



Western Washington University
Western CEDAR

Salish Sea Ecosystem Conference

2014 Salish Sea Ecosystem Conference
(Seattle, Wash.)

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

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<https://cedar.wwu.edu/ssec/2014ssec/Day2/123>

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Monitoring for Adaptive Management

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



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Dan Lantz
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King County

Roger Tabor
US Fish and Wildlife Service

May 1, 2014



Water Resource Inventory Area (WRIA) 8

Lake Washington/ Cedar/ Sammamish Watershed

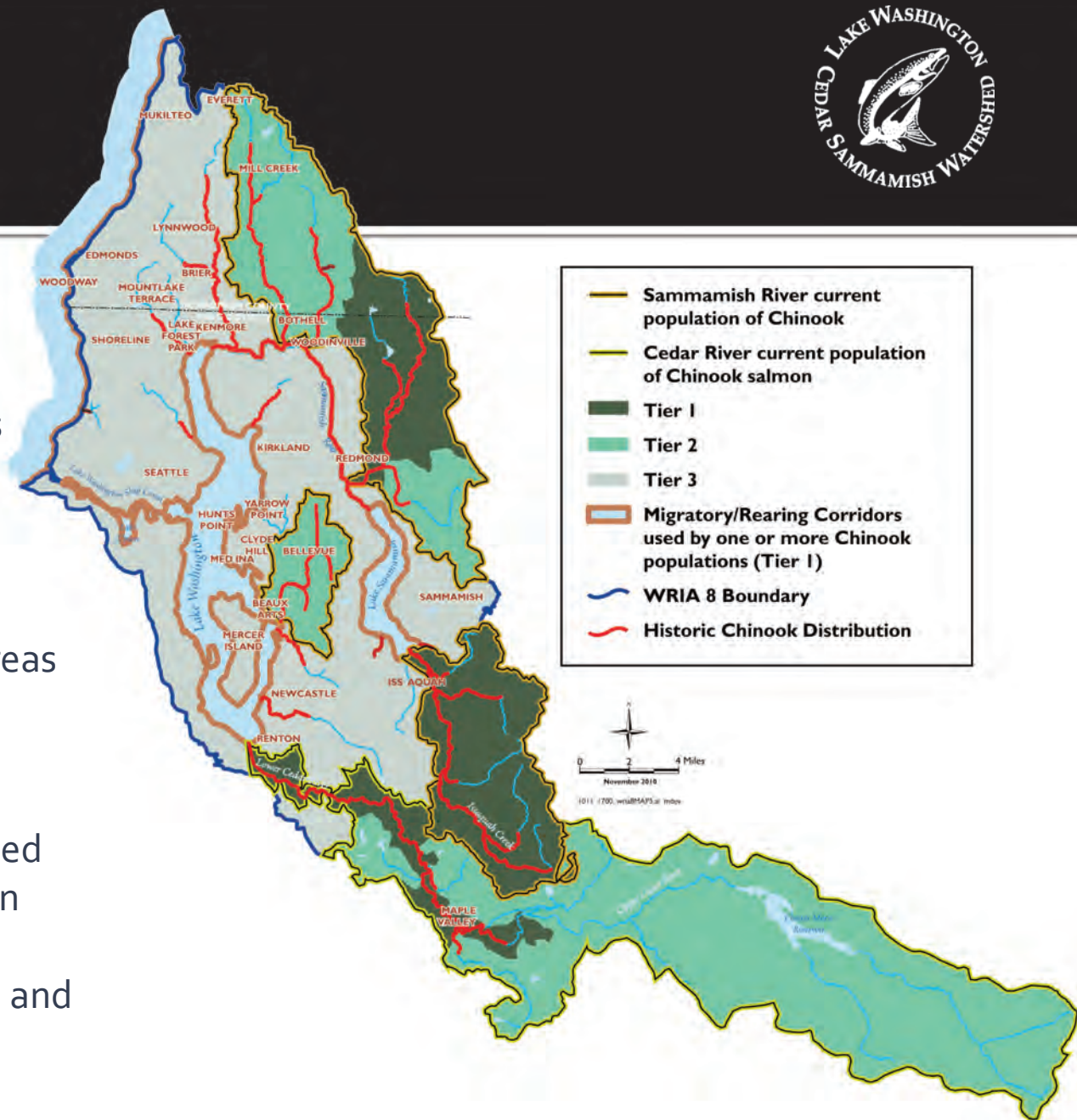
- 1.4 million inhabitants
- Most highly developed watershed in the state



