



Lower Columbia  
Estuary  
Partnership

# **Lower Columbia River Ecosystem Restoration Program**

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**Science to Policy Summit**  
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# Ecosystem-Based Management (EBM)

Requires these conditions (UNEP 2006):

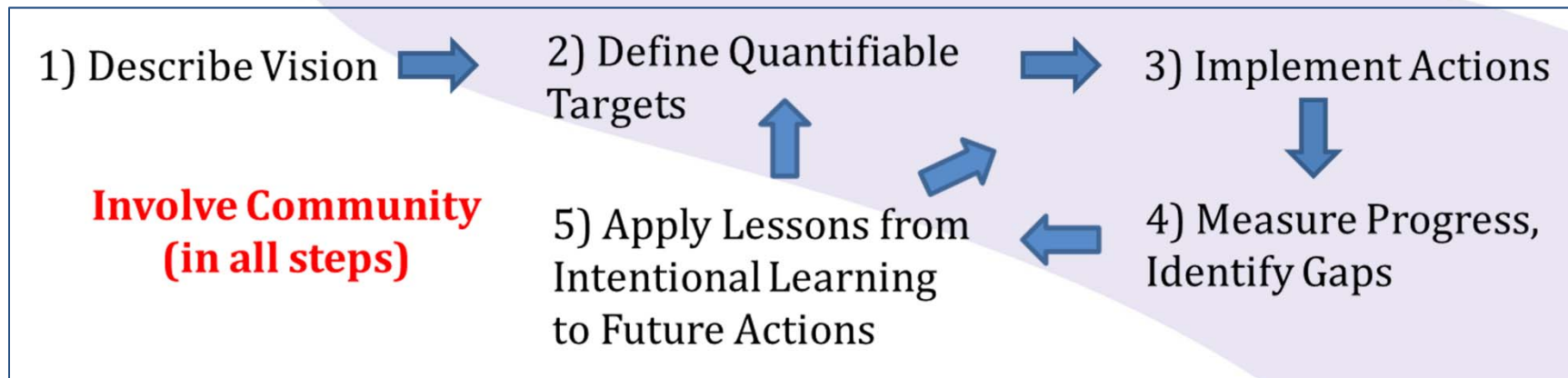
- **holistic vision/plan** - comprehensive description of system, articulation of management objectives
- **community** - effective engagement of policy makers, managers, stakeholders, scientists
- **foundation** - legal framework, management institutions, financial resources, effective communications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



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# 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 a primary 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



# 1) Define Vision for the lower Columbia

## 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**: e.g., Pacific salmonids, Col. White-tailed deer, Pacific Flyway species (NPCC 2004)
    - c. **Water Quality**
    - d. **Ecosystem Processes**





