



DEQ

State of Oregon
Department of
Environmental
Quality

Reference Condition Approach and Site Selection: An approach for biological criteria and watershed assessment

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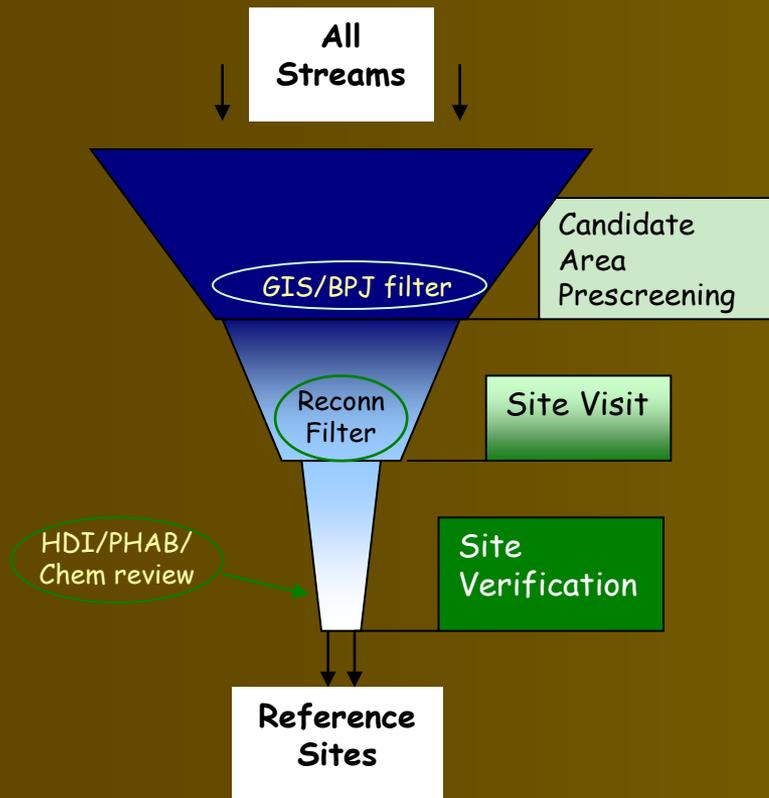
*National Water Quality Monitoring Council meeting
July 2010*



Overview

- 1992 to present - Identified more than 200 reference sites
- Wadeable streams (1st- 4th order) representing 84-92% of total streams miles in Oregon
- Use in Biocriteria, 303d, TMDL, Permitting support, stressor identification

Site Selection Process



1. Candidate area prescreening
 - Select region/natural gradients, use GIS and BPJ to map candidate areas
2. Site visit (Field reconnaissance & Sampling)
 - Site reach assessment of human disturbance ranks candidates (for sampling)
3. Site verification
 - Use site specific landscape, reach & sample data to verify and grade sites



1. Prescreening - GIS & BPJ

GIS

- Ag and urban land use (MRLC)
- Road density (TIGER)
- Forest Fragmentation (Oregon Biodiversity Project)

BPJ

- Consult with regional resource managers



2. Site Visit - Reach level metrics

5 metrics scored* based on proximity of disturbance:

- Roads,
- Logging,
- Agricultural and/or Urban land use,
- Rangeland,
- Miscellaneous (includes mining, recreational activity, other).

*absent=0, present=1, within 10 m=3, on the bank=5



3. Site Verification- Watershed specific assessment

GIS data - 3 Metrics scored* based on watershed extent of :

- Percent Ag-Urban land use
- Forest fragmentation
- Road density

*metric score uses the range of values to set score (maximum = 5, Lowest = 0)



4. Site Verification - HDI and Data review

- **HDI (Human Disturbance Index)**
Reach & watershed scores averaged and summed to give index score
- **Review sample data**
Anomalous sites for non-biological variables are flagged and reviewed before assigning final grade

5. Verification - Site Grading

A - Ideal watershed and stream condition, a watershed with **virtually no human disturbance**.