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



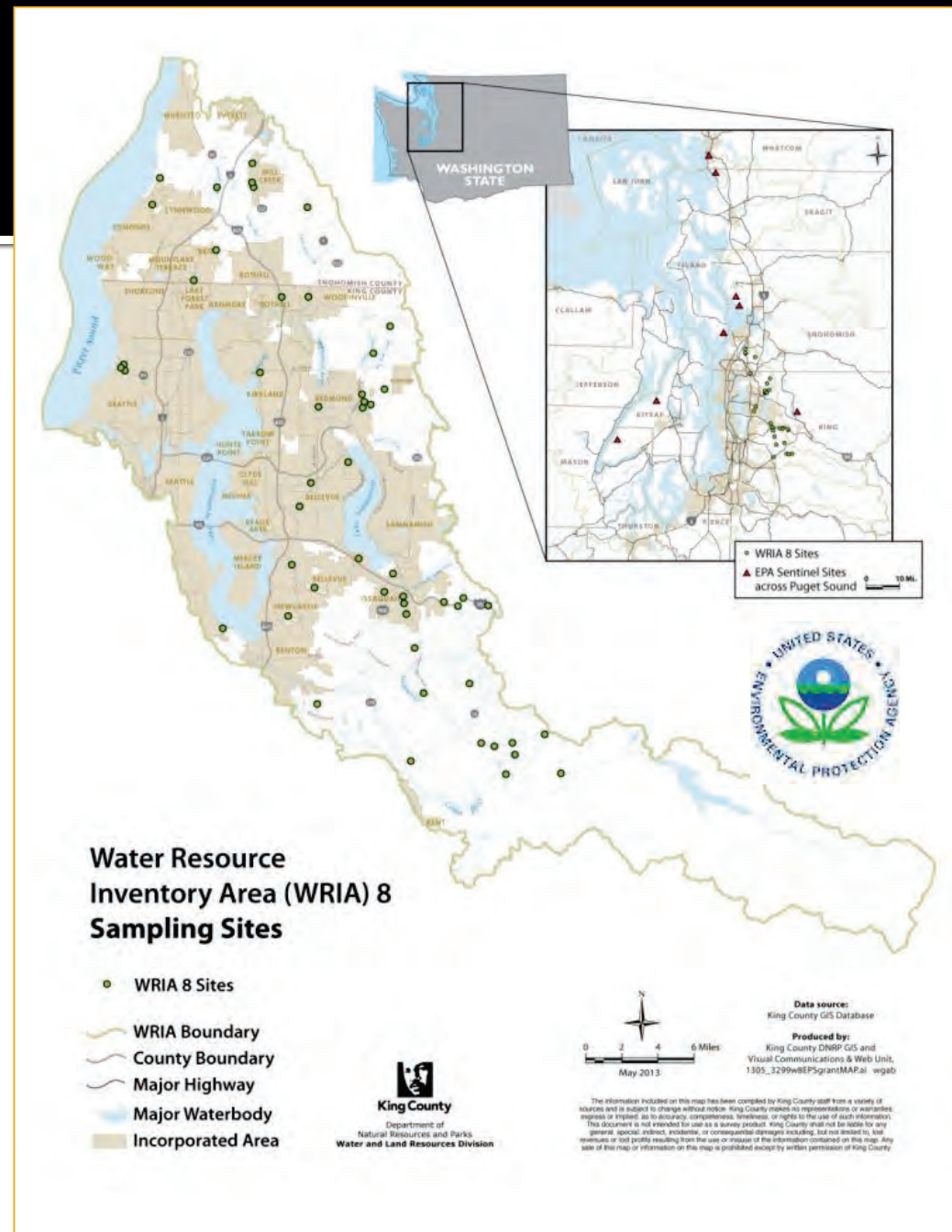
- Chinook Salmon (VSP)
 - (Fish in/fish out monitoring)

- 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



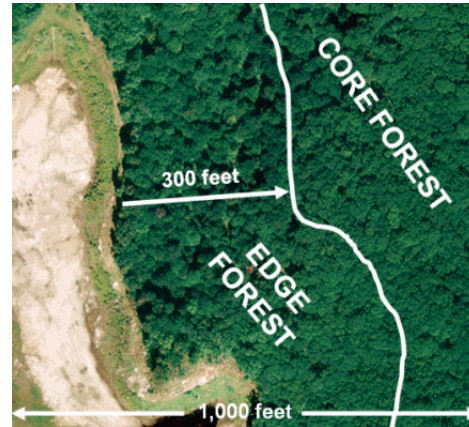
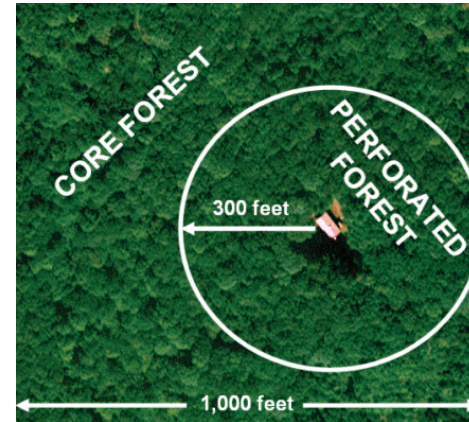
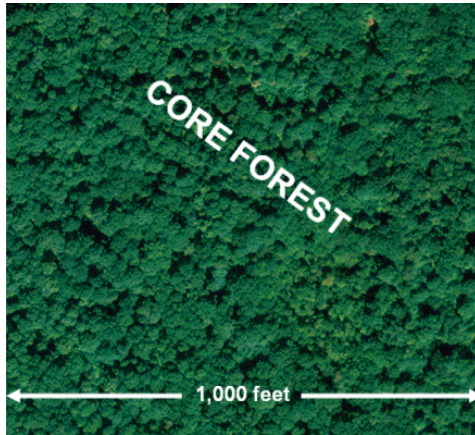
Metrics:

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/KM², elevation, forest fragmentation, etc.

Fragmentation Metrics



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

Database



Lake Washington/Cedar/Sammamish (WRIA 8) Watershed Wadeable Streams Status and Trends Monitoring Project

WRIA 8 - All Basins - All Creeks or Select one or more items for year

May Creek gauge (pick one): 37a 37b Lyon Creek gauge (pick one)

Statistics for hydrologic data is from year 2009 to year 2013 (other options available) (data statistics only)

Maximum days allowed in missing data to report hydrologic data

BIBI option:
 Traditional approach (10-50) New BIBI method (0-100), taxonomic resolution is coarse

Stream Benthos: Select one or more items Clear

Fish: Select one or more items Clear

Habitat: Analyzed volume per 100m of each size class, Percent substrate - Fine gravel and Clear

Hydrologic: Clear

Land Use: Forest fragmentation index - Edge, Forest fragmentation index - Large core, Forest fragmentation Clear

Temperature: selected: Maximum 7-day moving average of the daily maximum temperature July-August Clear

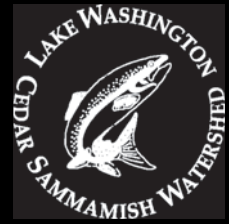
Clear Reaches Reset Dropdowns Get Hybrid (Hydrological statistics and raw other)

Average only Average, Count and SDEV Get Statistics Get Statistics for all Metrics (no need to select metrics)