## **2) Define Quantifiable Targets**

### **a. Natural Habitat Diversity, Historic Habitat Mosaic**

- 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



## 2) Define Quantifiable Targets

### a. Natural Habitat Diversity, Historic Habitat Mosaic

- 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

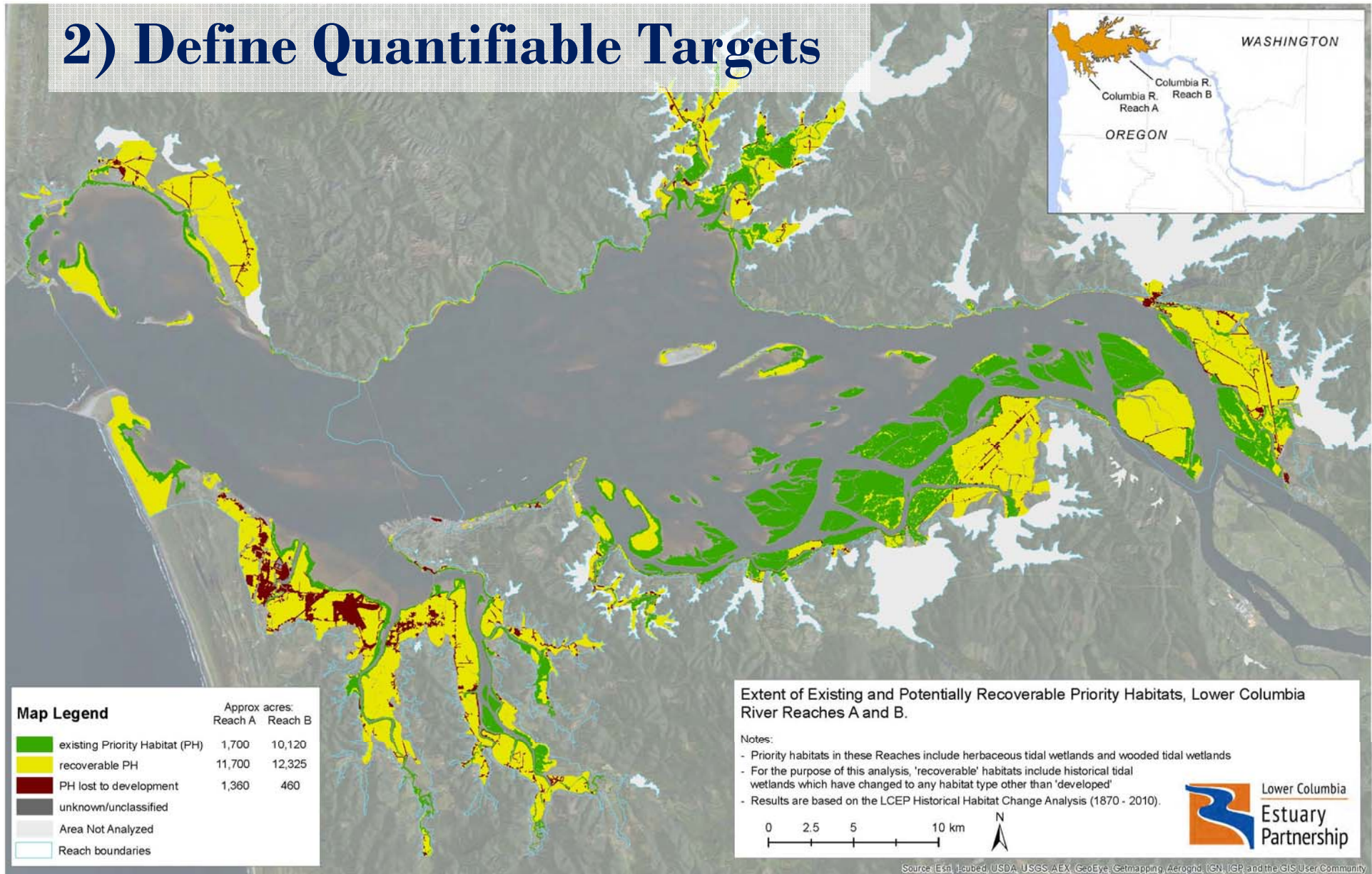
Habitat	Relevant Reaches
Tidal herbaceous wetlands	A – E, G
Tidal wooded wetland	A - D
Forested	A, D - G
Herbaceous	D - G
Shrub scrub	E, F
Non-tidal herbaceous wetland	F
Non-tidal wooded wetland	H

