Overview and Approaches to Ecosystem Restoration in the lower Columbia River and estuary

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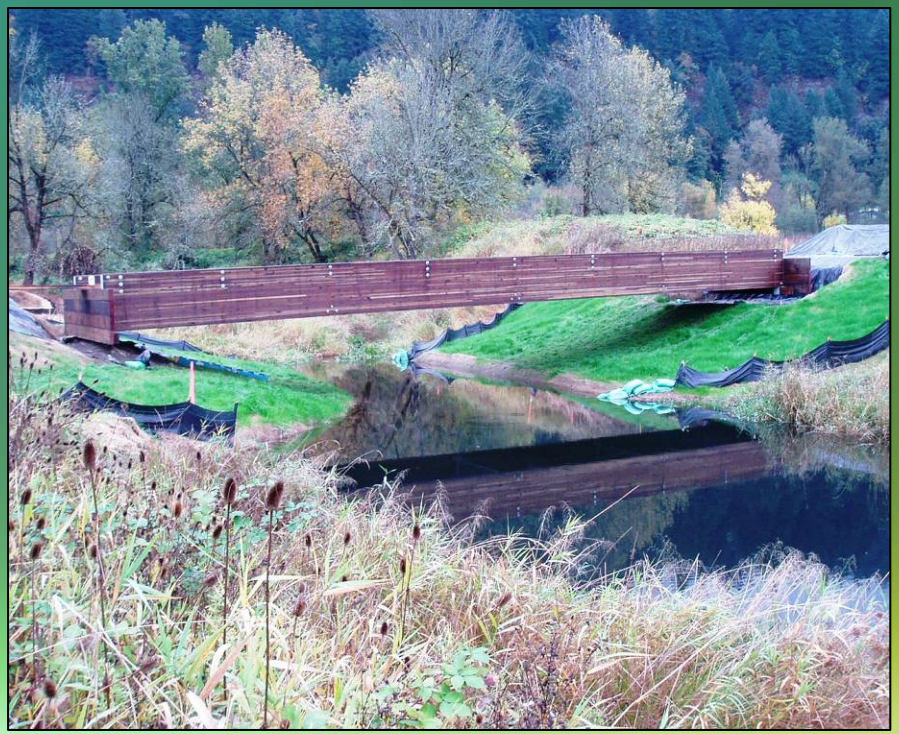
Habitat Loss

