May 1st, 10:30 AM - 12:00 PM

Monitoring for Adaptive Management: Status and Trends Monitoring of Aquatic and Riparian Habitats in the Lake Washington/Cedar/Sammamish Watershed

Scott A. Stolnack
King County (Wash.), scott.stolnack@kingcounty.gov

Hans B. Berge
King County (Wash.)

Monitoring for Adaptive Management

Status and Trends Monitoring of Aquatic and Riparian Habitats in the Lake Washington/Cedar/ Sammamish Watershed

Scott Stolnack
Hans Berge
Dan Lantz
Curtis DeGasperi
King County

Roger Tabor
US Fish and Wildlife Service

May 1, 2014

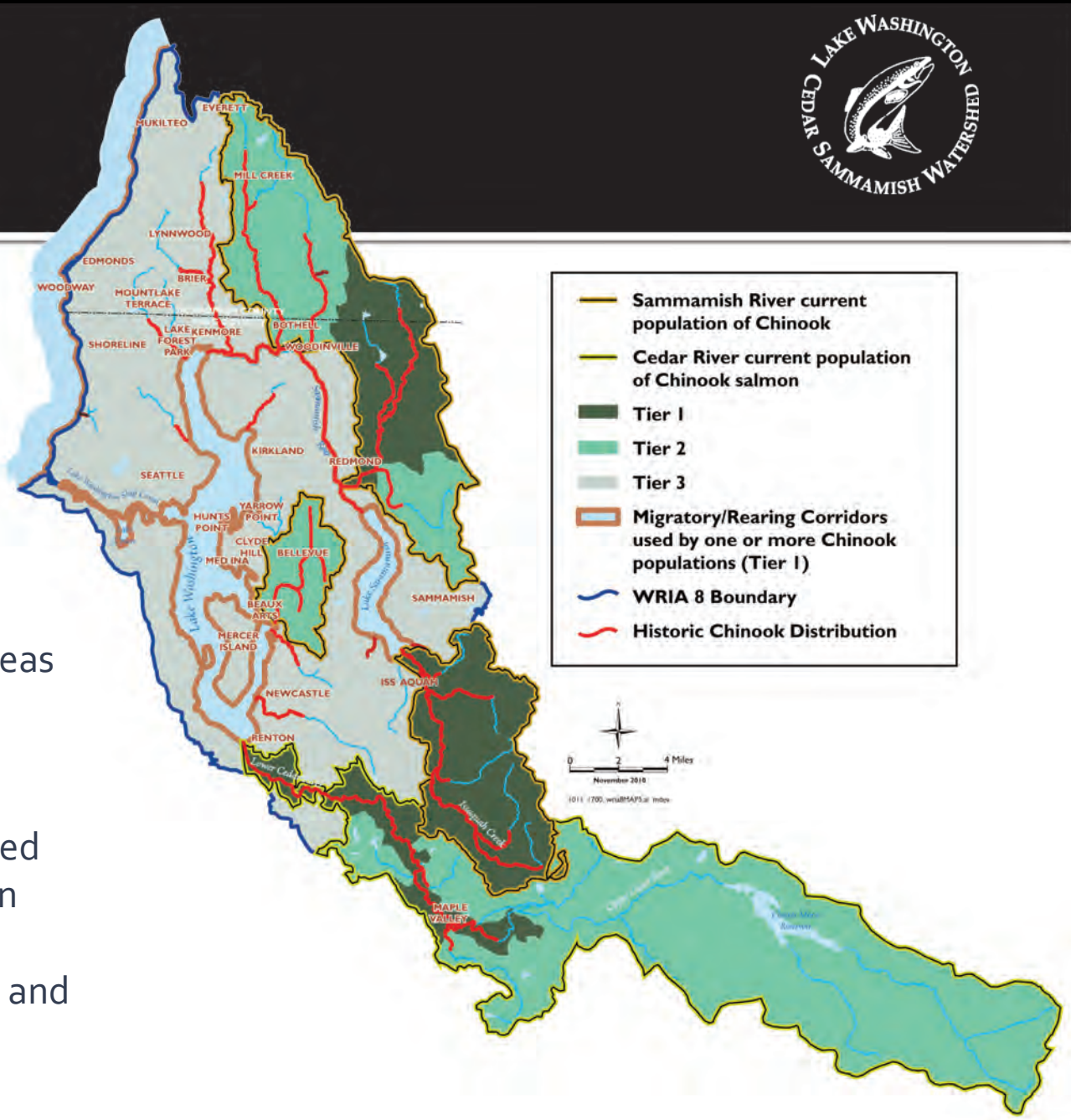
Water Resource Inventory Area (WRIA) 8

Lake Washington/ Cedar/ Sammamish Watershed

- 1.4 million inhabitants
- Most highly developed watershed in the state

Water Resource Inventory Area (WRIA) 8

- Two listed Chinook salmon populations, plus steelhead, bull trout, kokanee, other salmonids
- Protected headwaters (Cedar Watershed)
- Spawning and rearing areas generally outside urban growth boundary
- Salmon recovery governed by a collaborative "Salmon Recovery Council" of 27 jurisdictions plus business and environmental groups