*\*See Estuary Partnership 2012 for details*

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



## 2) Define Quantifiable Targets



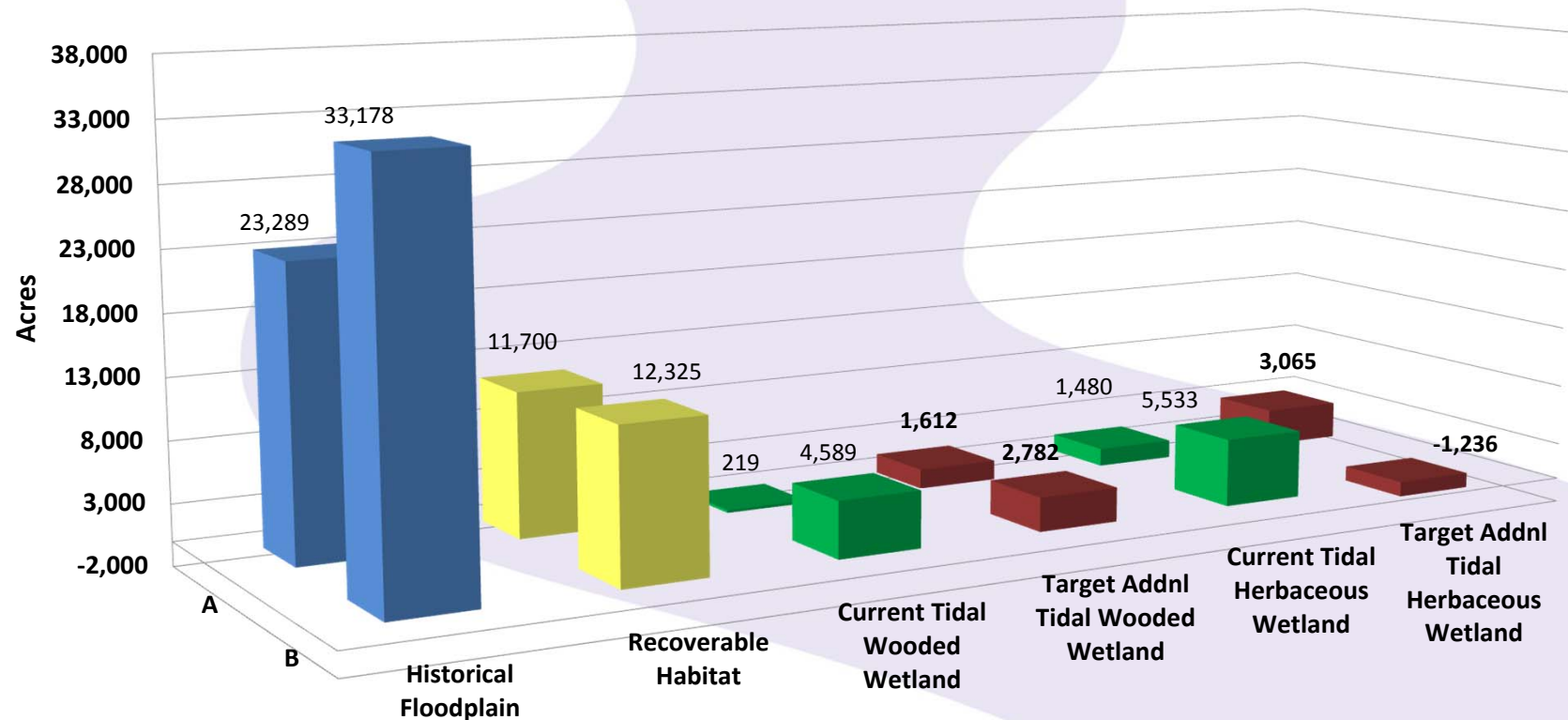
Application of Lines of Evidence 1 – Priority Habitats for Recovering Habitat Diversity

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

## 2) Define Quantifiable Targets

### a. Natural Habitat Diversity, Historic Habitat Mosaic

**Draft Targets** for Priority Habitats  
in Reaches A, B



➤ Need to integrate sea level rise and wetland migration inland

## 2) Define Quantifiable Targets

### – Targets for Identified Attributes:

#### b. Focal Species:

- **Pacific salmon -**
  - **Juvenile Pacific 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
  - **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
- **Columbia White-tailed deer habitat (USFWS) (*underway*)**
- **Pacific Flyway Habitats (PCJV, USFWS) (*planned*)**

#### c. Water Quality:

- **Priority Toxic Contaminant Clean up sites (Yakama Nation) (*underway*)**
- **Sea level rise and climate change (*planned*)**

