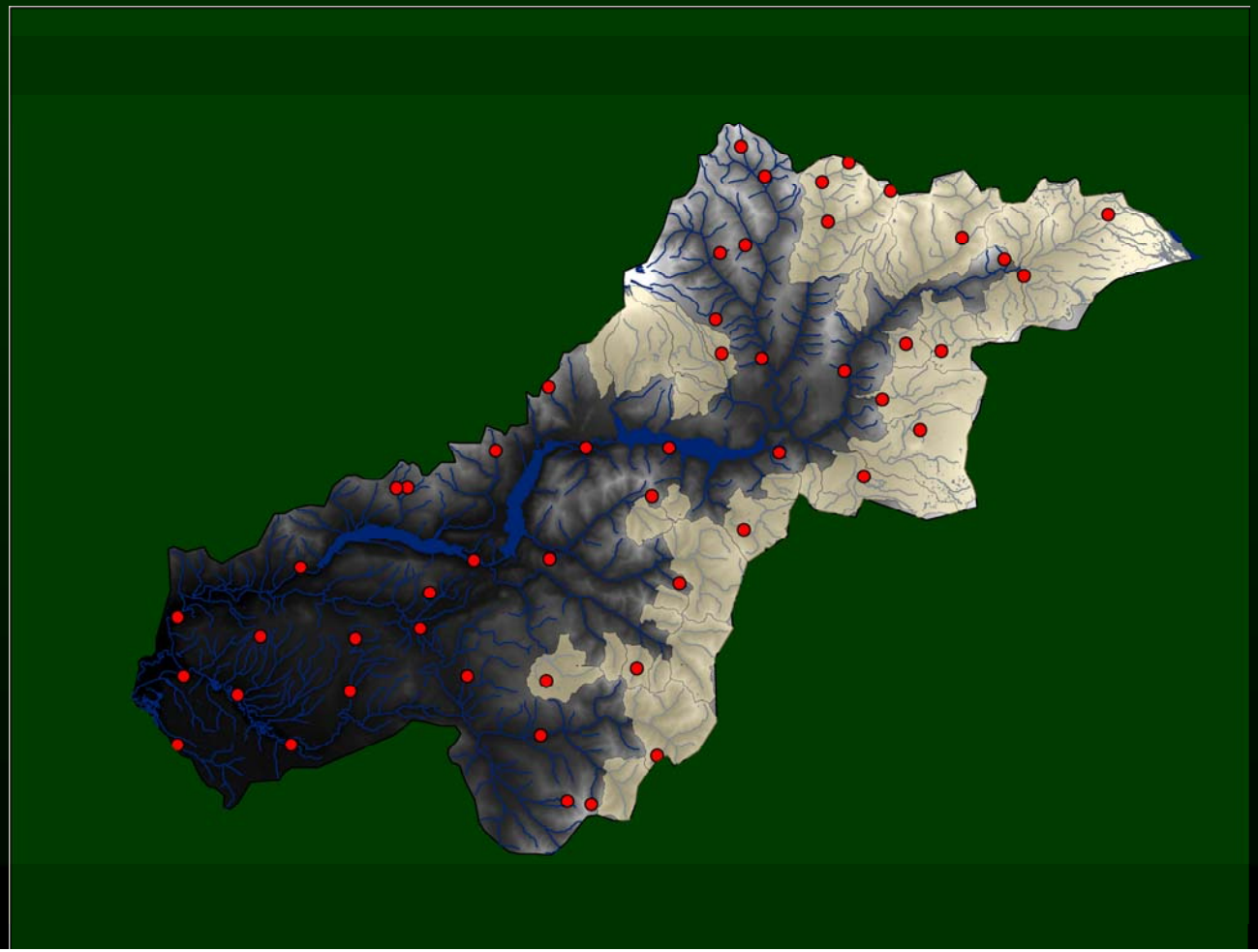
Sample design – GRTS

- 100 sites



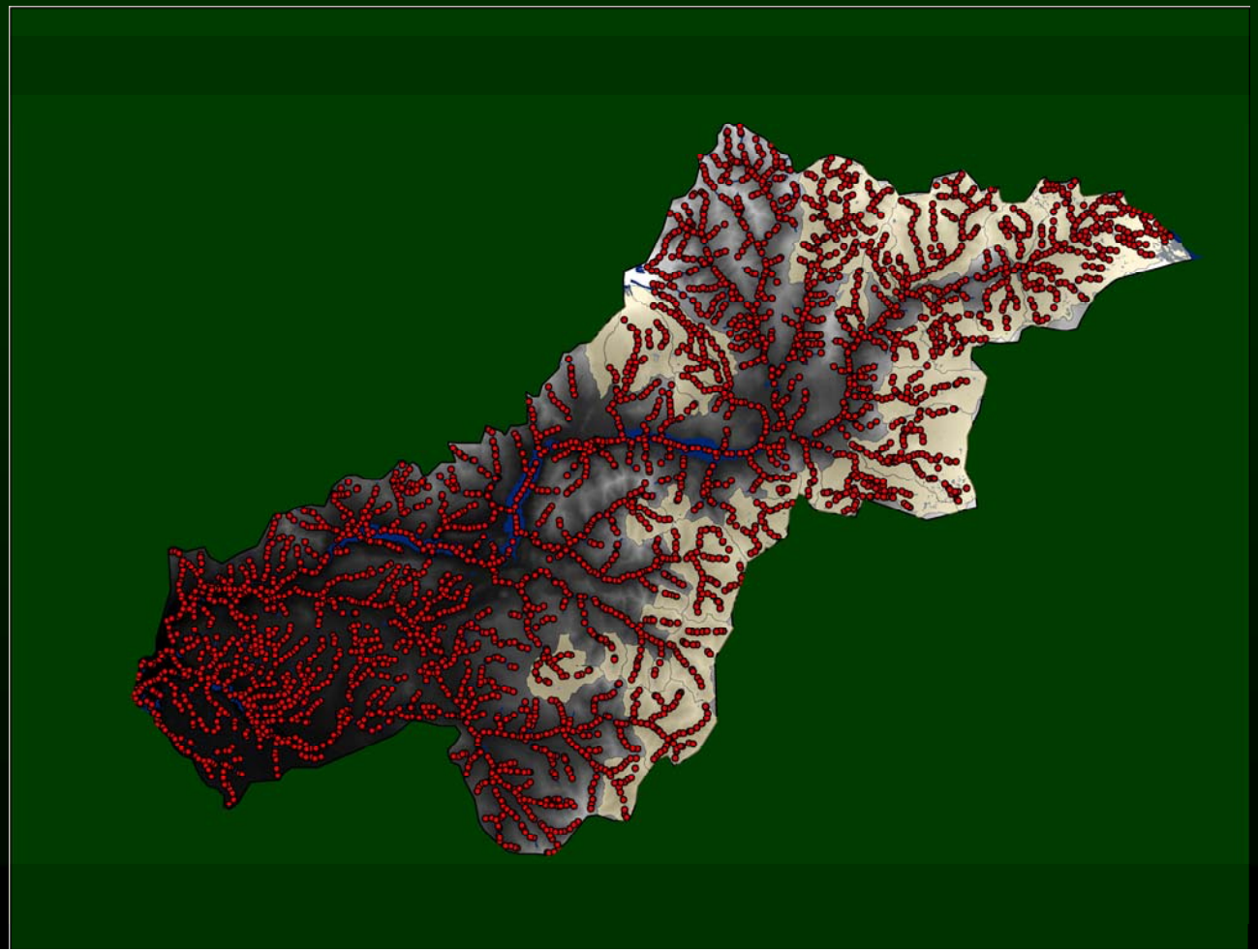
Sample design – GRTS

- 50 sites



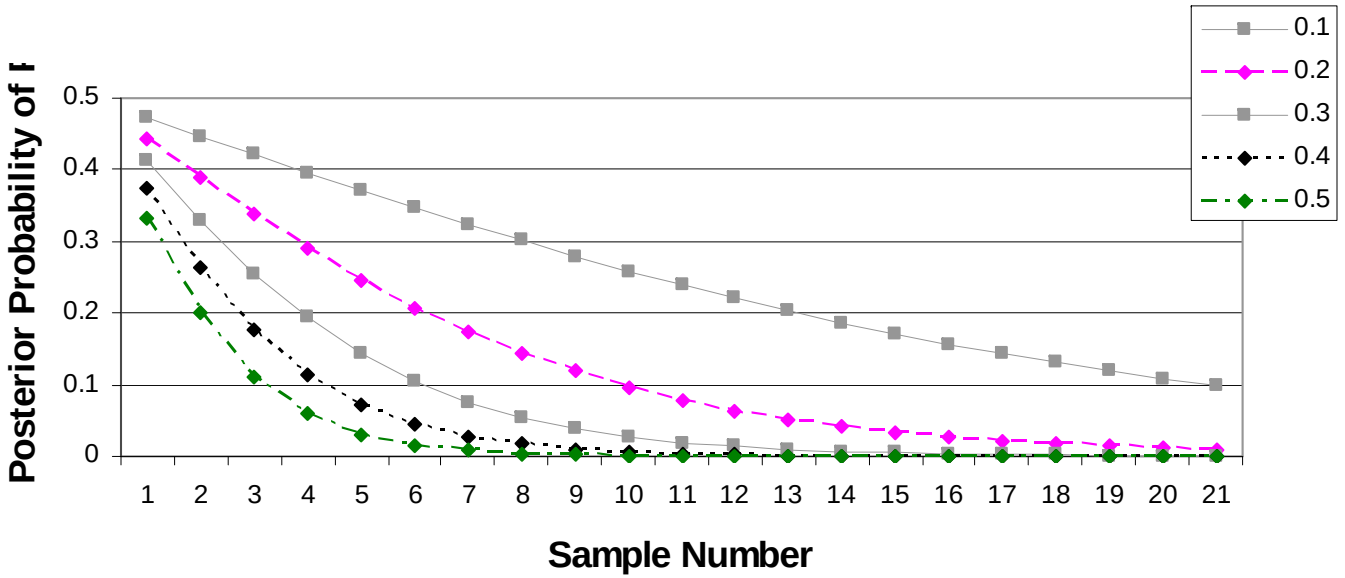