All Genus Species Get Taxonomy

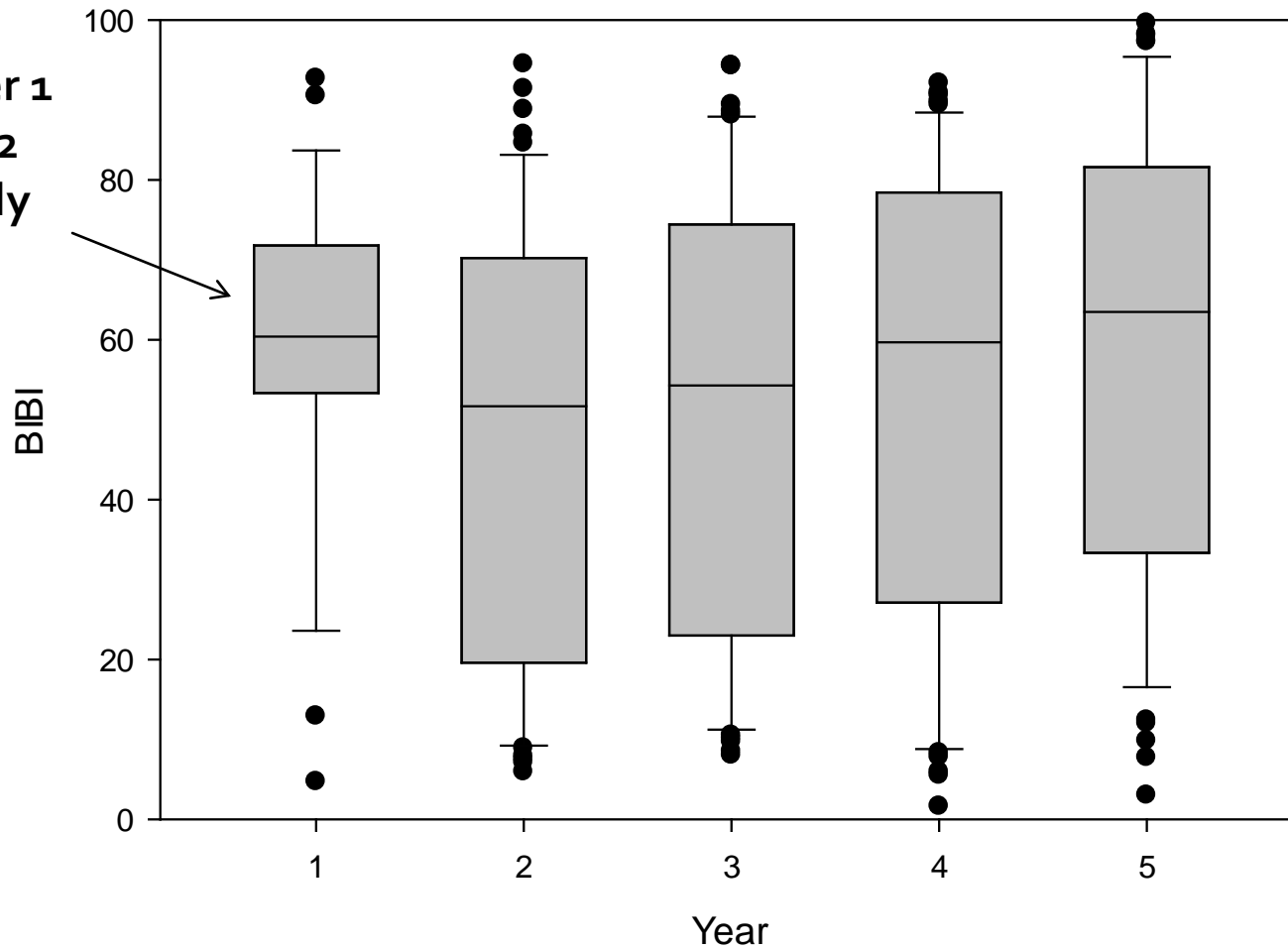
SOME ASSEMBLY REQUIRED

Descriptive Statistics

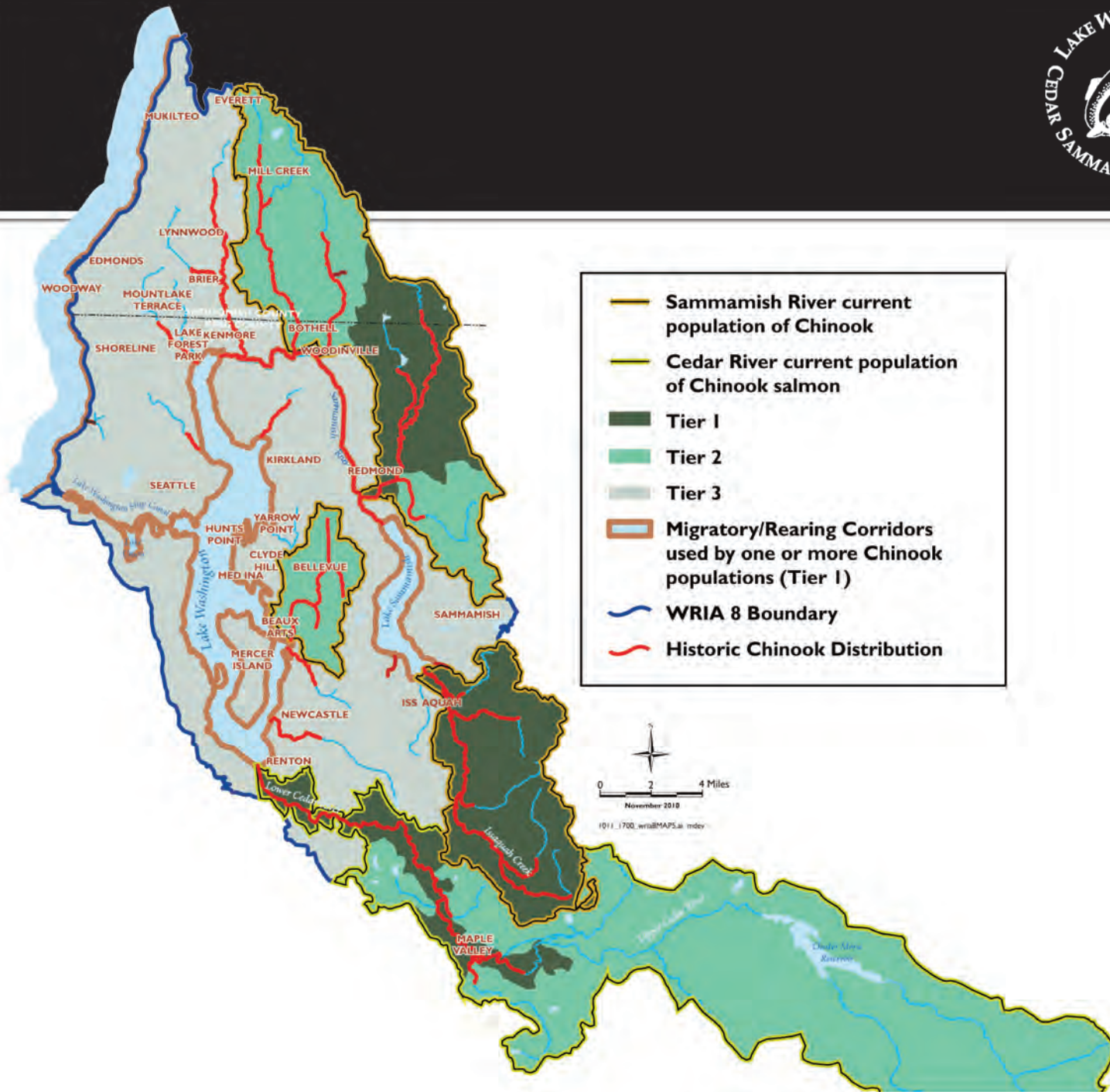


BIBI by Year

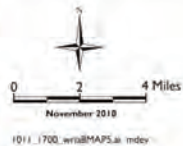
2009: Tier 1
and Tier 2
areas only
(n = 29)



2010-2013:
All Tiers
(n = 52)