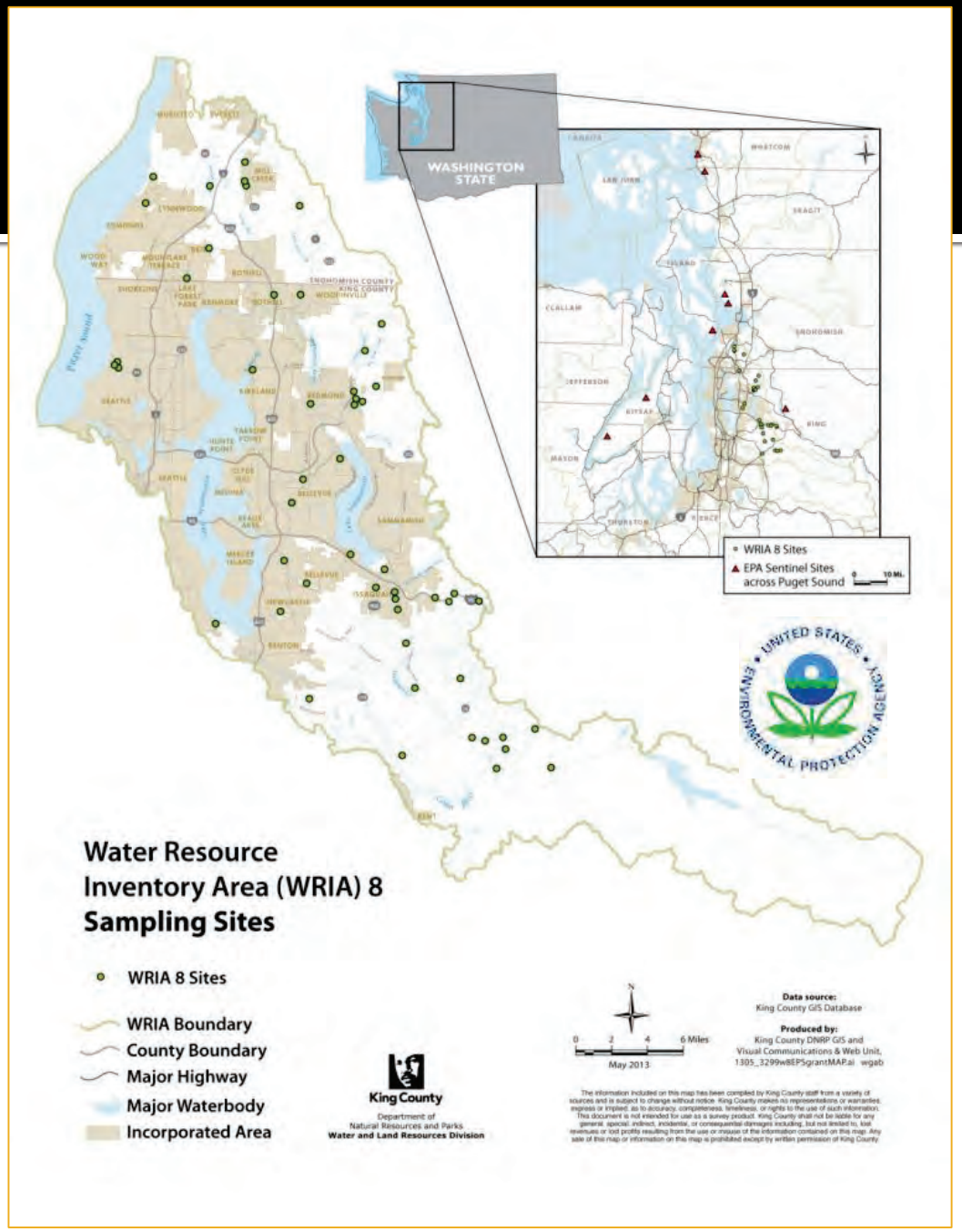
Status and Trends Monitoring

- Chinook Salmon (VSP)
  - (Fish in/fish out monitoring)

- Watershed Conditions
  - Stream Condition (habitat, biota)
  - Streamflow
  - Water Quality
  - Land Cover

Approach: Status and Trends

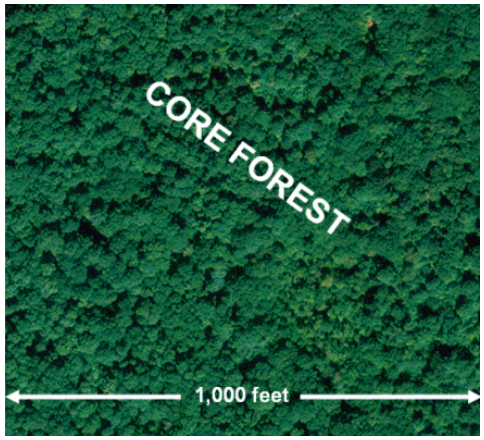
- 52 sites in WRIA 8
  - (Ecology/EMAP GRTS sample draw)
- 5y sampling window
  - (year 1: n = 29)
- +5 EPA "Sentinel" sites across Puget Sound
  - Chuckanut Creek
  - Glendale Creek
  - Griffin Creek
  - Dewatto River
  - Big Beef Creek