Sample design – GRTS

- 4,056 sites



Sample design – Pine Creek

Sample design – Probability of detection?



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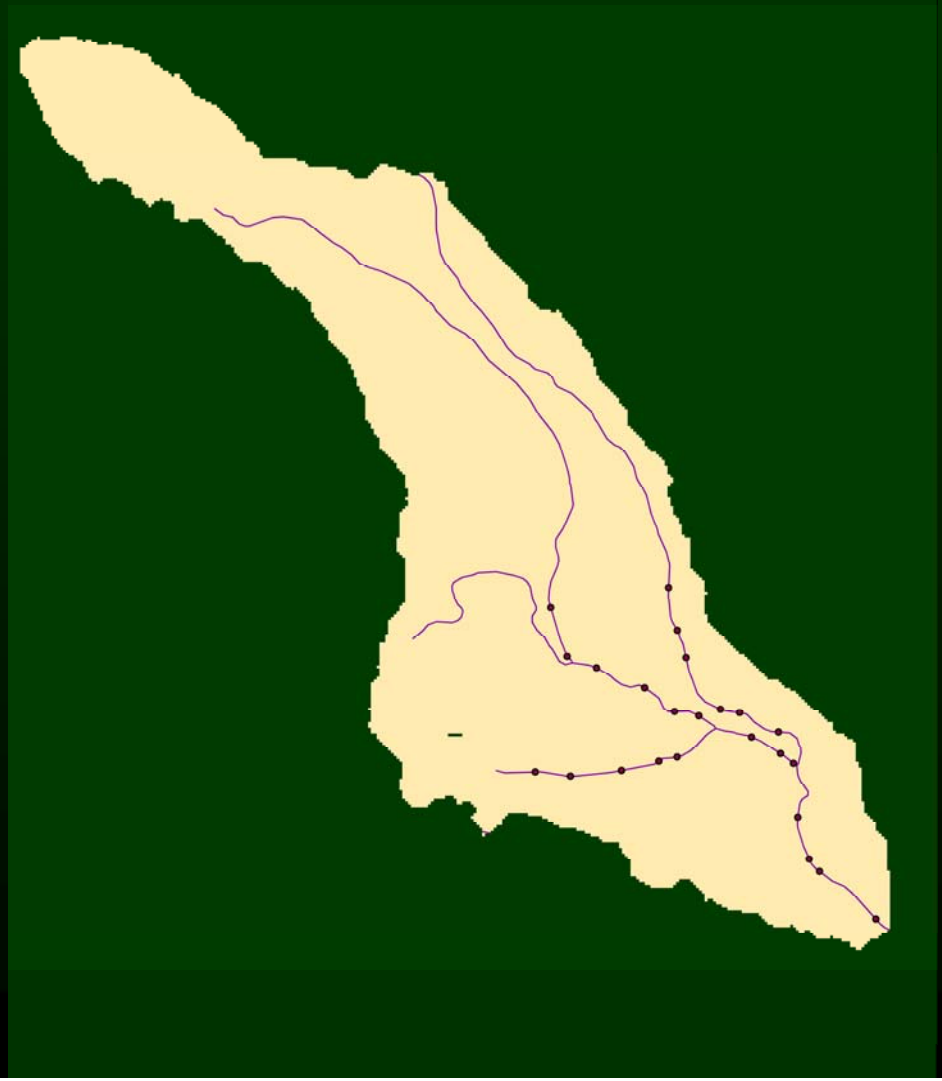

