Lower Columbia Estuary Partnership

Habitat Coverage Targets for the Lower Columbia River - How Much is Enough?

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Ecosystem-Based Management

Requires these conditions (UNEP 2006):

- **holistic vision/plan** - comprehensive description of system, articulation of management objectives
- **community** - effective engagement of policy makers, managers, stakeholders, scientists
- **foundation** - legal framework, management institutions, financial resources, effective communications
- **process** - effective adaptive management

1) Define Vision for the lower Columbia

- **CCMP Vision -**
  - *Integrated, resilient, and diverse biological communities are restored and maintained*
  - *Habitat supports self-sustaining populations of plants, fish and wildlife*

- **Restoring the *biological integrity* of the lower Columbia and estuary is the ultimate goal of the Estuary Program**

1) Define Vision for the lower Columbia

What is Biological Integrity?

- **USEPA definition -** the ability of an aquatic ecosystem to support a **balanced, integrated, adaptive community of organisms** having a **species composition, diversity, and functional organization** that is **comparable to natural habitat** in the region

  (Karr and Dudley 1981; Frey 1977)

➢ How do we Measure Biological Integrity?

Biological Condition Gradient (USEPA: Davies and Jackson 2006)

- Similar to Index of Biological Integrity (Karr 1981)
- Used in freshwater streams; USEPA adapting it to estuaries
- ***Science Community identifies key ecosystem attributes -***
  a. **Natural Habitat Diversity, Historical Habitat Mosaic**
  b. **Focal Species**
  c. **Water Quality**
  d. **Ecosystem Processes**
  - *then defines "minimally disturbed" and series of threshold conditions along trajectory of increasing stressors for each attribute*

a. Natural Habitat Diversity, Historic Habitat Mosaic Attribute

- **Integral for other attributes (e.g., focal species)**
  - Native species evolved with historic habitat conditions; restoring to those conditions should be protective of those native species
- **Completed Habitat Change Analysis comparing 1870s habitat coverage to 2010**
  - Historic habitat coverage is proxy for natural habitat diversity
  - Identify significant losses and types
  - Protect remaining intact habitats; recover lost habitats in areas where practical

a. Natural Habitat Diversity, Historic Habitat Mosaic Attribute

– Forested
– Non-tidal and tidal forested wetlands
– Herbaceous
– Non-tidal and tidal herbaceous wetlands
– Shrub scrub
– Non-tidal shrub scrub
– Tidal shrub scrub
– Tidal flats
– *Deep water*
– *Other (bare ground)*
– *Aquatic areas that support life stages:*
  - *Spawning habitats*
  - *Cold water refugia*
  - *Rearing habitats*
  - *Shallow, slow velocity*
– Site or landscape specific mosaic, gradient along channel/slough; channel complexity, elevation gradient; description of this per reach;
– Landscape metrics, patch size, across lower river, averages

Priority habitats to protect

Habitat	Relevant Reaches
Tidal herbaceous wetlands	A – E, G
Tidal wooded wetland	A - D
Forested	A, D - G
Herbaceous	D - G
Shrub scrub	E, F
Non-tidal herbaceous wetland	F
Non-tidal wooded wetland	H

See Estuary Partnership 2012 for details
http://www.estuarypartnership.org/habitat-restoration-strategy

b. Focal Species Attribute

Focal Species

- Chinook, chum steelhead, coho
- Pacific lamprey
- Green and white sturgeon
- Bald eagle
- Columbia White-tailed deer

Ecologically Significant

- N. Pikeminnow
- Shad
- Eluachon
- Caspian tern
- Osprey
- Yellow warbler
- Red-eyed vireo
- Dusky Canada goose
- Sandhill crane
- River otter

***Focal Species and Other Indicator Species Identified through NPCC Sub-basin Plan (2004)**

c. Water Quality Attribute

- **Key indicators:**
  - water temperature, dissolved oxygen, dissolved gas, pH, primary productivity, toxic contaminants, pathogens