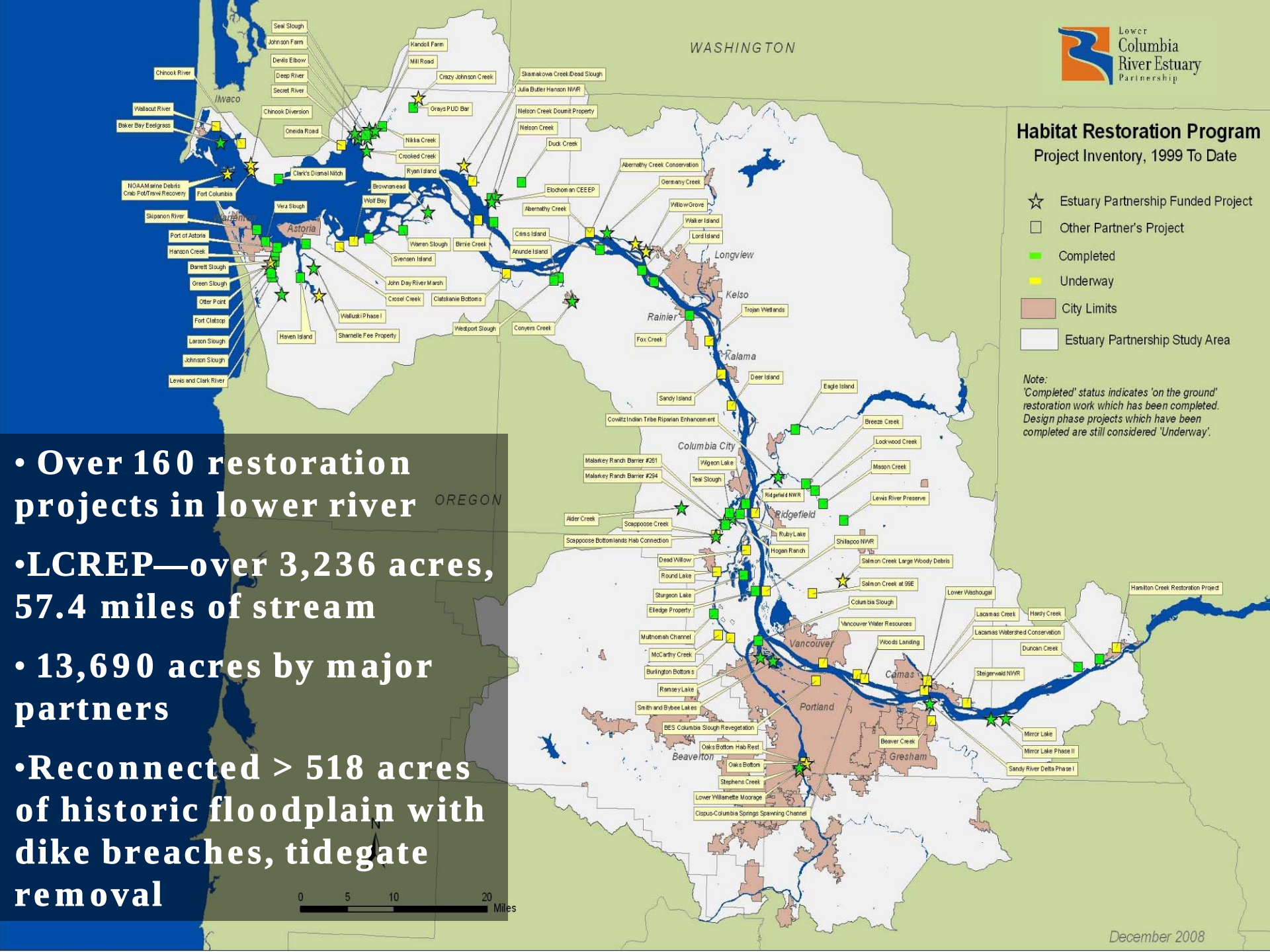
- Significant declines in emergent marsh and tidal swamp habitats
- Off-channel habitats cut off
- Reduction in flow, access to habitats
- Decreases in habitat complexity
- Changes in habitat forming processes
- Resulting in rearing, spawning, and refuge habitat loss for ESA listed species
- Restoration of these habitats should help improve these species' abundance and sustainability
- **To the extent possible, we need to restore historic conditions on the ecosystem scale to achieve these goals**

Restoration Goals

- **16,000 acres to be restored by 2010**
  - Updated to 19,000 acres by 2014
  - From LCREP Management Plan and EPA Strategic Plan
- **Includes 13,000 acres of wetlands**
  - 3,000 acres of tidal wetlands along lower 46 miles



Culvert Removal, Young Creek



- **Over 160 restoration projects in lower river**
- **LCREP—over 3,236 acres, 57.4 miles of stream**
- **13,690 acres by major partners**
- **Reconnected > 518 acres of historic floodplain with dike breaches, tidegate removal**