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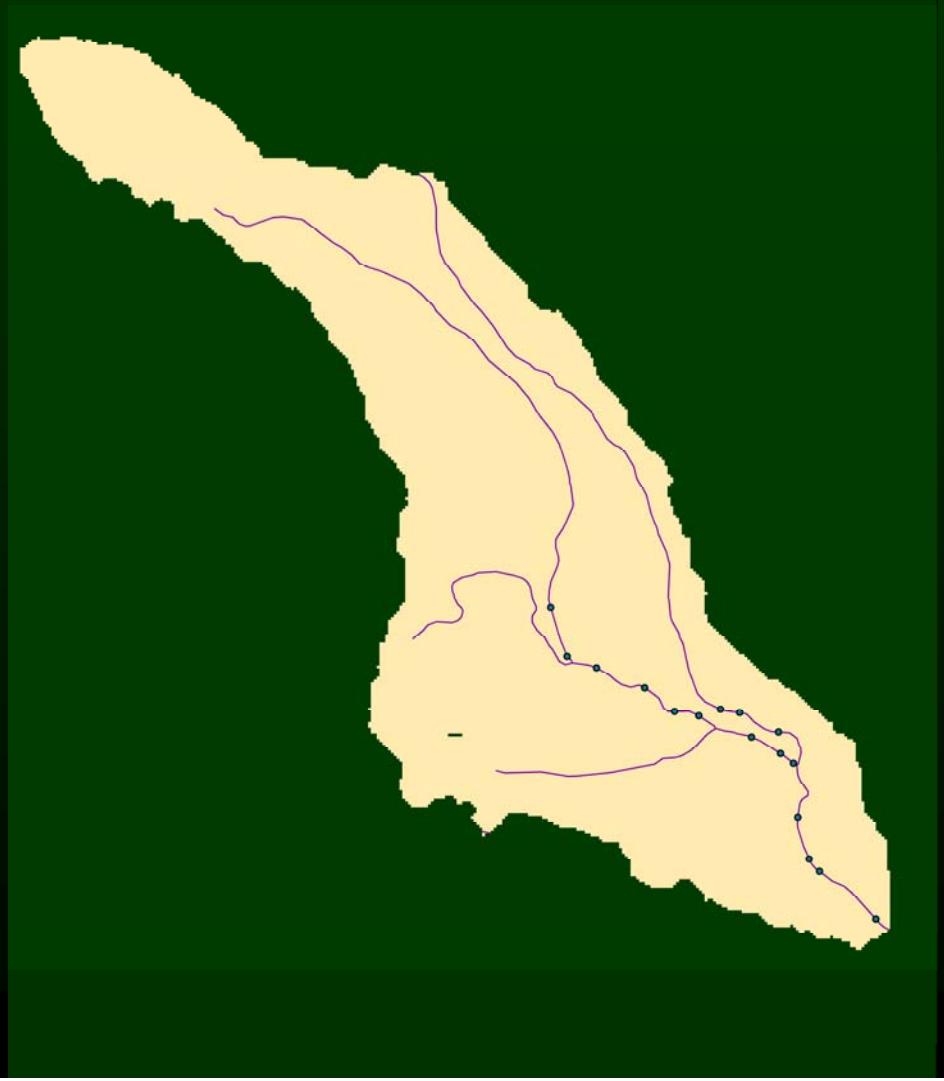
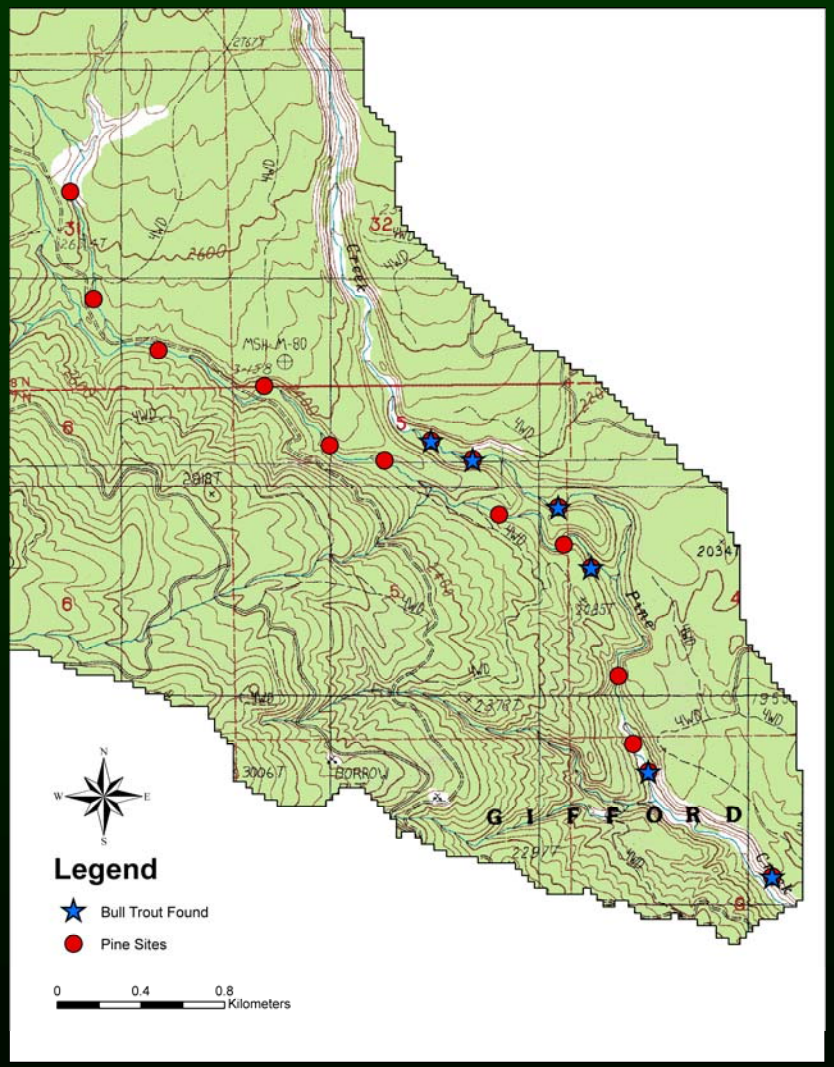
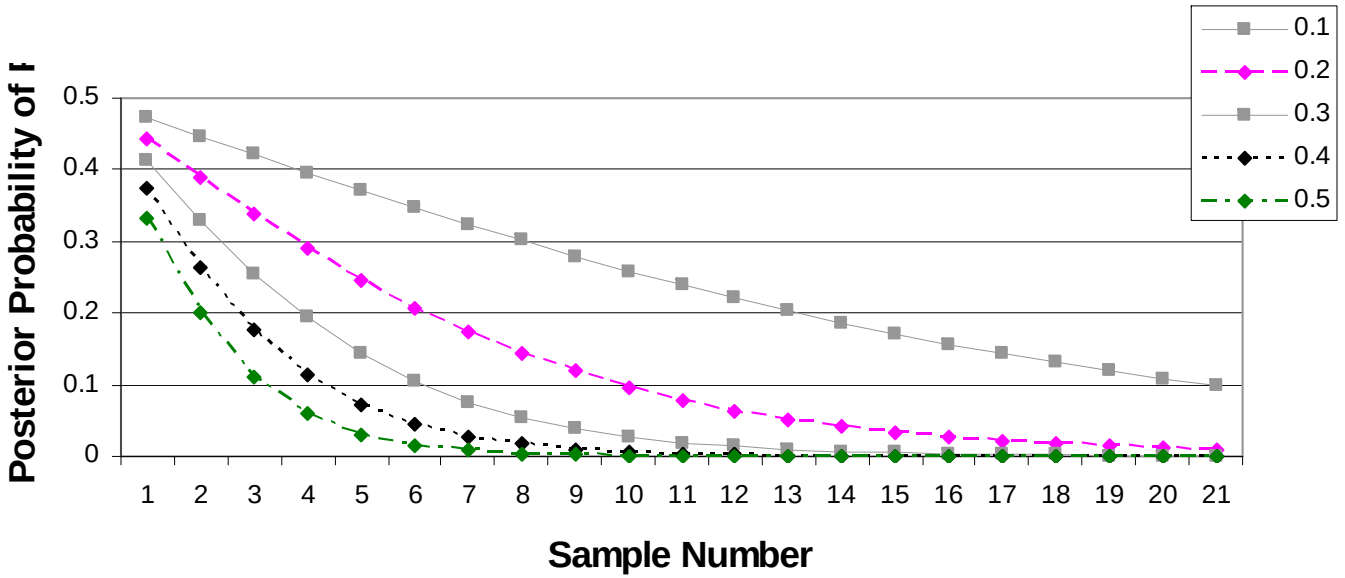