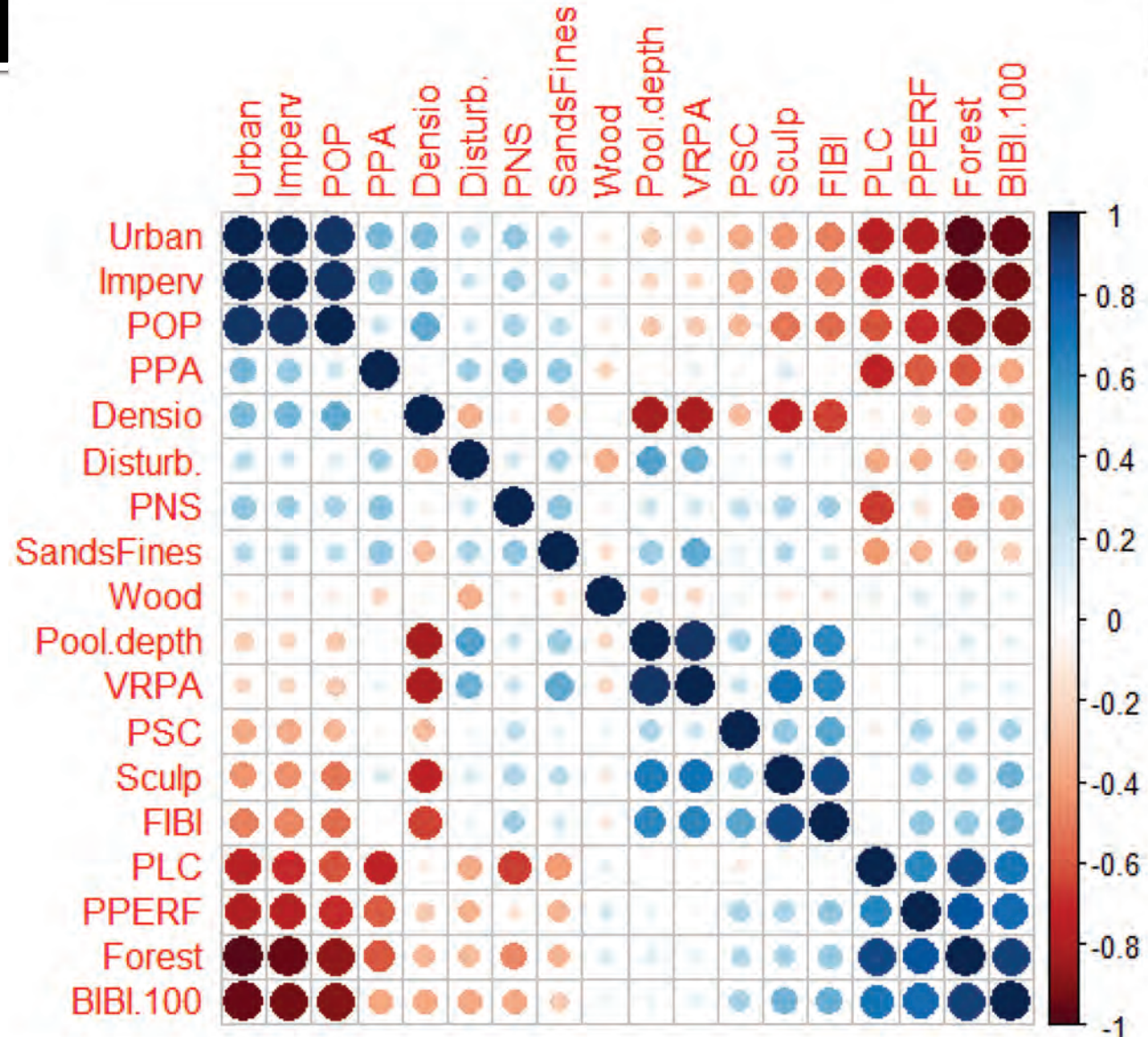
- Sammamish River current population of Chinook
- Cedar River current population of Chinook salmon
- Tier 1
- Tier 2
- Tier 3
- Migratory/Rearing Corridors used by one or more Chinook populations (Tier 1)
- WRIA 8 Boundary
- Historic Chinook Distribution