Restoration Projects

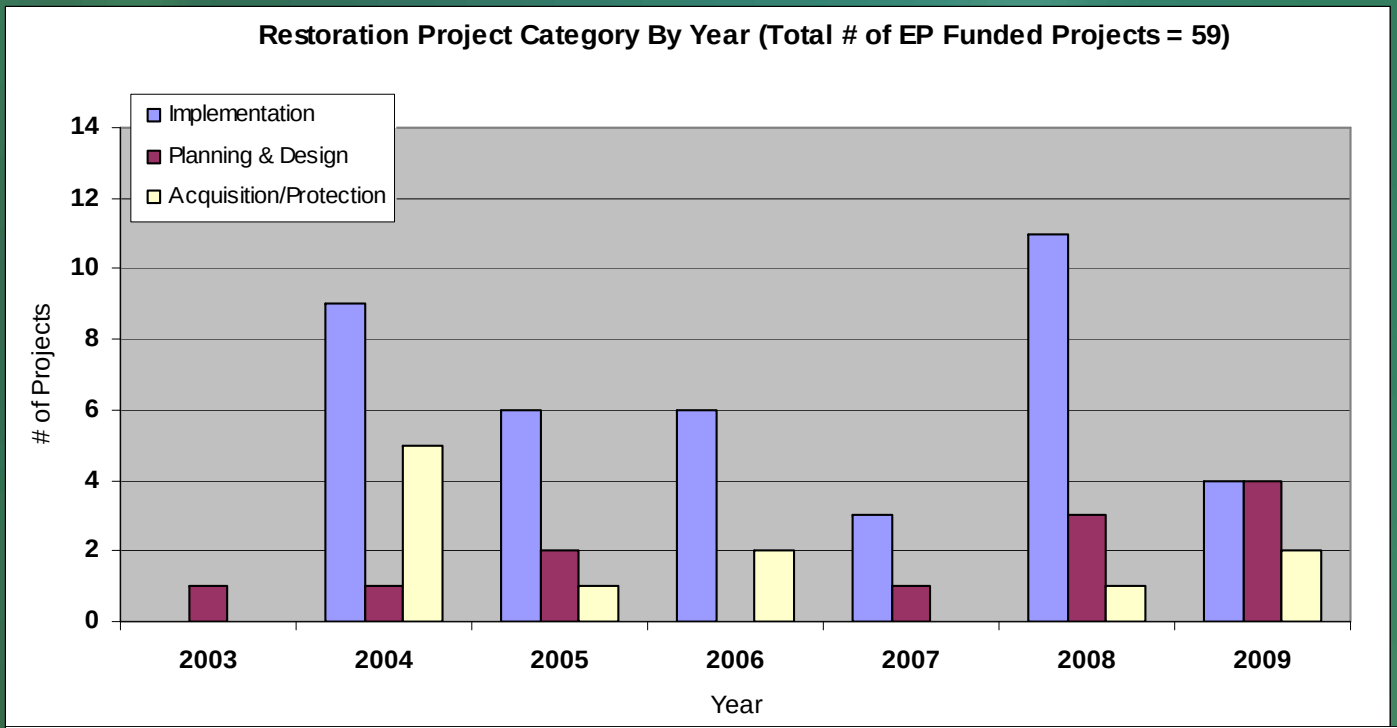
- Most projects have occurred in the floodplain and tributaries