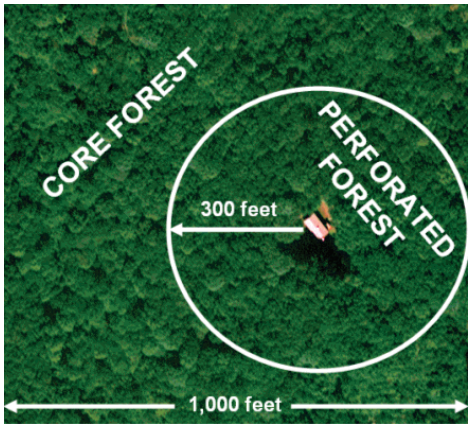


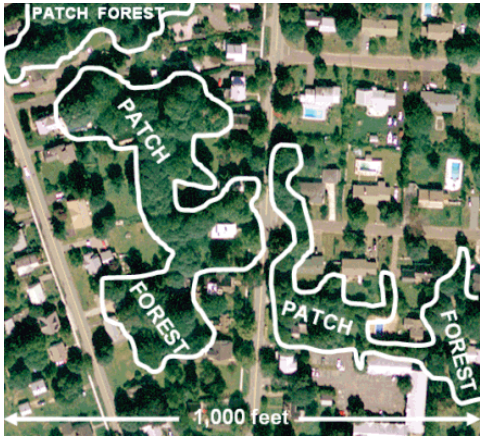
Metrics:
Baseline Information/Status & Trends

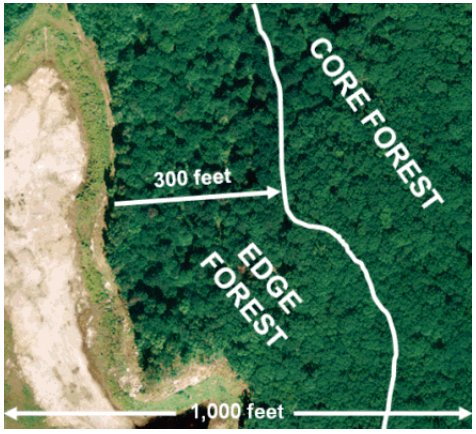
- Biology: BIBI, FIBI, diversity indices
- Habitat: normalized metrics vertical residual pool area, embeddedness, % fines, LWD count/volume, riparian cover, disturbance, etc. (ECY/EMAP protocols)
- Hydrology: Flashiness, high pulse count, low pulse count, TQ Mean, R-B Index, etc (subset of sites)
- Summer water temperature: 7DADM, days above critical thresholds, etc. (one year)
- Land cover: % urban, % impervious, % forest, population/KM^2, elevation, forest fragmentation, etc.

Fragmentation Metrics



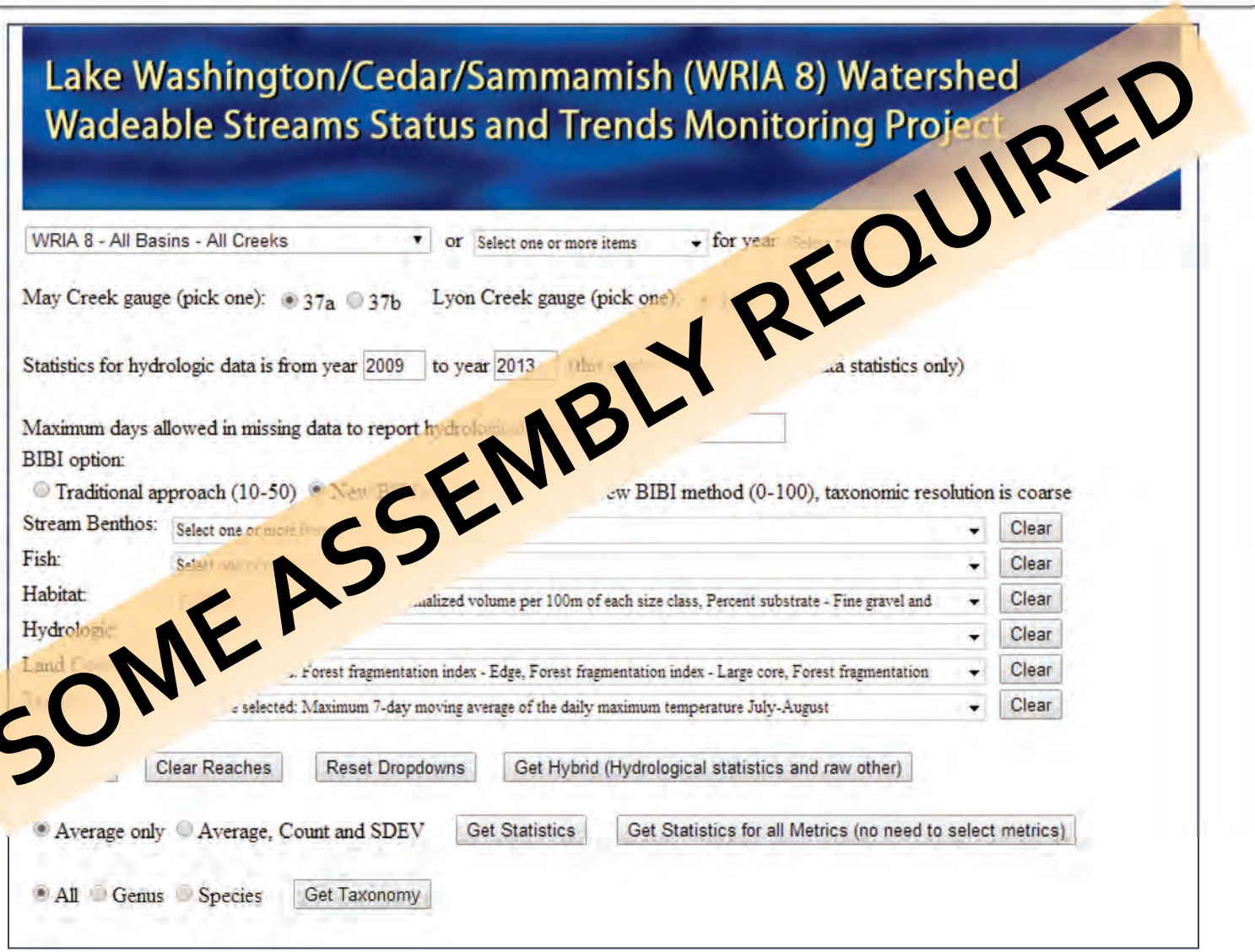






Derived from LandSat (30m) land cover product:
"300 feet" = 3 pixels and "1,000 feet" = 10 pixels