B - Good watershed and stream condition, **some limited human disturbance** and/or BMPs are well implemented.

C - Marginal watershed and stream condition. Considerable human disturbance. **Best available**. Replace if better quality reference sites are located.



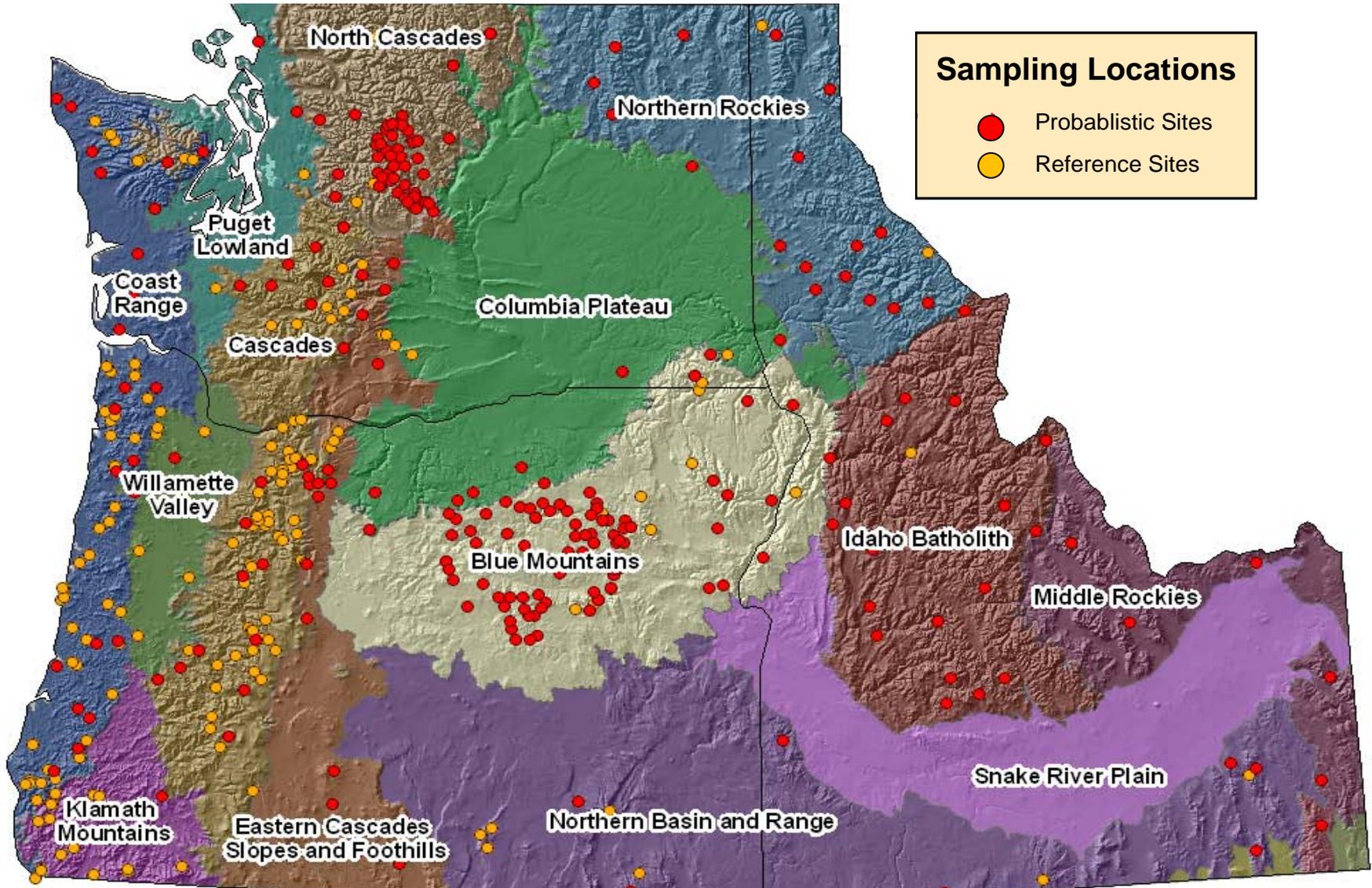
Site Grading continued

D - Site represents **sub-marginal** stream and watershed conditions, considerable human disturbance is present at **reach or watershed**.