Funding Partners

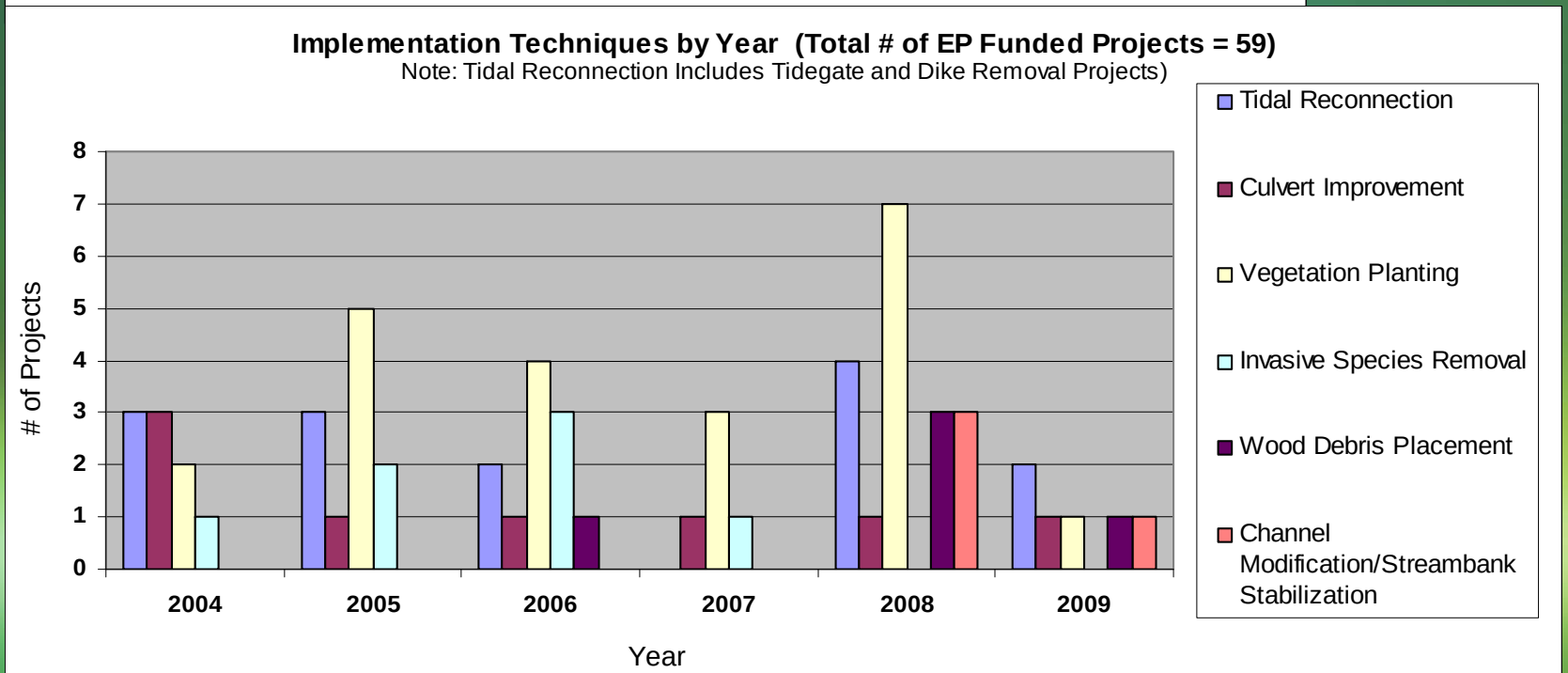
- **NPCC/BPA:**
  - ca. $4,000,000 (2003-2007)
  - ca. $6,000,000 (2008-2010)
  - **Pile Dike Program:** ca. $3,000,000 (2008-2010)
- **NOAA – Community Based Restoration**:
  - ca. $666,250 (2004-2007)
  - ca. $350,000 (2008-2010)
- **NOAA – Marine Debris Removal**:
  - ca. $100,000 (2008)
- **EPA – Targeted Watershed:**
  - ca. $700,000 (2003-2005)
- **Corps of Engineers - Section 536:**
  - ca. $2,000,000 since 2002
  - e.g., Crims Island, Julia Butler Hansen Wildlife Refuge, Sandy River Delta, Vancouver Water Resources Center, etc.

Implementation Partners

Estuary Partnership, Local Governments, Conservation Organizations (e.g., CLT), Watershed Councils, CREST, WA Fish Recovery Board, OWEB



Inter-annual variability in rate & types of projects



Opportunity-driven restoration

- Bottoms-up approach, reactive to RFP
- Favors projects after concept is already developed, usually meeting a local need
- Favors sponsors with capacity to manage projects
- Favors project that can leverage funding from multiple sources (e.g., BPA, LCRFRB, OWEB)
  - has helped promote tributary/floodplain focus
- Project significance often assessed on local level, but less clear on landscape scale
- To date, restoration efforts have been more fragmented than ecosystem-based
  - Connected to upstream restoration projects?
  - Focus on protecting entire life cycle?
  - Tie to water quality and food web?
  - Incorporate toxic contaminant sources and pathways?