– *\*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

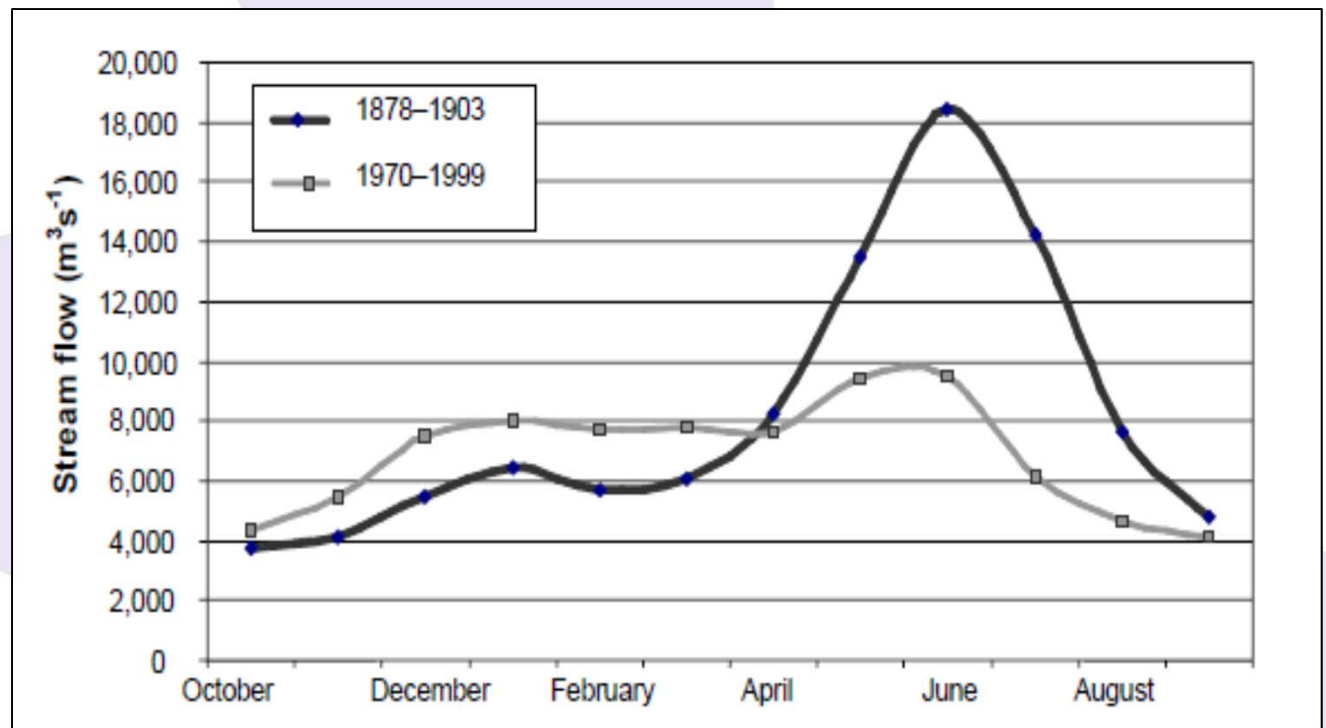


**\*Focal Species and Other Indicator Species Identified through NPCC Sub-basin Plan (2004)**

## 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.)

## Summary

### **What we think we can provide for Treaty negotiations over the next decade:**

- √ Vision for the lower Columbia over the long term
- √ Ecological attributes of importance for protection
  - Natural Habitat Diversity, Historic Habitat Mosaic
  - Focal species (e.g., P. salmonids, C. White-tailed deer)
  - Water Quality
  - Ecosystem Processes (e.g., more normative flows, floodplain inundation, sediment transport)
- Specific quantifiable and spatially explicit targets for attributes



# Considerations for the Treaty

## Climate change impacts:

- **Sea level rise**
- **Changing precipitation patterns –**
  - More precipitation falling as rain, lower snow packs in mountains
  - Higher winter flows, lower summer flows
  - Increased frequency, duration, magnitude of floodplain inundation
  - Altered timing and rates of change in flow events
  - More intense storms, increased wave energy, increased erosion
- **Changes in upwelling patterns off coast -**
  - Increased potential intrusion into estuary of hypoxia and acidification
- **Warmer water temperatures–**
  - Less habitat for cold water species

# Considerations for the Treaty

## Mitigating for Climate Change:

- To maintain floodplain wetlands extent, will need to **allow wetlands to migrate inland**
- **Strategic levee and dike modification** to allow inland migration and floodplain inundation by involving communities early
- Support **aquatic species ability to adapt** to changes in annual hydrograph?
  - Diversity of life history strategies important for resiliency of salmon species
  - Should we move up timing of juvenile salmon migration to avoid warmer summer water temperatures?
    - *How will this affect adult returns?*
  - Provide sufficient cold water refugia in tributaries to aid adult returns in summer?

**Questions?**