Correlations Matrix



- % Urban
- % Impervious
- Population/km²
- % Patch (PPA)
- Densiometer
- % Human Disturb.
- % Native Fish spp. (PNS)
- % Sands+Fines
- Wood count
- Avg pool depth
- Vertical Residual Pool Area**
- % Small core (PSC)
- Sculpin count
- Fish IBI
- % Large Core (PLC)
- % Perforated
- % Forest
- BIBI (100 scale)



Multivariate Approaches

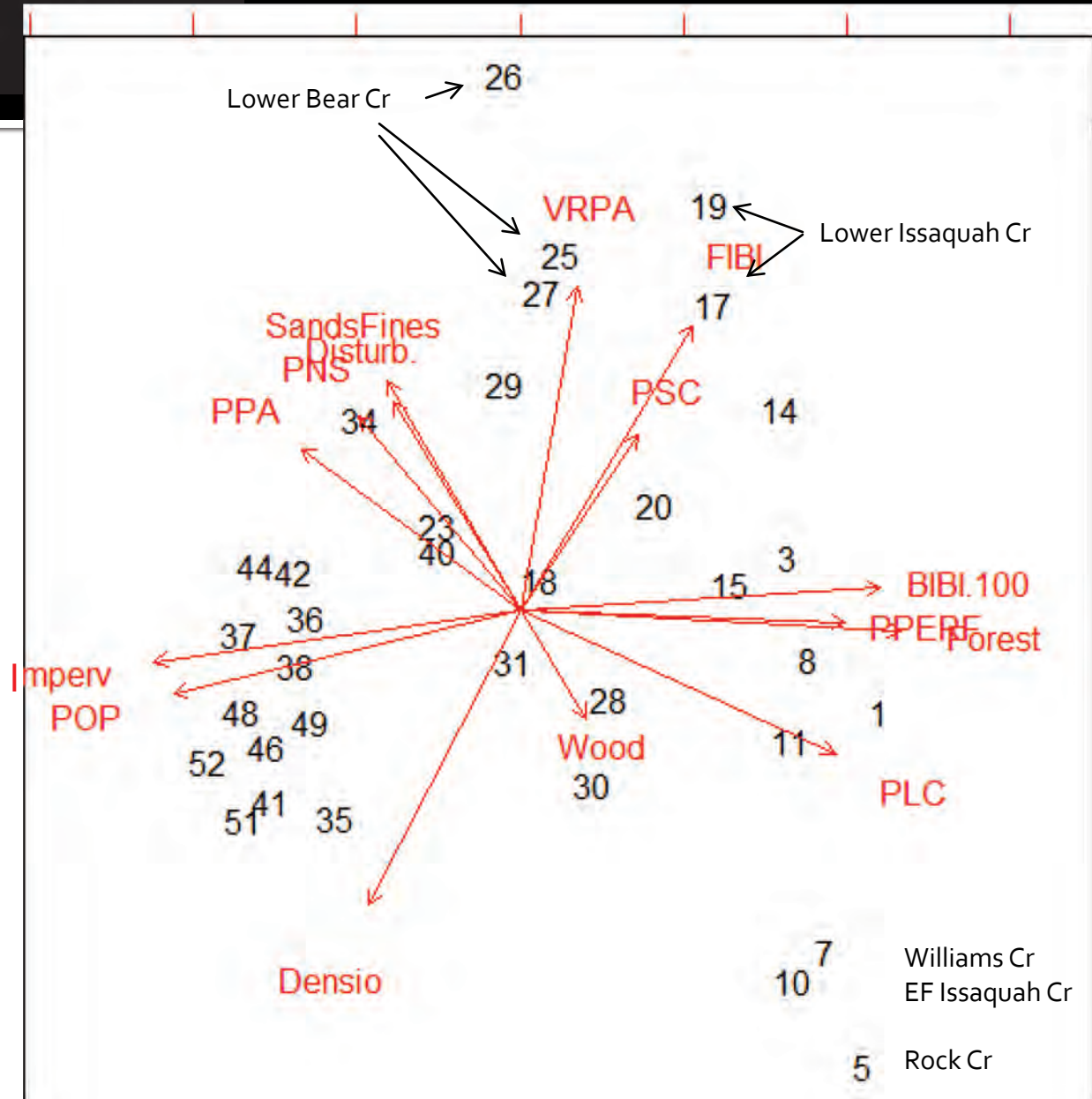