Program Improvements

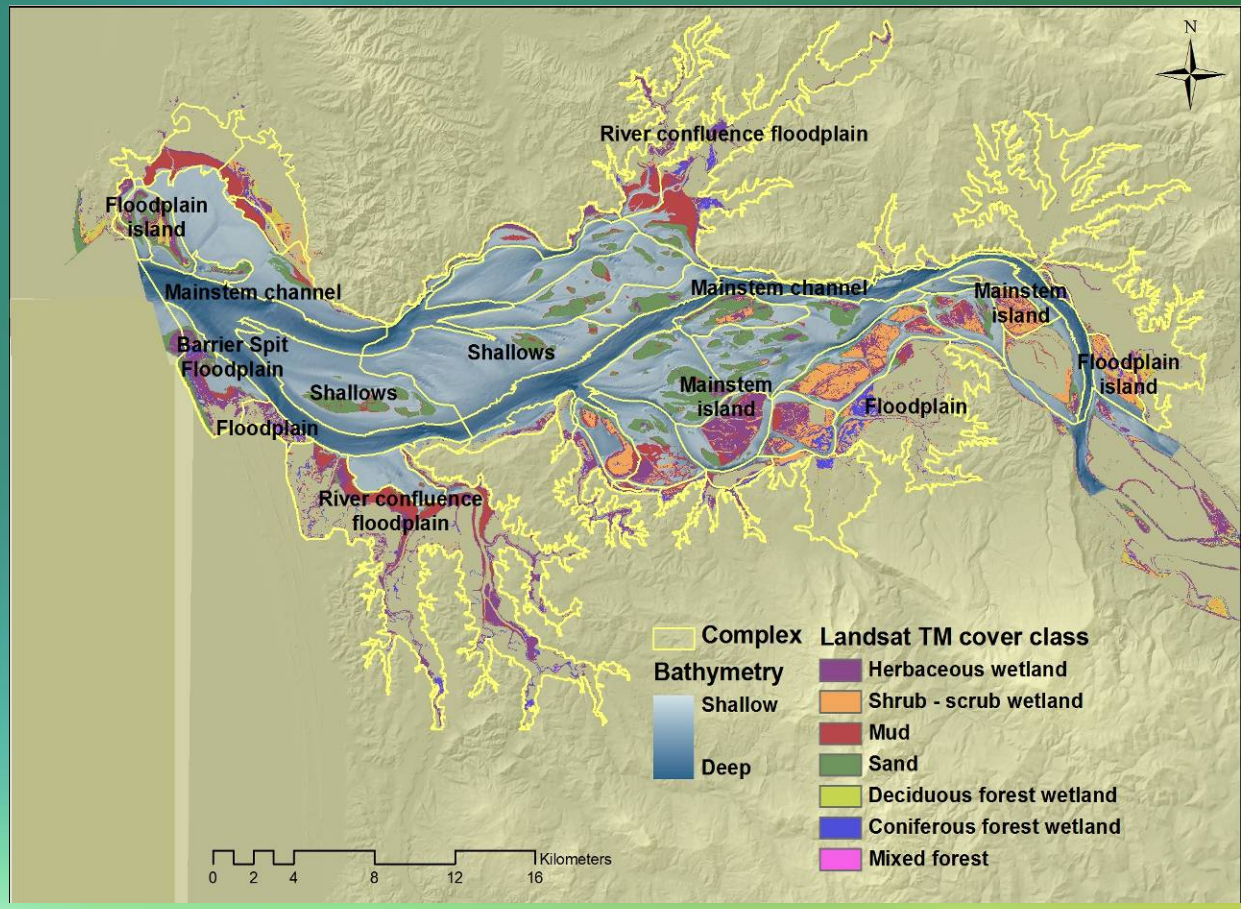
- Developing science and understanding of the complex system
- Experience leads to more informed project designs and decisions
- Improved monitoring efforts resulting in better decisions/designs
- Can lead to more strategic approach focusing on ecosystem scale restoration
  - Requires bi-state, central coordinating entity

Tools to inform Restoration

- Classification—inc. Bathymetry, landcover
- Restoration Prioritization
- Shoreline Condition Inventory
- Ecosystem Status Monitoring
- Action Effectiveness Monitoring
- Reference Sites
- Cumulative Effects
- Meta-analysis
- Data Management
- Adaptive Management