E - Site represents **poor** stream and watershed conditions, considerable human disturbance is present at **reach and watershed**.

F - Site represents **very poor** stream and watershed conditions, human disturbance is extensive throughout **reach and watershed**.

Reference sites used by R-10 states for EMAP-West





Considerations

- Disagreements with standards
 - Some reference sites exceed WQ standards
 - A percentiles approach leaves some reference sites as “impaired”
 - If a site fails a WQ standard but shows low human disturbance, can it be considered to be in natural state for that parameter?
- Potential to track climate change effects
 - With minimal human disturbance on the ground, are effects observed at reference sites due to climate effects?
 - Reference sites can be more stable than non-reference sites
 - Should have a network of reference and managed sites for trends

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- Phil Larsen, Phil Kaufmann, Bob Hughes - EPA/OSU Corvallis
 - Doug Drake - ODEG

Selecting Reference Condition Sites
An Approach for Biological Criteria and Watershed Assessment:
www.deq.state.or.us/lab/biomon/reports/WSA04-002.pdf

Cultus Creek (Cascade meadow stream)



2. Site Visits - Reach level Checklist

- Human Disturbance reach-level activity checklist (modified from Kaufmann et al, 1999)
- Simple set of metrics produces a reach-level Human Disturbance Score to rank sites
- Allows for objective ranking of candidate sites before or after sampling