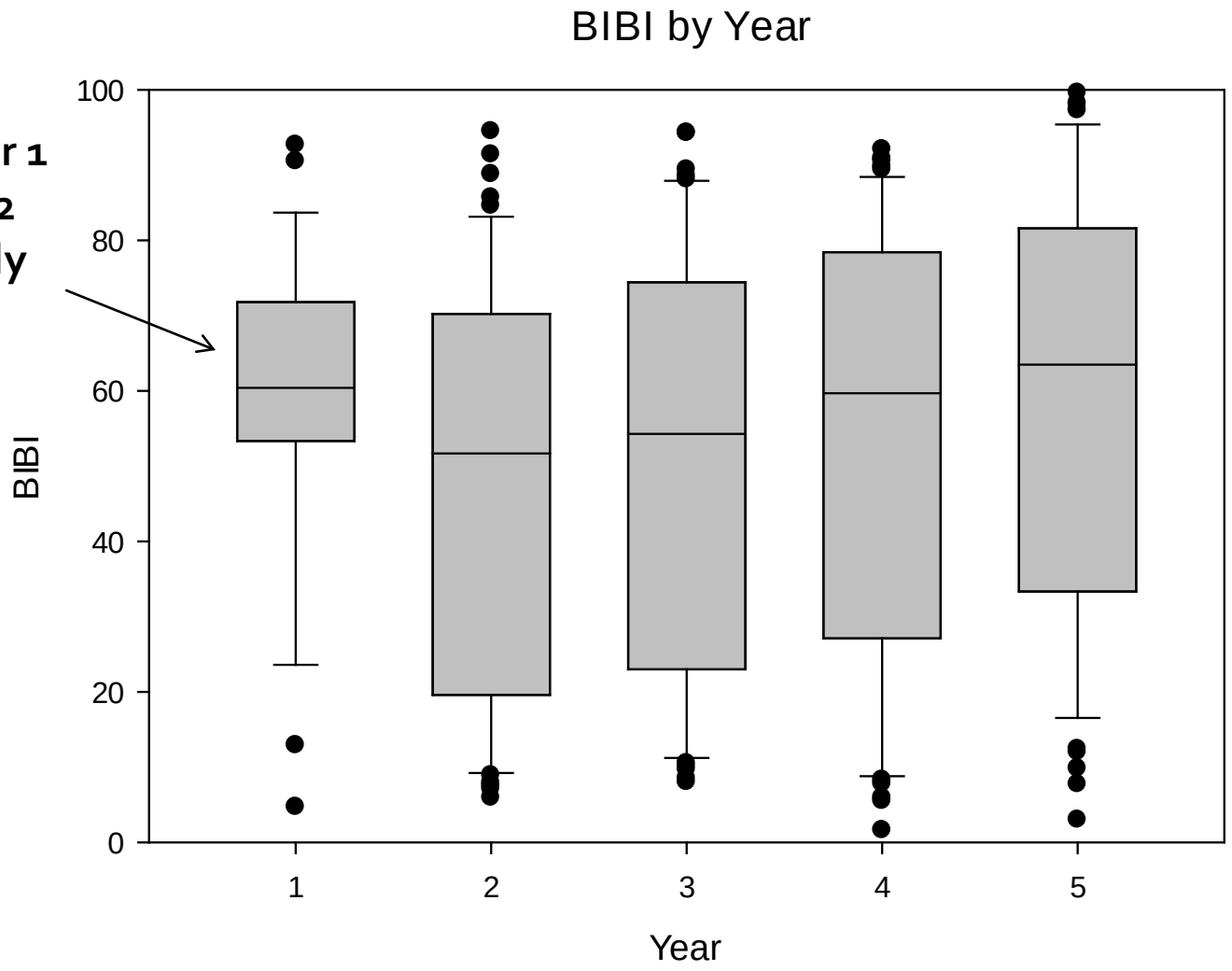
Database



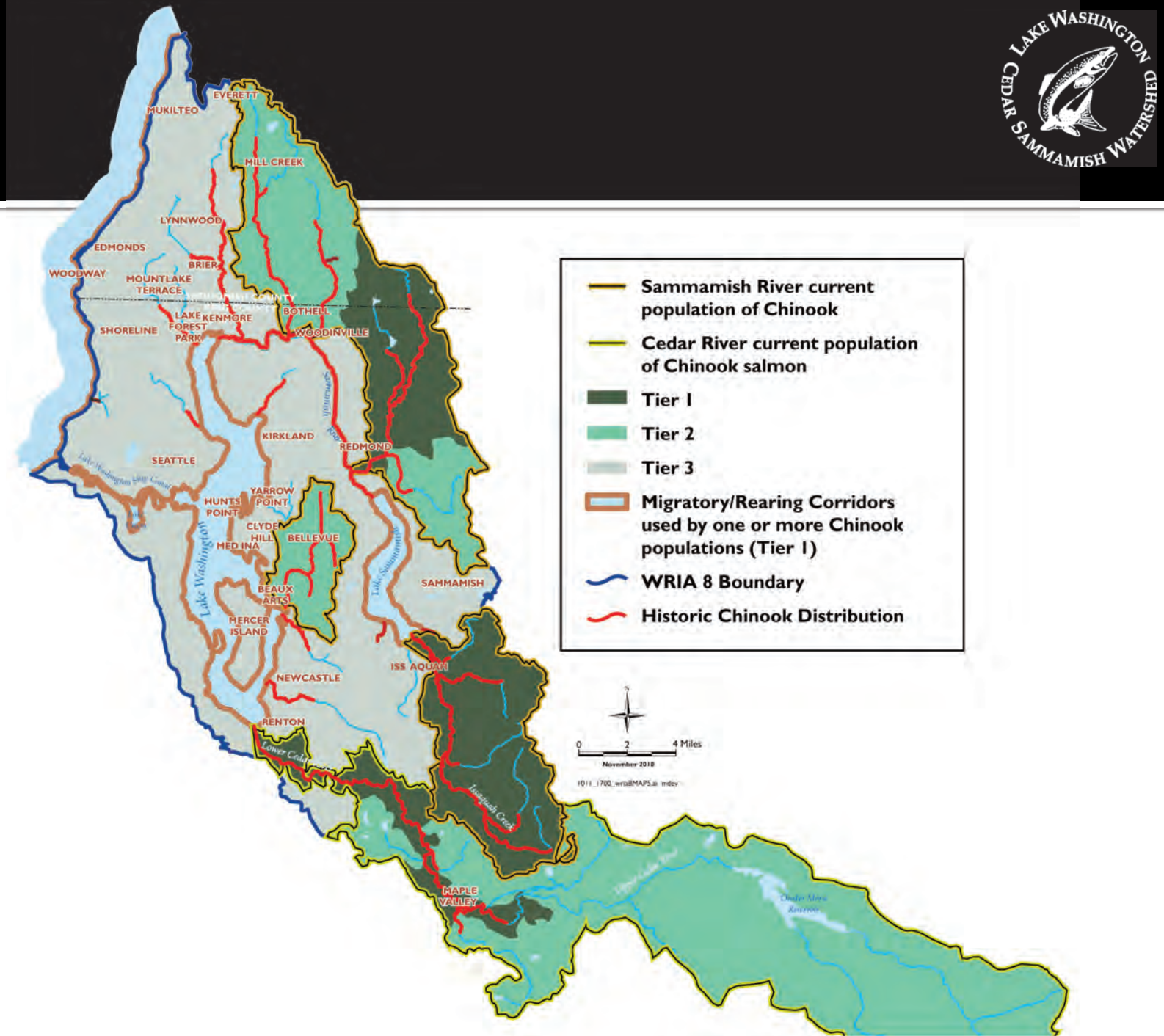
SOME ASSEMBLY REQUIRED

Descriptive Statistics

2009: Tier 1 and Tier 2 areas only (n = 29)