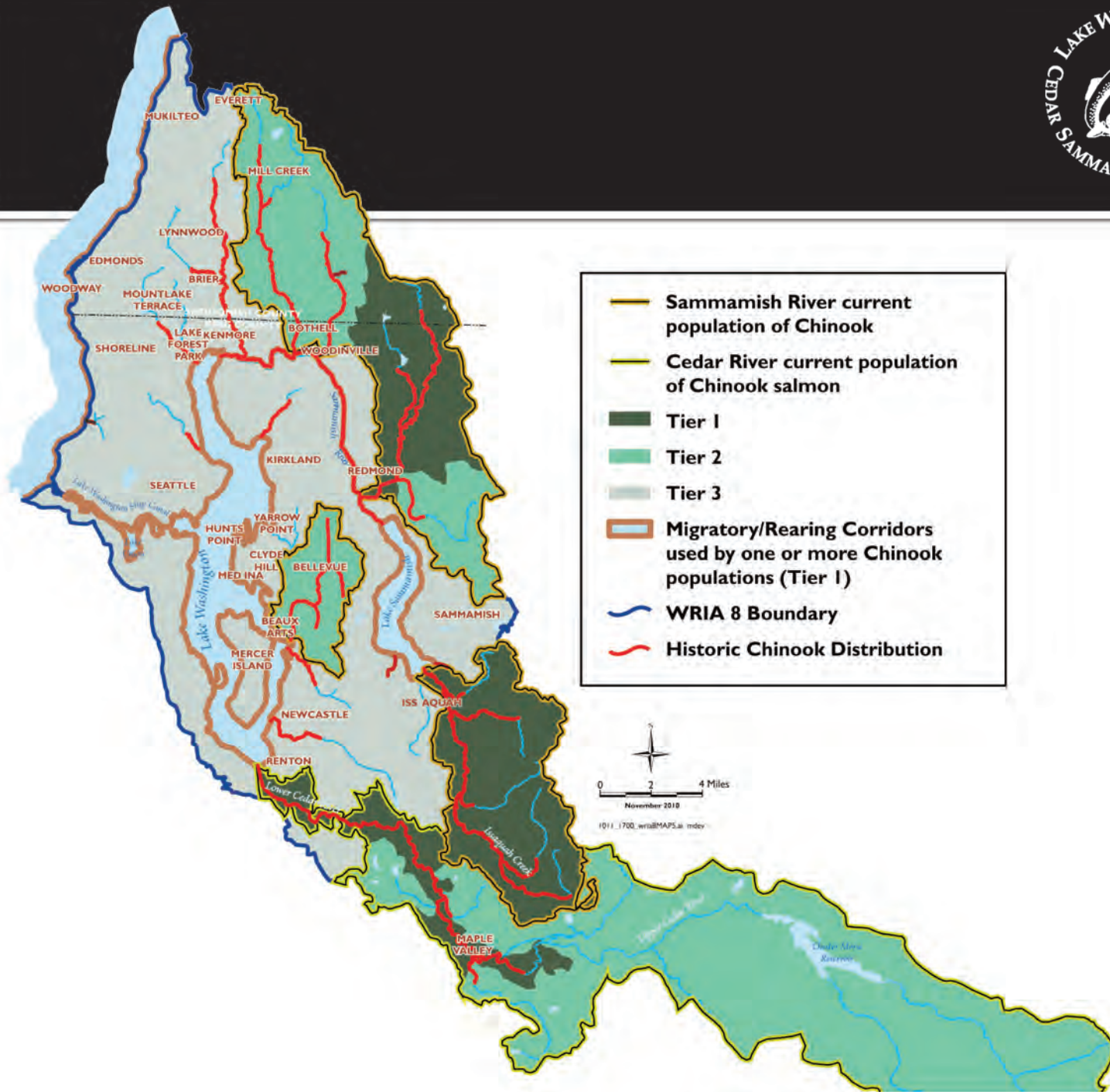
- Principal Components Analysis
- Nonmetric Multidimensional Scaling
- Logistic Regression

Principal Components Analysis

- % Impervious
- Population/km²
- % Patch (PPA)
- Densiometer**
- % Human **Disturb.**
- % Native Fish spp. (PNS)
- % Sands+Fines
- Wood** count
- Vertical Residual Pool Area**
- % Small core (PSC)
- Fish IBI
- % Large Core (PLC)
- % **Perforated**
- % Forest
- BIBI (100 scale)