CRE Ecosystem Classification

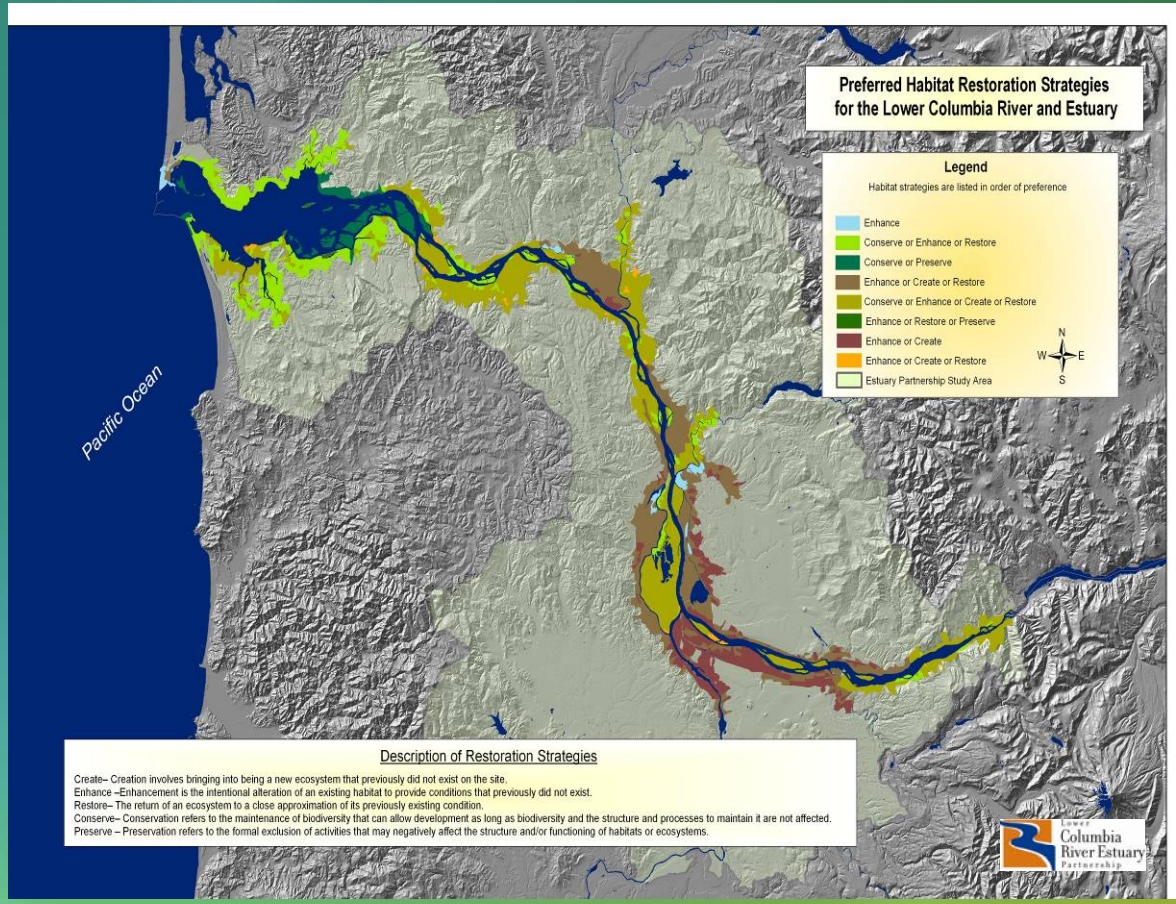
- **Applications:**
- **Prioritizing habitats for protection and restoration**
  - **Using landscape metrics**
  - **Number of patches**
  - **Types of patches**
  - **Edge density**
    - **Fragstats**
    - **McGarigal, K., S. A. Cushman, M. C. Neel, and E. Ene. 2002. Available from UMASS**



From Burke et al. 2005 presentation @ ERF

Habitat Restoration Prioritization Strategy

- Two-tiered - Scales from system-wide to project specific
- Tier 1 uses disturbance model (stressors)
  - provides method for comparing site function and structure at larger scales
  - Focuses on existing data
  - refine by updating/ adding new data