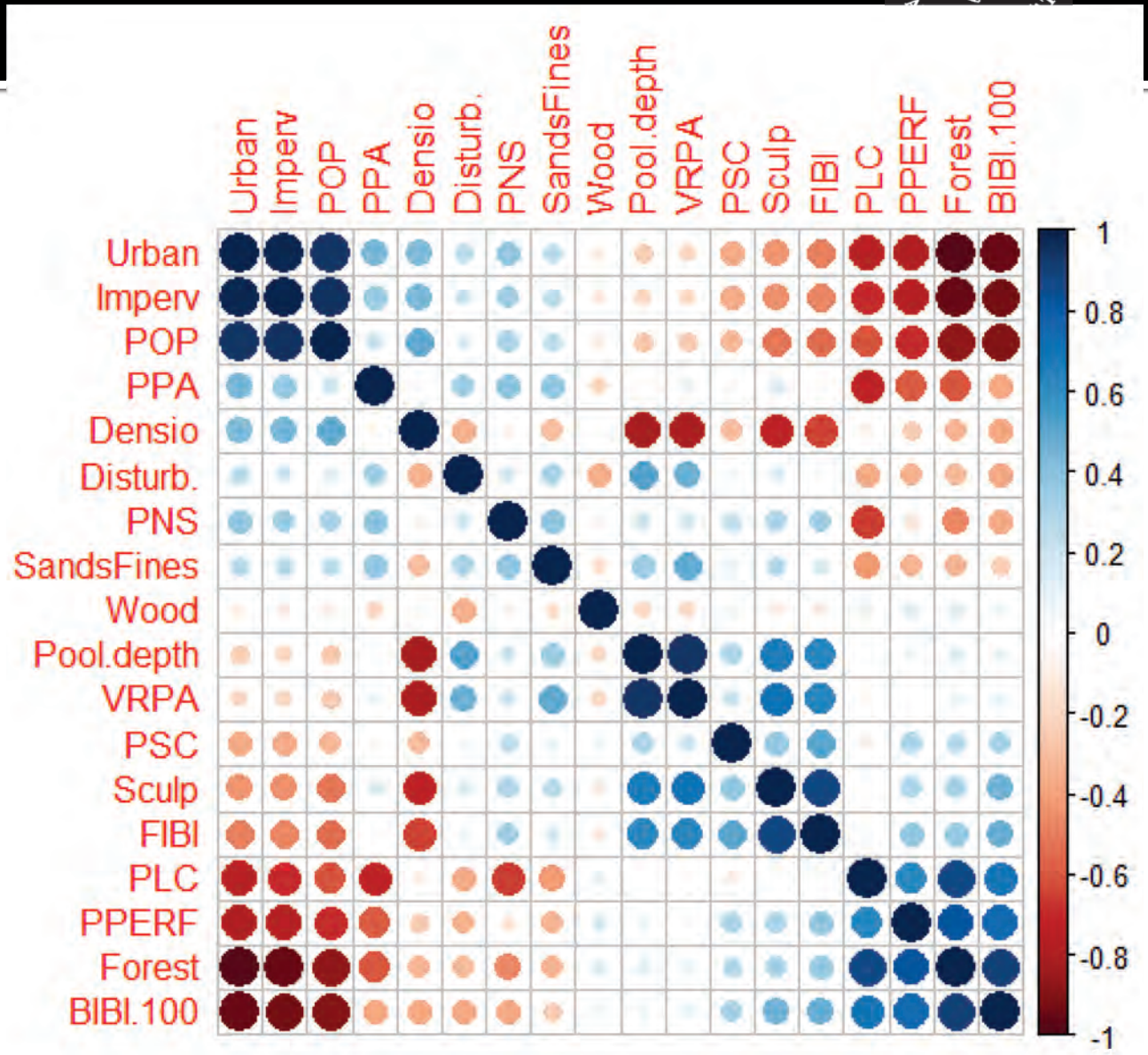


2010-2013: All Tiers (n = 52)


LAKE WASHINGTON CEDAR SAMMAMISH WATERSHED
EVERETT
MUKILTEO
MILL CREEK
LYNNWOOD
EDMONDS
BRIER
WOODWAY
MOUNTLAKE TERRACE
SNOHOMISH COUNTY
KING COUNTY
BOTHELL
LAKE FOREST PARK
KENMORE
SHORELINE
WOODINVILLE
KIRKLAND
REDMOND
SEATTLE
YARROW POINT
HUNTS POINT
CLYDE HILL
BELLEVUE
MEDINA
BEAUX ARTS
MERCER ISLAND
SAMMAMISH
ISSAQUAH
NEWCASTLE
RENTON
MAPLE VALLEY
Lake Washington
Lake Sammamish
Issaquah Creek
Cedar River Reservoir
Sammamish River current population of Chinook
Cedar River current population of Chinook salmon
Tier 1
Tier 2
Tier 3
Migratory/Rearing Corridors used by one or more Chinook populations (Tier 1)
WRIA 8 Boundary
Historic Chinook Distribution
0
2
4 Miles
November 2010

Correlations Matrix

% Urban
% Impervious
Population/km^2
% Patch (PPA)
Densiometer
% Human Disturb.
% Native Fish spp. (PNS)
% Sands+Fines
Wood count
Avg pool depth
Vertical **R**esidual **P**ool **A**rea
% Small core (PSC)
Sculpin count
Fish IBI
% Large Core (PLC)
% Perforated
% Forest
BIBI (100 scale)