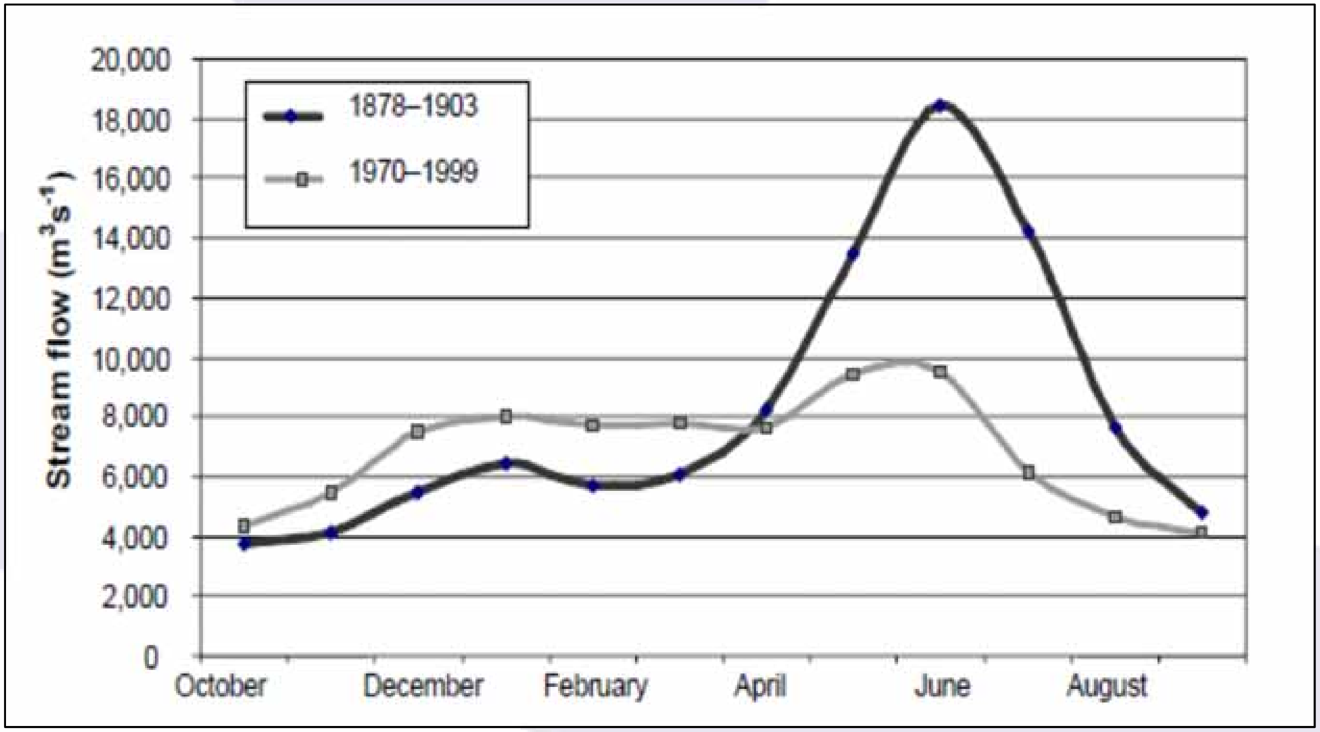
- **Two efforts:**

1. **Compiled all toxic contaminant data** (sediments, water column, organisms) **through 2010 into central database, available to partners**
   - Analyzed for descriptive analyses and potential "hot spots" by classes of contaminants
     - Metals (mercury, copper)
     - Legacy pesticides (DDx)
     - Current use pesticides (Chloropyrifos **)**
     - PBDEs (indicator of human disturbance)
     - PAHs
     - PCBs
   - Deliverables include report, maps, tables, figures and database
     - contaminant distribution maps with locations above risk based screening thresholds noted
     - concentration vs river mile plots
2. **Collaboration with Yakama Nation on contaminant clean up site prioritization**
   - Database and maps of all known sites, prioritized by number of factors (proximity near waterbody, proximity to natural areas)