Plot numbers = increasing order (population per km²)

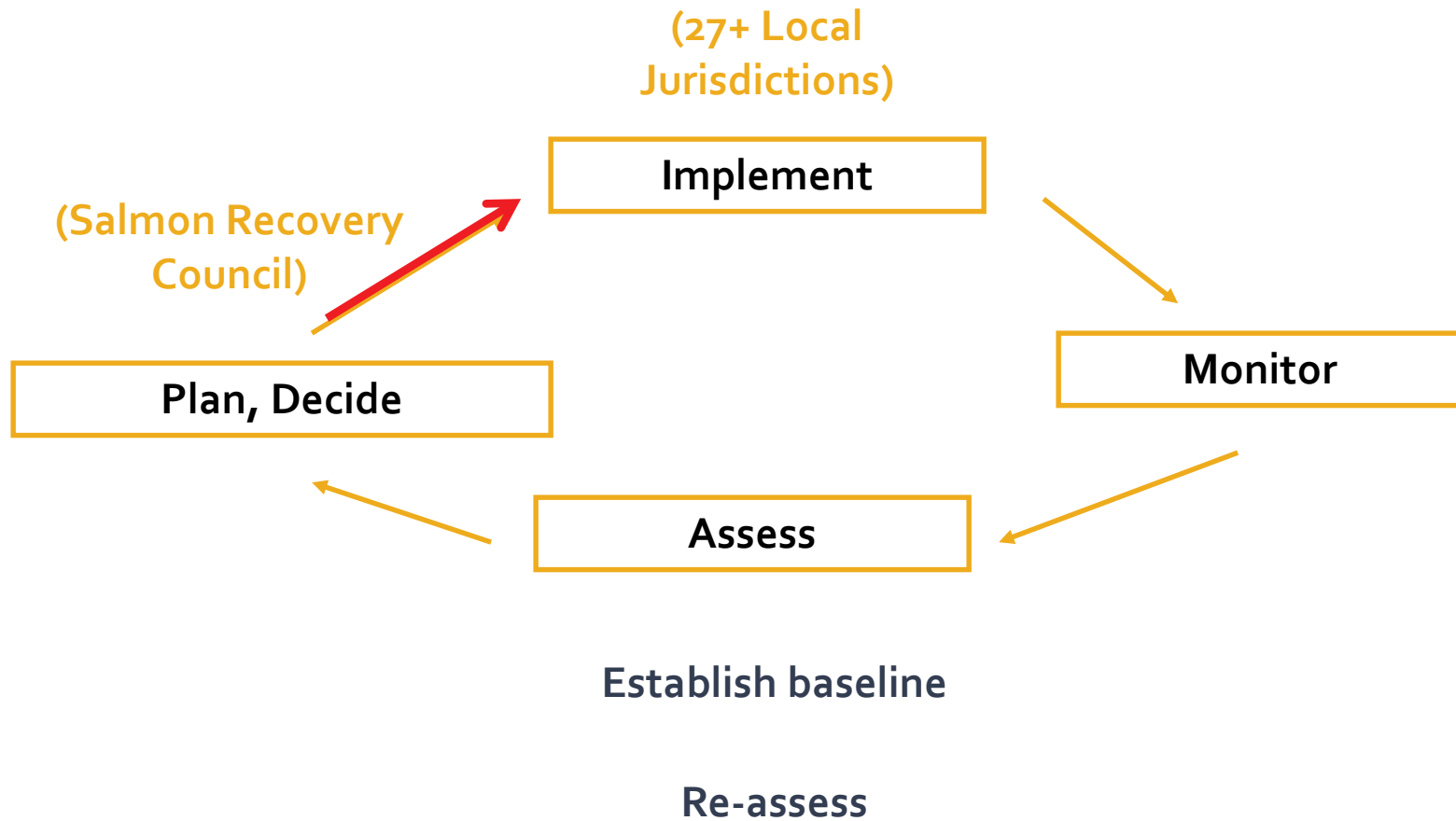
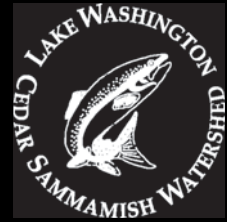




- Sammamish River current population of Chinook
- Cedar River current population of Chinook salmon
- Tier 1
- Tier 2
- Tier 3
- ▭ Migratory/Rearing Corridors used by one or more Chinook populations (Tier 1)
- WRIA 8 Boundary
- Historic Chinook Distribution

0 2 4 Miles
November 2010
1011_1700_wria8MAPS.mxd

Adaptive Management



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

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