HDI Score examples

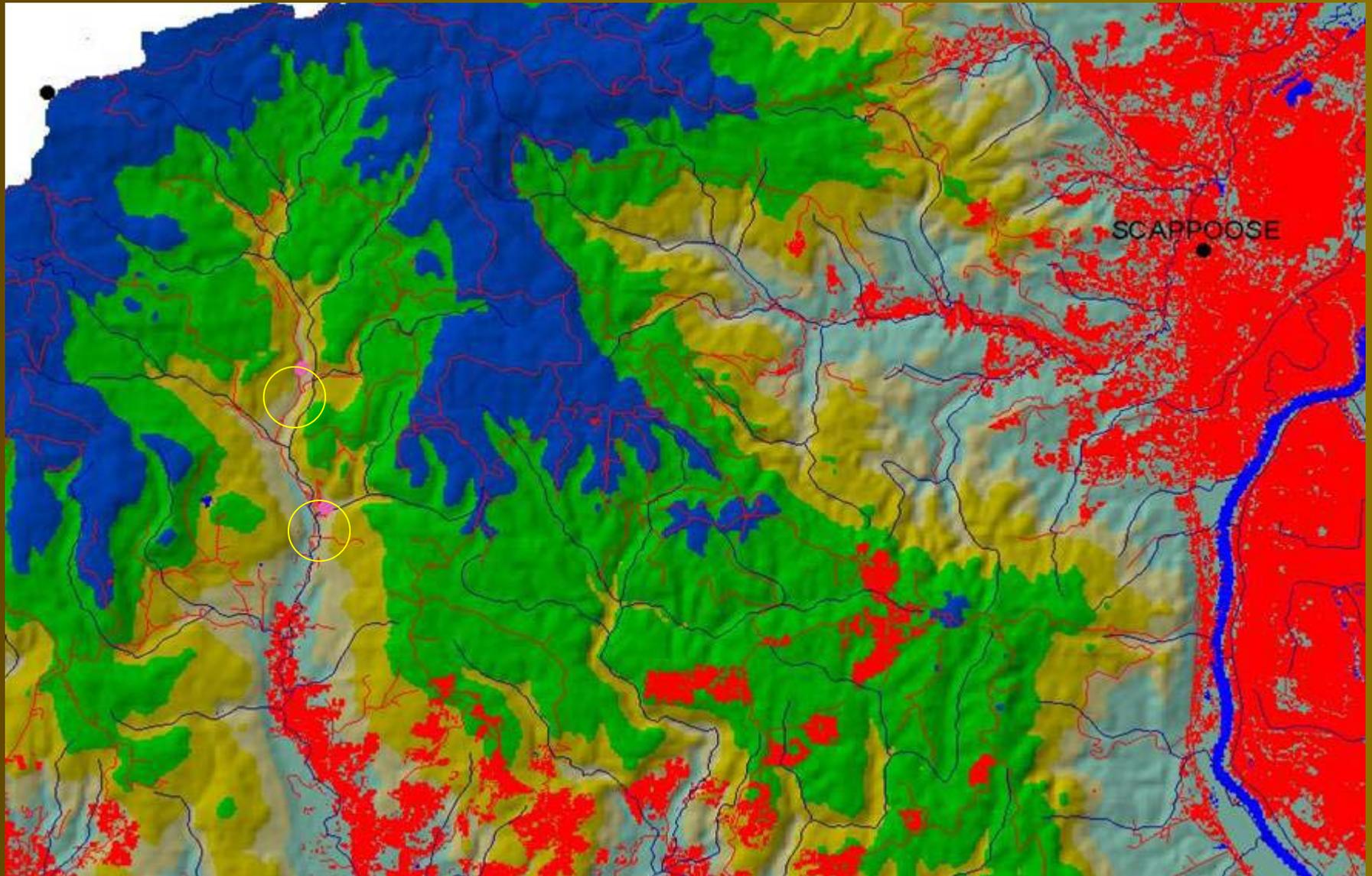
Activity (scale)	Cultus Creek	Testament Creek	Tillamook River
Ag/Urban (reach)	Not present = 0	Present = 1	Within 10 m = 3
Logging (reach)	Not present = 0	Present = 1	Within 10 m = 3
Range (reach)	Not present = 0	Not present = 0	Within 10 m = 3
Roads (reach)	Not present = 0	Present = 1	On the bank = 5
Misc (reach)	Not present = 0	Trail on bank = 5	Trash on bank = 5
Ag/Urban (watershed)	0.07% = 0.003	3% = 0.15	6% = 0.32
Forest Frag (watershed)	0 = 0	84% = 4.2	62% = 3.1
Road (watershed density)	0 = 0	13% = 1.7	5.4% = 0.68
HDI Score	0.001	3.6	5.2