Sample design – Pine Creek

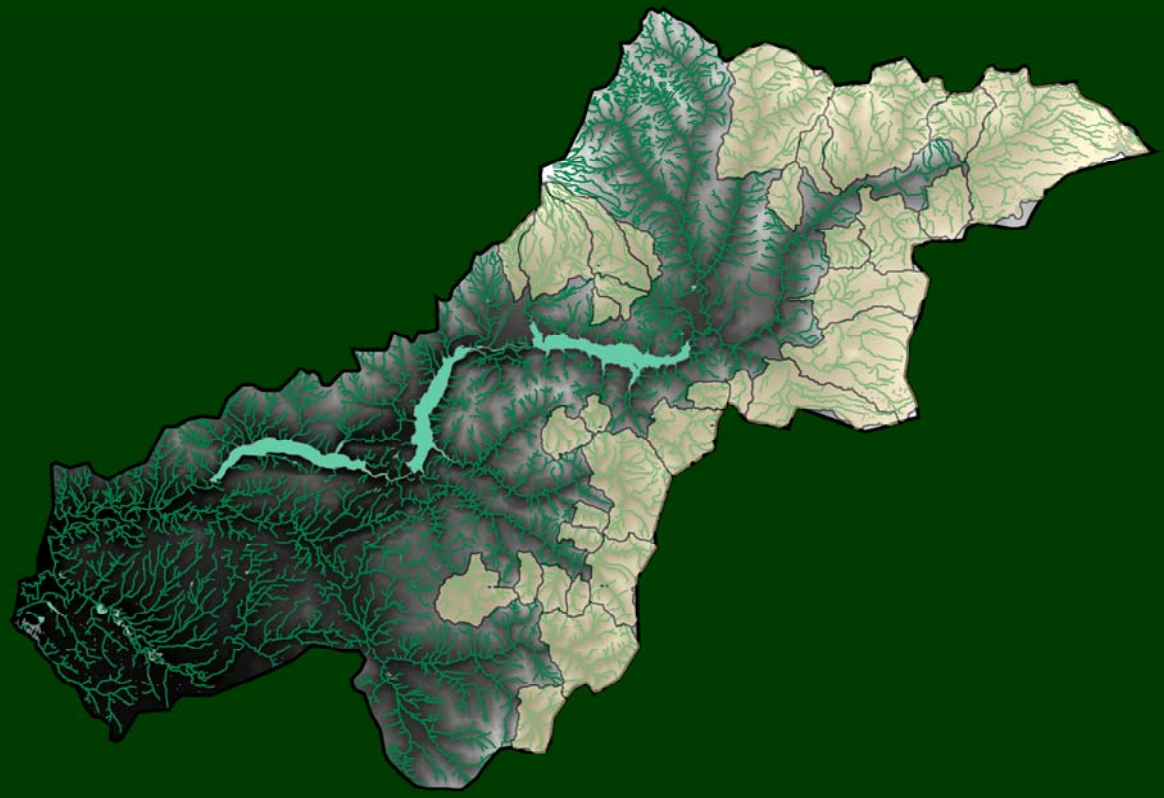
- Bull trout captured in 6 of 16 sites
- Probability of detection = 6/16 = 37.5%