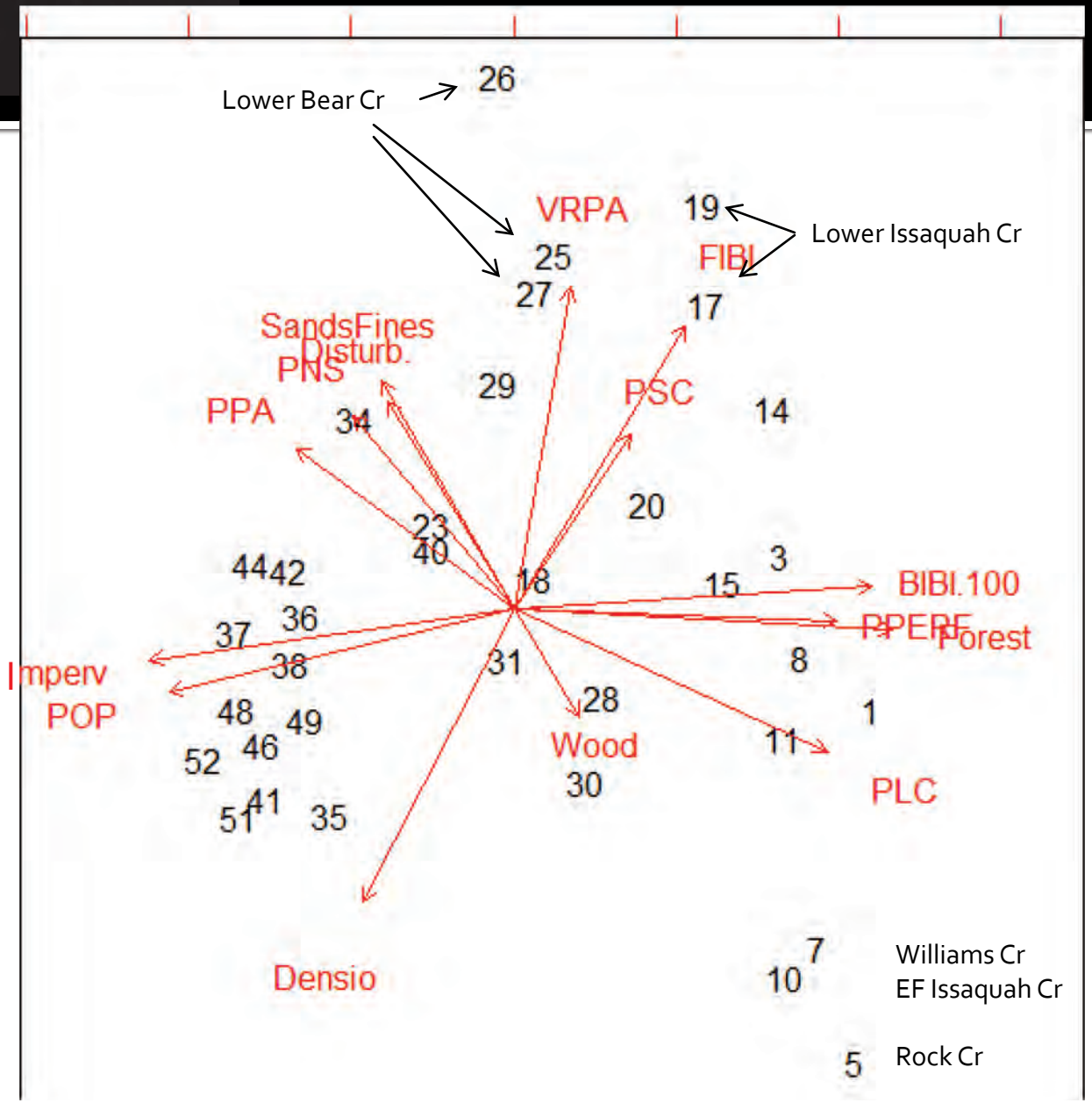
Multivariate Approaches

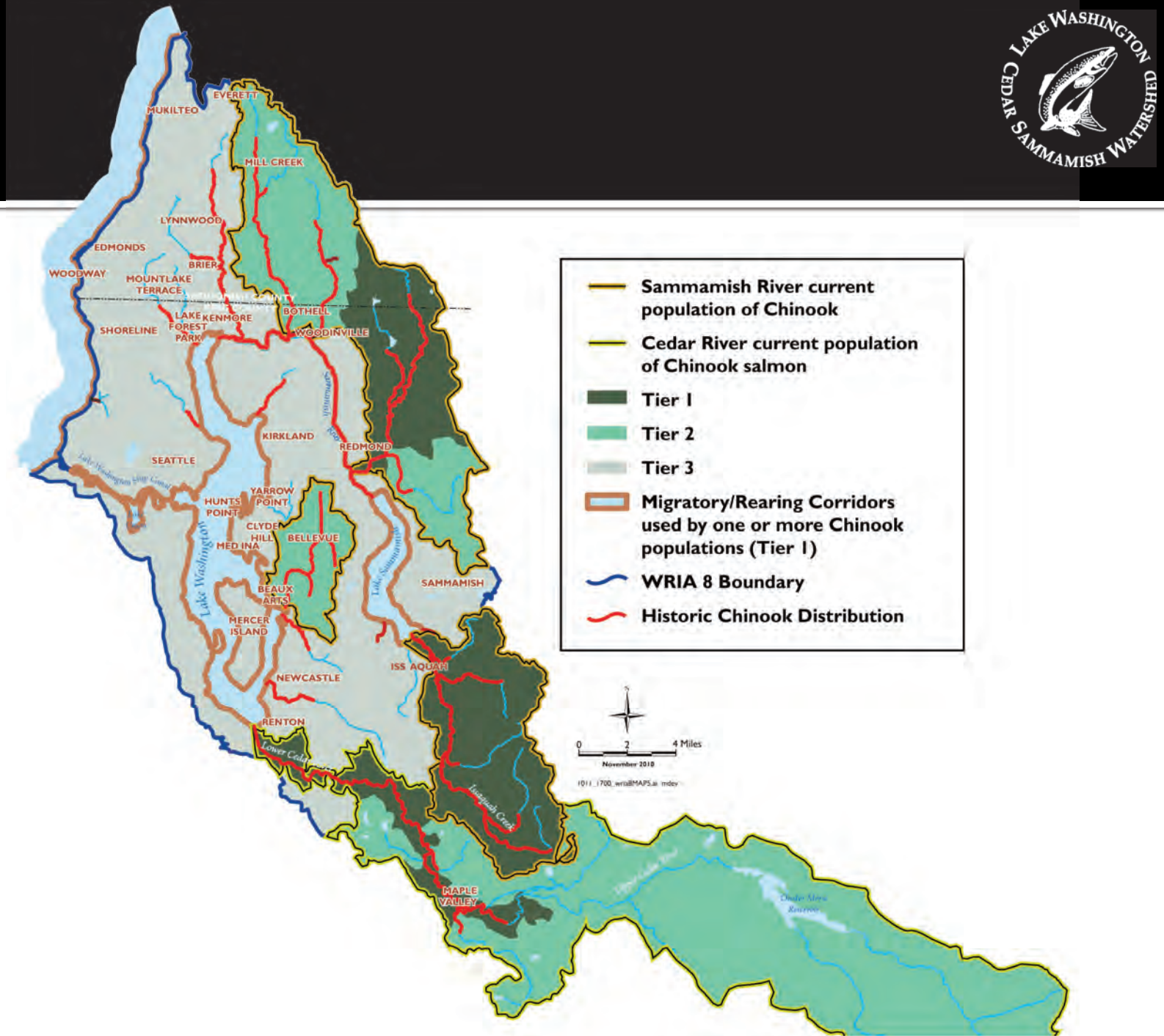
- Principal Components Analysis
- Nonmetric Multidimensional Scaling
- Logistic Regression