d. Ecosystem Processes Attribute

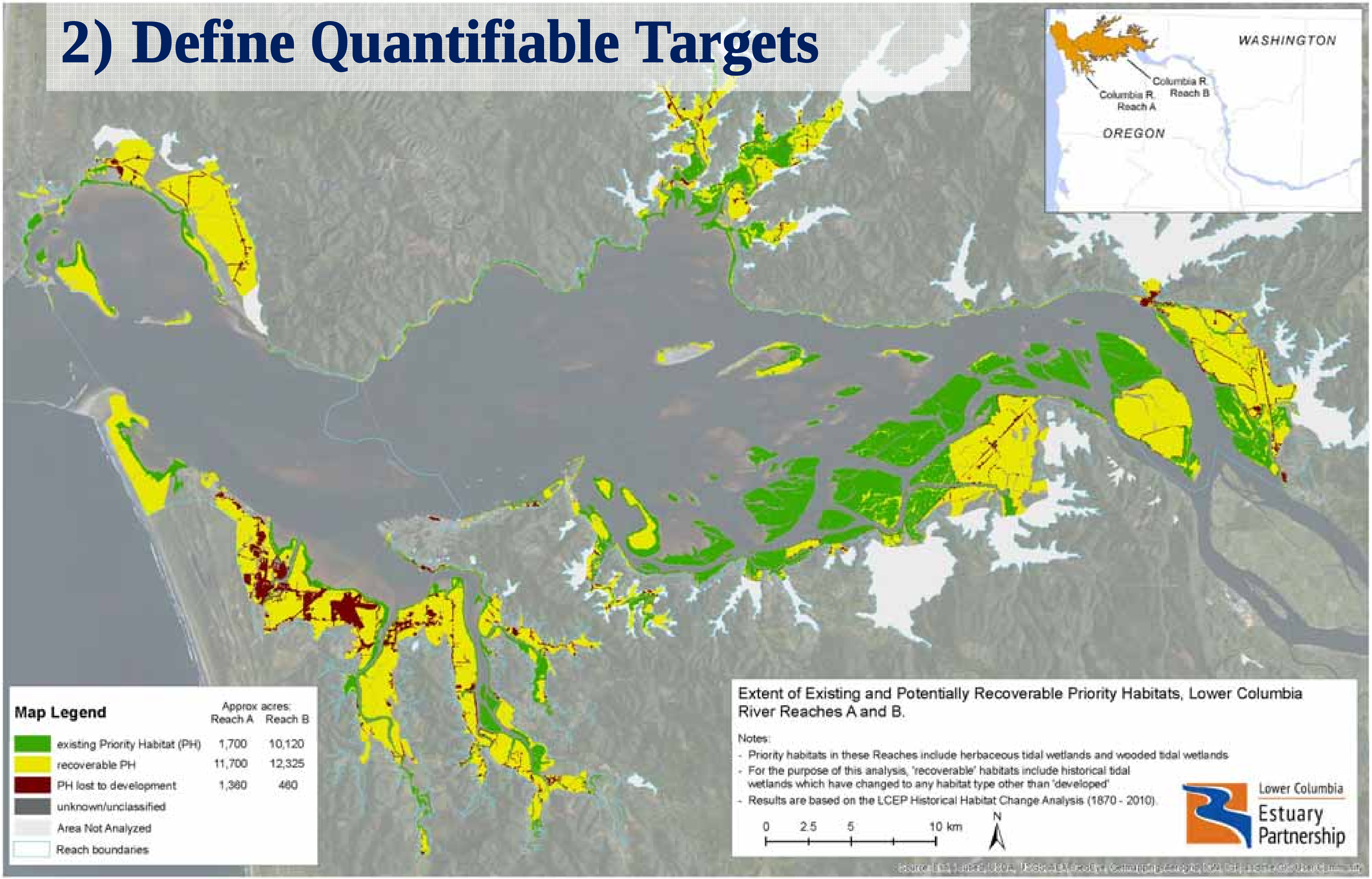
- **Natural Hydrologic Processes and Sediment Dynamics**
- **Natural Food Web and Trophic Processes**
- **Natural Habitats and Habitat Forming Processes**

➢ Natural annual hydrograph, flooding of floodplain habitats is fundamental for natural ecosystem processes



Changes in the annual Columbia River flow at Beaver Army Terminal, 1878–1903 vs. 1970–1999. (from Bottom et al. 2005.)