Sample design – Probability of detection

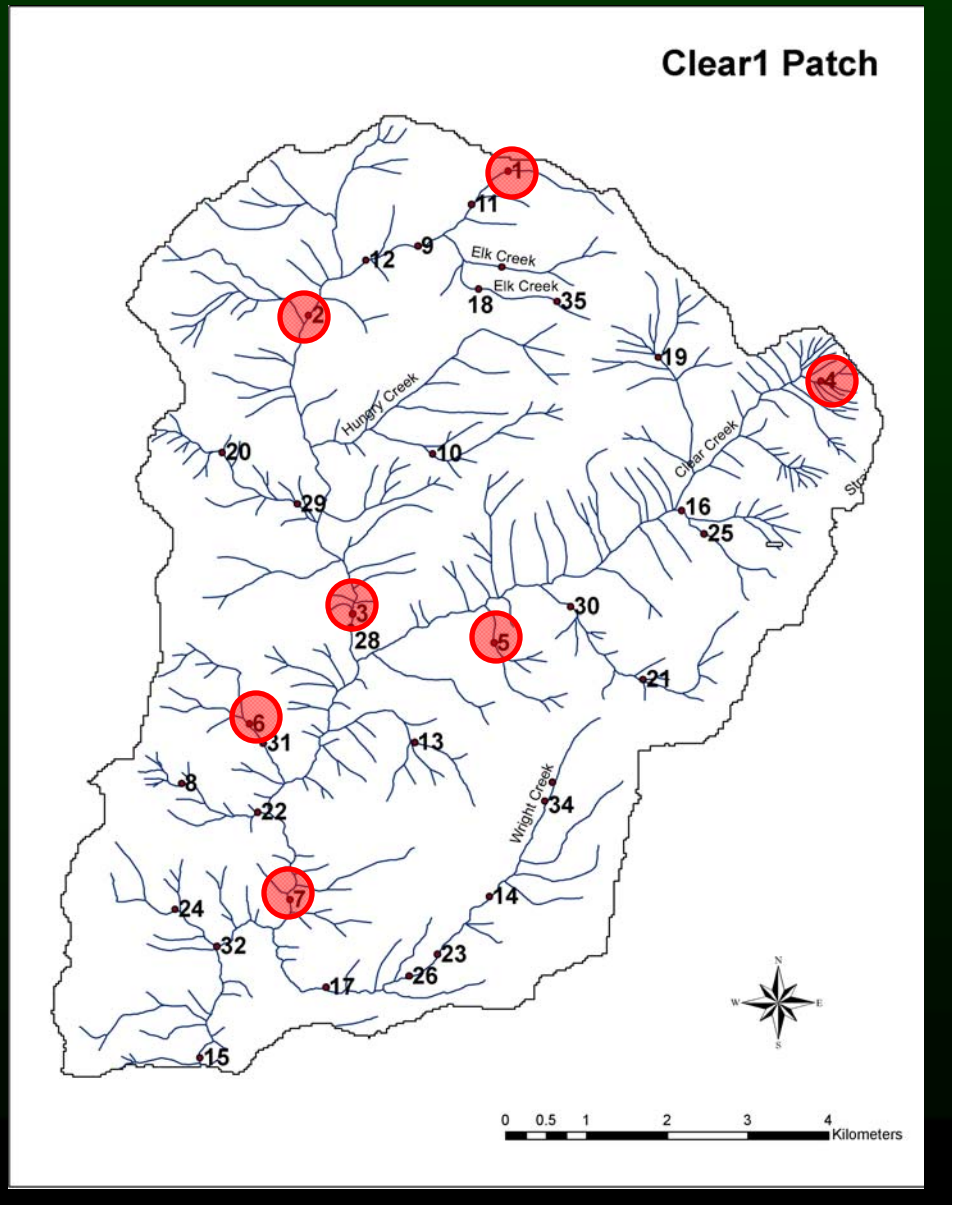


Sample design – Distribution



Sample design – Distribution

- Top 35 of 142 sample sites
- Sample the top 7 to determine among patch distribution (i.e., occupancy)
- Once multiple size classes (> 30 mm difference) are detected, patch determined occupied
- If bull trout not detected, 80% confident that the patch is not occupied