Principal Components Analysis

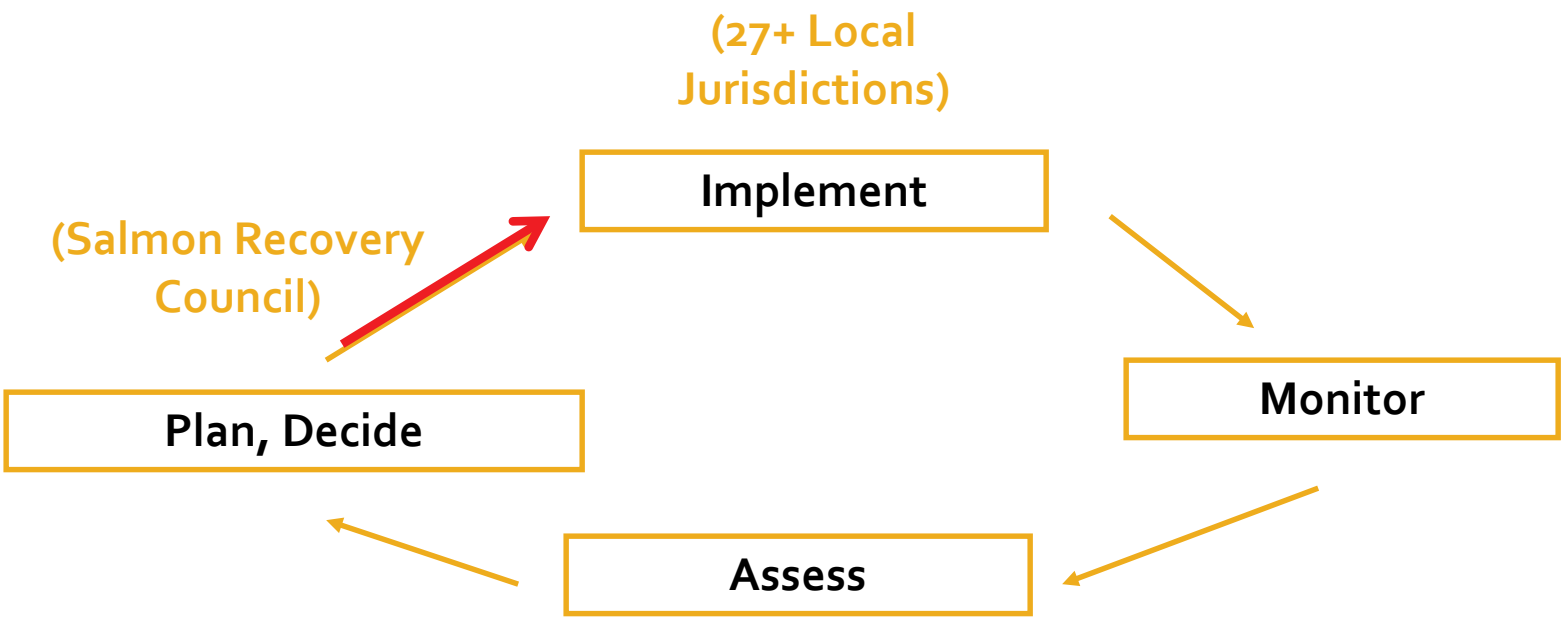
% Impervious
Population/km^2
% Patch (**PPA**)
Densiometer
% Human **Disturb**.
% Native Fish spp. (**PNS**)
% Sands+Fines
Wood count
Vertical **R**esidual **P**ool **A**rea
% Small core (**PSC**)
Fish IBI
% Large Core **(PLC**)
% **Perf**orated
% Forest
BIBI (100 scale)

Plot numbers = increasing order (population per km^2)




LAKE WASHINGTON CEDAR SAMMAMISH WATERSHED
EVERETT
MUKILTEO
MILL CREEK
LYNNWOOD
EDMONDS
BRIER
WOODWAY
MOUNTLAKE TERRACE
SNOHOMISH COUNTY
KING COUNTY
BOTHELL
LAKE FOREST PARK
KENMORE
SHORELINE
WOODINVILLE
KIRKLAND
REDMOND
SEATTLE
YARROW POINT
HUNTS POINT
CLYDE HILL
BELLEVUE
MEDINA
BEAUX ARTS
MERCER ISLAND
SAMMAMISH
ISSAQUAH
NEWCASTLE
RENTON
MAPLE VALLEY
Lake Washington
Lake Sammamish
Issaquah Creek
Cedar River Reservoir
Sammamish River current population of Chinook
Cedar River current population of Chinook salmon
Tier 1
Tier 2
Tier 3
Migratory/Rearing Corridors used by one or more Chinook populations (Tier 1)
WRIA 8 Boundary
Historic Chinook Distribution
0
2
4 Miles
November 2010

Adaptive Management



Establish baseline

Re-assess

Adaptive Management

10 -Year Review (2015)

- Are we doing what we said we'd do?
- Are actions having the predicted effects?
- Interlocal Agreement renewal
- Recovery Plan update
- Recommendations to leadership
- Corrective actions

Adaptive Management:
Special challenges and caveats

Each jurisdiction has its own local priorities and schedules concerning…

- Land use and critical areas planning
- Shoreline planning updates
- Capital improvement programs
- Local needs (urban, rural)
- Election cycles
- Special interests
- Etc…

Thank You

- U.S. Environmental Protection Agency
- WRIA 8 Salmon Recovery Council & Partners
- King County Dept. of Natural Resources and Parks
- Washington Department of Fish and Wildlife
- Washington Department of Ecology

scott.stolnack@kingcounty.gov