2) Define Quantifiable Targets



Application of Lines of Evidence 1 – Priority Habitats for Recovering Habitat Diversity

Available from website: http://www.estuarypartnership.org/historical-habitat-change

➢ Restoration Prioritization Strategy identifies priority geographic areas for protection and restoration

Multiple lines of evidence approach:

1. **Historic vs. current habitat coverage change analysis *(complete)***
   - Historic habitat coverage is proxy for natural habitat diversity
   - Identify significant losses and protect remaining intact habitats
2. **Juvenile salmonid Habitat Suitability Index model *(complete)***
   - Identify locations in mainstem of optimum water velocities, temperature, and depth, adapting regional criteria, employing OHSU SELFE model results
3. **Priority tributaries in OR and WA Salmonid Recovery Plans *(complete)***
   - Tidal reaches of tributaries priority for chum and fall/late fall Chinook (subyearling life history strategy that rear extensively in tidal areas); weighted system on mainstem based on Skagit data
4. **Columbia White-tailed deer habitat (USFWS) (*draft*)**
5. **Habitats Priority for Pacific Flyway (USFWS) (*planned*)**
6. **Priority Toxic Contaminant Clean up sites (Yakama Nation) (*draft*)**
7. **Sea level rise and inland migration of wetlands (*planned*)**

***See Estuary Partnership 2012 for details*

http://www.estuarypartnership.org/habitat-restoration-strategy

Quantifiable Targets - Pros

- **Communication tool for stakeholders - clearly articulates program goals**
  - The more clear and well defined your goals, the better for clearly defining a restoration and research strategy to reach goals
    - *Example* - X acres of A Habitat in Reach Z; Y acres of B Habitat in Reach B allows us to measure progress, makes clear what is missing, what is remaining to do)
- **Allows program to compete with other goals that have powerful influence on public policy - focuses efforts**
  - Clearly articulated goals allows programs to stay on track; keeps you from reacting to issue du jour; allows you to say “no” to Y research/restoration project if X research/restoration is more in line with filling gaps to reach target

Quantifiable Targets - Pros

- **Allows program to compete with other goals that have powerful influence on public policy - focuses efforts**
  - In competitive political arenas, weak goals can be costly to achieving biodiversity conservation
- **Quantitative method for reporting progress, such as report cards, assigning scores; reduces subjectivity**
- **Meets performance measures requirements of:**
  - GPRA, EPA's Biological Condition Gradient (BCG), USFWS Comprehensive Conservation Plan (CCP) for National Wildlife Refuges, EPA's Tiered Aquatic Life Uses (TALU) and an Index of Biological Integrity (IBI)

Quantifiable Targets - Cons

- **Lot of work!!**
- **Consensus is key for regional support and implementation**
  - Lack of ***robust*** scientific rationale can make targets seem arbitrary by stakeholders, which makes consensus difficult
  - Scientific rationale can be: 1) historic conditions at a specific time period, 2) reference conditions, 3) resource-based (species requirements) or 4) regulatory threshold (e.g., water quality criteria)
- **Picking the right number**
  - If target is not viewed as protective (high) enough, the program will be viewed as not sufficiently protective of resources, and will be faced with increasing the number too early on (after targets are met)
  - If the number is too high, the program can look unrealistic and out of touch

- **Are we done when we reach our target?**
  - Careful how we communicate goals

Methods for Setting Measureable Targets

- **Historic conditions -** 1870, 2010 or somewhere in between if data exist for entire lower Columbia (e.g., Tampa Bay 1950s habitats)
- **Reference site conditions -** analogous river system to the Columbia?
- **Regulatory threshold -** e.g., water quality "not-to-exceed" thresholds
- **Resource –based -** Three Overarching Approaches:

1. **Single species** - identify population goals (e.g., minimum viable population, population viability analyses), then identify habitat needs to meet population goals as basis for targets
2. **Multiple Species -** similar to #1, but identify focal or target species, population targets, habitat needs
3. **Ecosystems** - protect percentage of historic habitat extent and if sufficient will be protective of species using those habitats
   - 12% on national scale (WCED 1987); 10% (IUCN 1993)
   - 30% – 42% based on evidence-based approaches (e.g., species-area curves [MacArthur and Wilson 1967])

Principles for Credible Targets

- **Separate science from feasibility**
  - Targets should be ecologically based and insulated from political or social pressures
  - Science alone should drive the target setting
  - Once targets are set, feasibility may be considered to evaluate likelihood of achieving stated targets
- **Follow scientific method**
  - Follow transparent process that can be challenged or refuted by evidence
  - Assumptions should be clearly documented
  - Uncertainties should be explained, documented
  - Subjected to peer review
- **Anticipate change**
  - Incorporate scientific monitoring and research to reduce key uncertainties
  - If new knowledge indicates the targets will not meet overall vision, goals of program, adaptively manage

Adapted from Tear et al. 2005

Standards for Credible Targets

1. **Use best available science**
   – Underlying reasoning is scientifically valid
   – Theory or technique can be (or has been) tested
   – Subjected to peer review and publication
   – Known or potential error rate and existence of standards
   – Attracted widespread acceptance within relevant scientific community
2. **Evaluate multiple alternatives**
3. **Set targets for short (1-25 years) and long time periods**
   – Population viability analyses often use 95% probability of persistence to >100 years
4. **Incorporate "three R's":**
   - **Representation** – capturing some of everything
   - **Redundancy** – reduce level of risk of losing representative components of targets
   - **Resilience** – refers to condition, quality of component, refers to ability to persist through disturbances
5. **Evaluate errors and uncertainties**

Adapted from Tear et al. 2005

Example: The Nature Conservancy

- **Also National Wildlife Refuges explored this same approach**
- **Coarse-filter/fine-filter approach** – conserving full array of natural habitats will adequately support the vast majority of species
  - Coarse filter –representation of all native ecosystem types and communities
  - Fine filter – add areas for rare and vulnerable species that are inadequately represented by coarse filter
- For *resiliency*, minimum size criterion for each ecosystem type
- For *representation* and *redundancy*, target number of occurrences for each ecosystem type, stratified by region
- Overall target of 30% of an ecosystem type's historic extent (1850s)
  - Based on mathematical relationship between habitat area and the number of species an area can support or "species-area curve" (MacArthur and Wilson 1967)
  - Researchers evaluated 10% and 30% of each ecosystem's historic extent to determine if protective of ecoregion's more common species
  - Chose 30% - 1) additional habitat exist outside reserve network; 2) species and communities tend to occur across multiple ecoregions; 3) published thresholds generally suggest # of discrete locations where common species occur ranging from 10 - >80 rangewide

From Tear et al. 2005

DRAFT Targets

- **No net loss of native habitats (2009 baseline; 114,050 acres lost since 1870)**
- **Recover 30% of historic extent for priority habitats by 2030; 40% of historic extent by 2050**
  - *Representation* of types, communities ("coarse filter")
  - *Representation* of rare, vulnerable types, communities ("fine filter")
  - Ensure many examples of types, communities in each region for *redundancy*
  - Restore quality, condition of habitats - *resiliency* of types, communities to persist through disturbance
- **Other aspects:**
  - Multiple large "reserves"
  - Smaller patches interspersed that fill gaps, ensure corridors, increase connectivity
    - *Identify minimum size criterion*
    - *Identify minimum number of occurrences of habitats by region*

Next Steps

- Identify minimum size criterion for larger “reserves” and small patches of habitats
  - Encourage implementation of anchor areas
- Identify minimum number of occurrences of habitats by region
- Identify gaps in habitats, key corridors
- Determine if these targets are protective of common species
  - ensure # discrete locations 10->80 for use by common species
- Have targets peer reviewed (e.g., ISRP)
- Track implementation of targets
- Monitor effectiveness of targets in reaching goal (i.e., *restoring biological integrity of lower Columbia*)

- *Develop targets for focal species attributes and revisit these targets to ensure they don’t conflict*


Comments?
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