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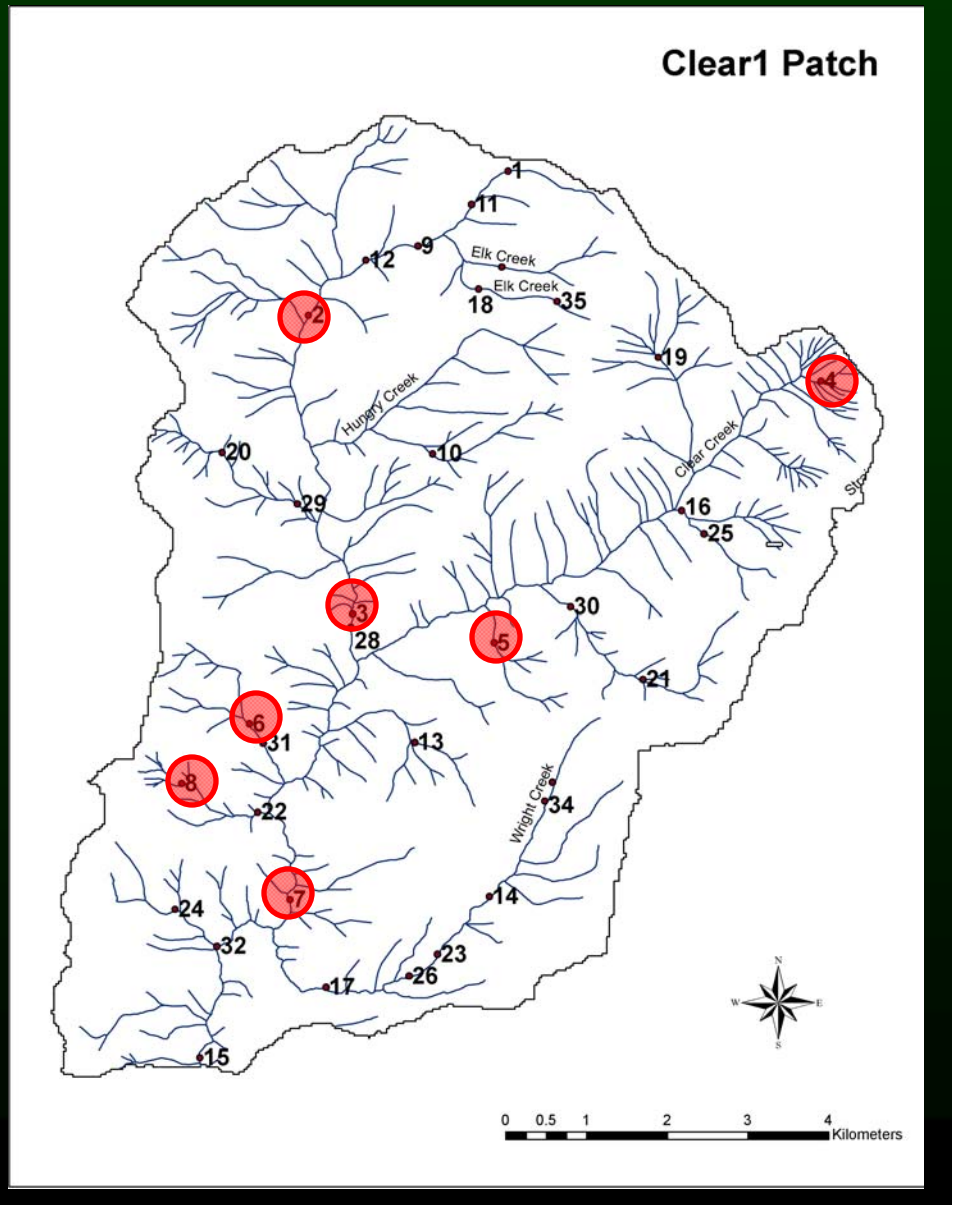
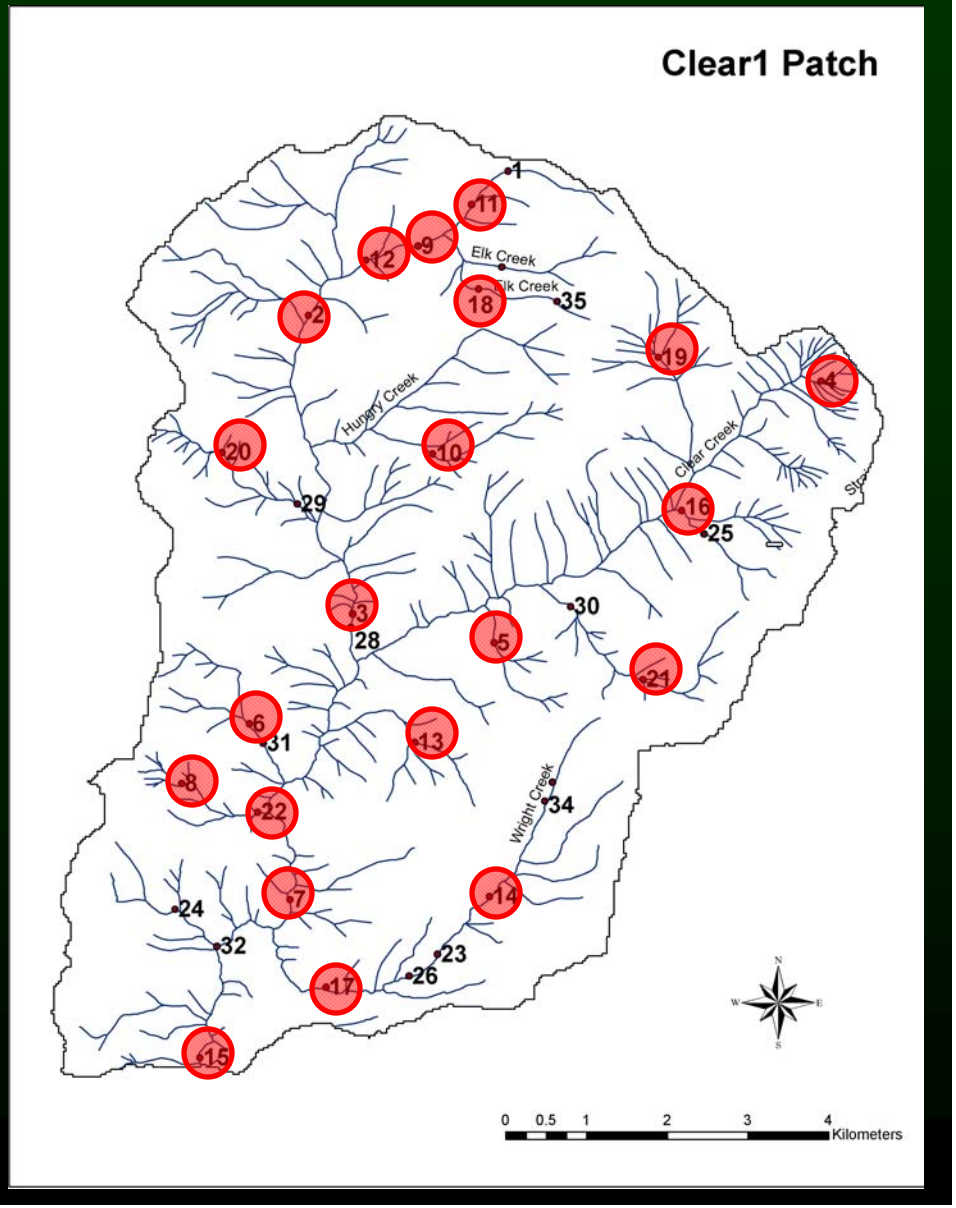