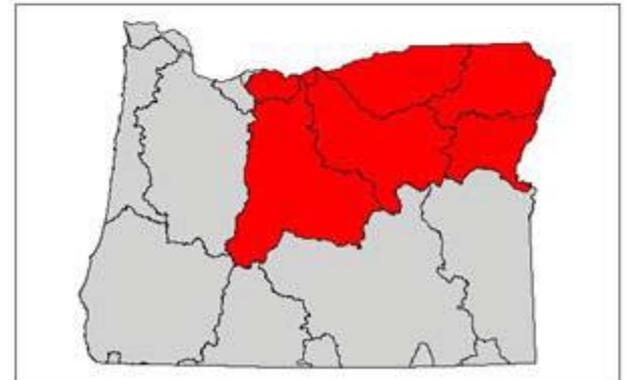
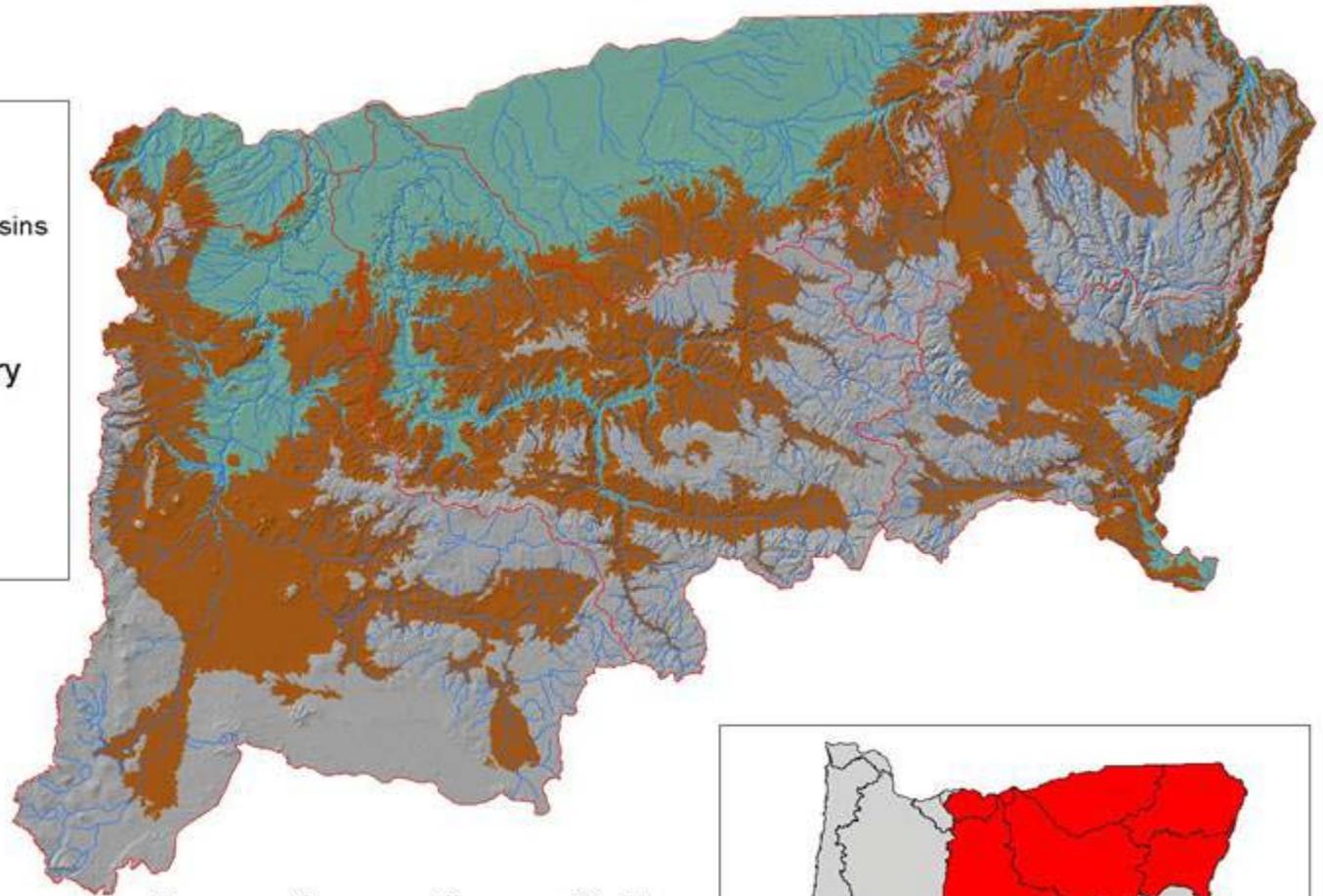
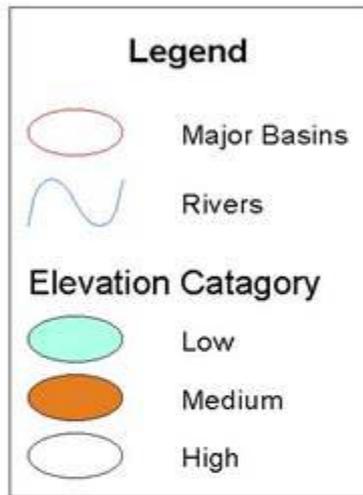
Lessons Learned

- BPJ - helpful, but verify quality of candidates
- GIS - Use best available layers
- Reconnaissance - Can't do enough
- Verification - Anomalous data highlighting unique sites
- Process is iterative and helps identify gaps in coverage

1. Prescreening - GIS example



1. Prescreening - Natural gradient



Road density (scoring example)