Sample design – Distribution

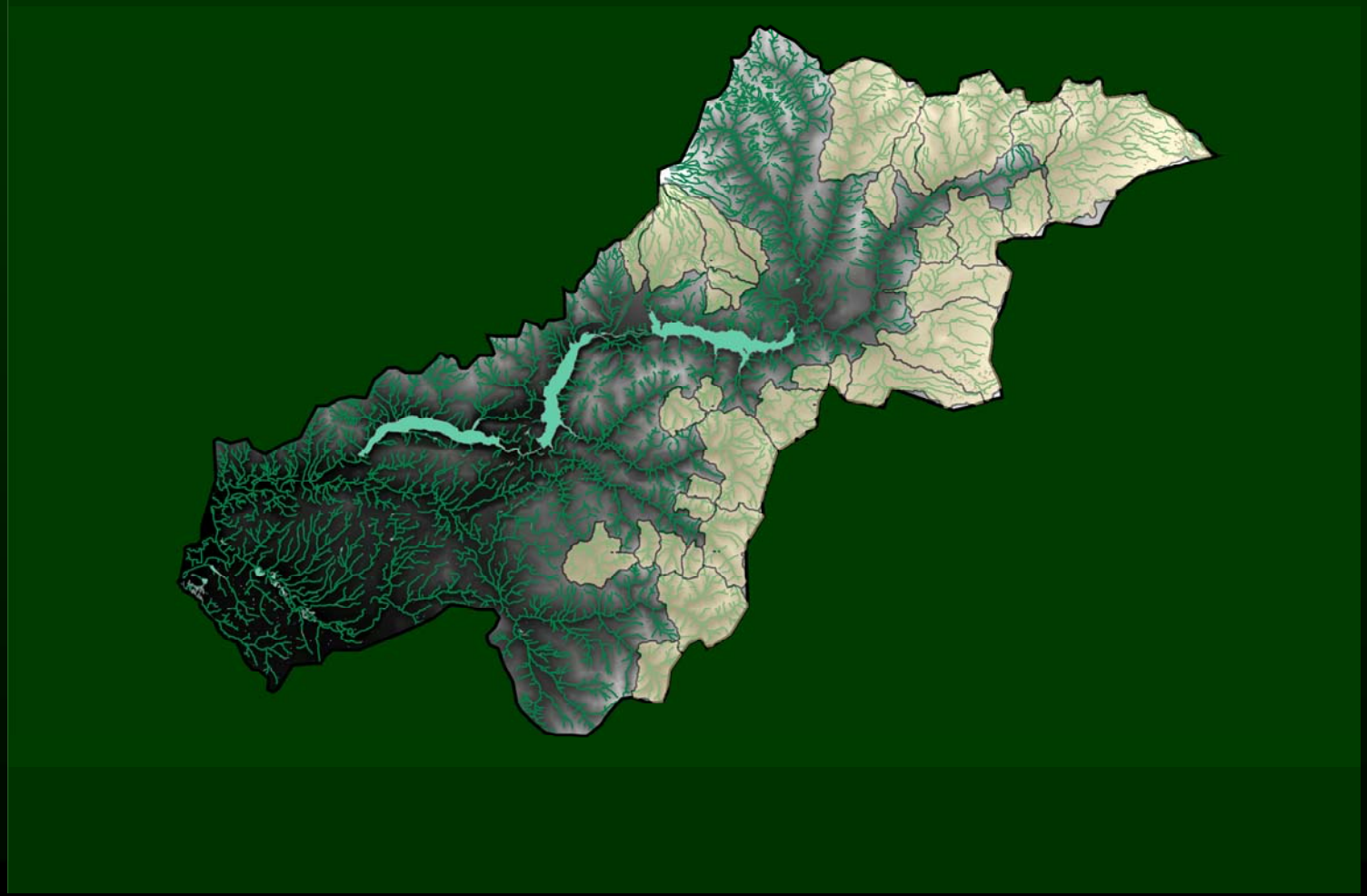
- Determine bull trout distribution within occupied patches
- Expand initial 7 sample sites to the top 21
- These become your standardized sites for monitoring changes in distribution



Sample approach

- Biological
  - Electrofish 50 m reach bounding sample site (no block nets)
  - Capture and ID all fish
- Physical
  - Gradient
  - Channel dimensions
  - Woody debris
  - Undercut banks

Results



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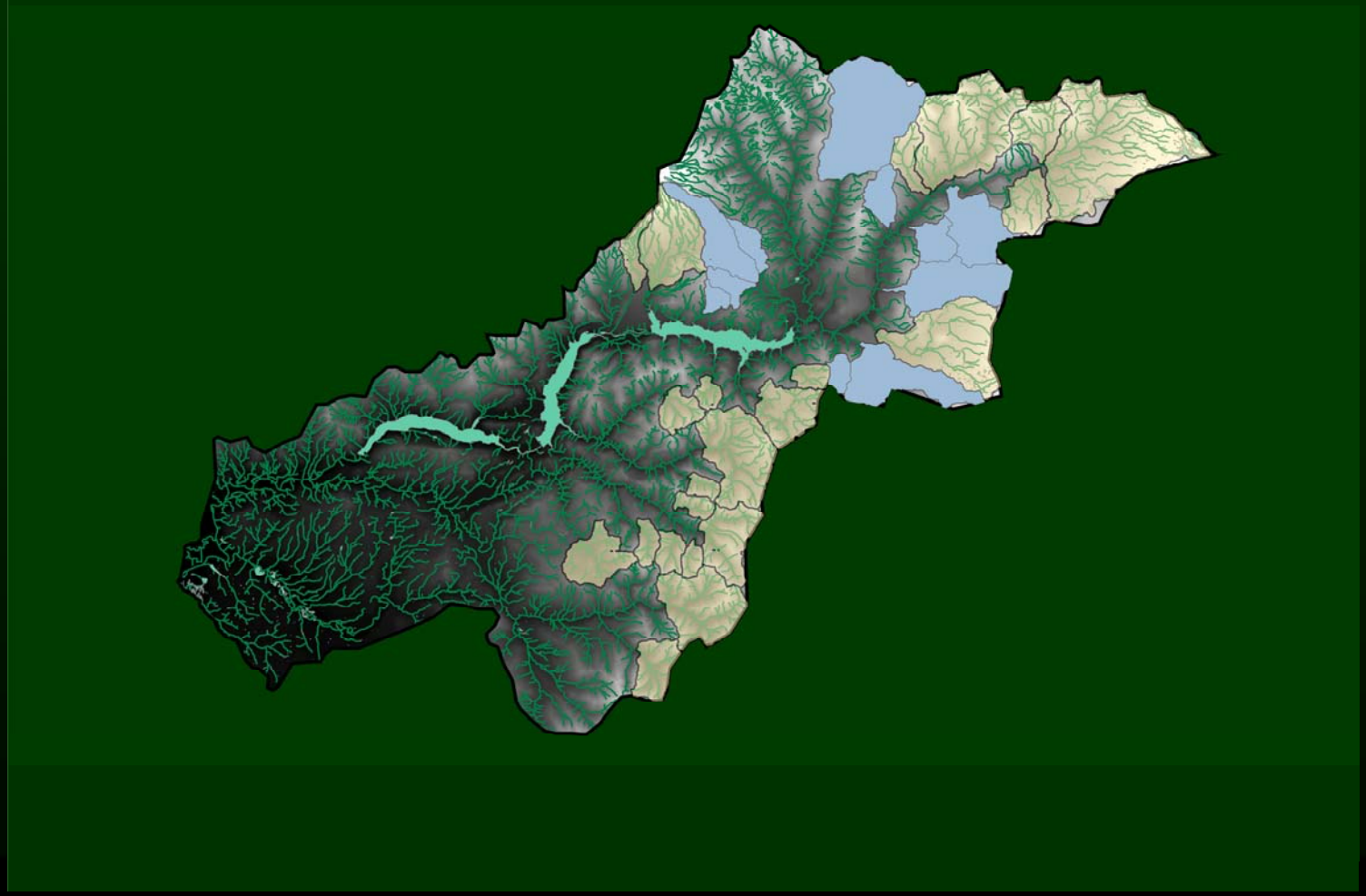
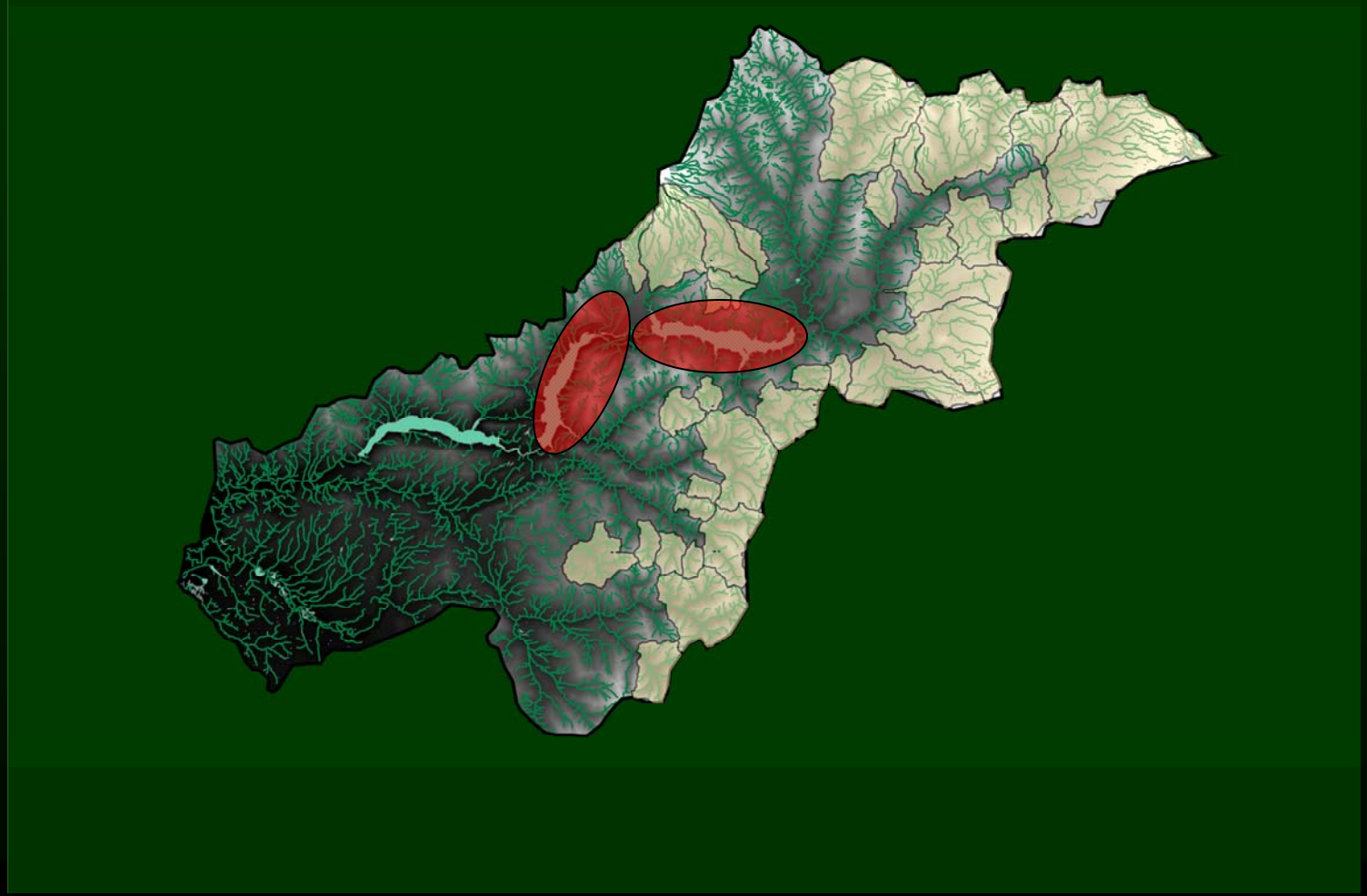


Results

Review and modification

- Local knowledge can be incorporated
  - i.e., barriers, known distribution, known spawning areas, life history types present
- Lewis River subbasin
  - Barriers
  - Reservoirs
  - Adfluvial life history strategy

Review and modification



Advantages of patch concept

- Provides a template for sampling with minimal resources
- Provides a template for assessing current state of distribution among patches within a core area and monitoring changes
- Provides a template for assessing current state of distribution within a patch and monitoring changes
- Provides a statistically sound and rigorous evaluation approach – "scientifically defensible"
- May provide an approach to monitoring trends in abundance