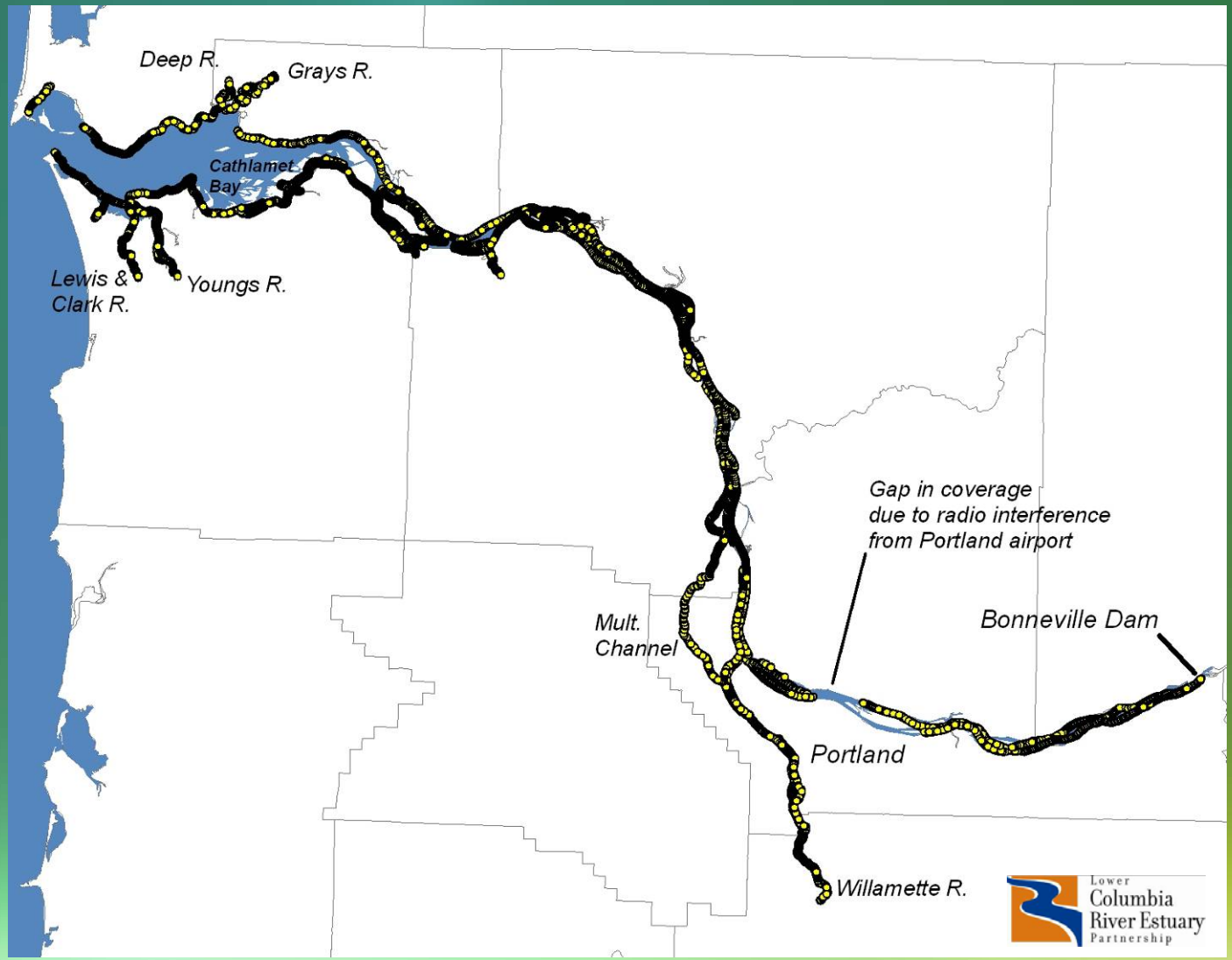


*PNNL and Estuary Partnership

- Tier 2 provides scientific method of comparing specific projects using change in function and likelihood of success

Digital Shoreline Condition Inventory

- Digitized video of shoreline
- 605 miles shoreline surveyed:
- Jul 2005 – Oct 2006
- Modified Shoreline: 277 miles
- Natural Shoreline: 250 miles



Types of Monitoring/Research

- **Ecosystem condition status and trends**
  - **Ecosystem Monitoring Project**
    - Assess condition of indicators of ecosystem condition & changes over time
    - Estuary Partnership, PNNL, NOAA Fisheries, USGS, UW
- **Action Effectiveness Research**
  - **Action Effectiveness Monitoring**
    - Assess effectiveness of individual restoration projects
    - Estuary Partnership, CREST, NOAA Fisheries, CLT, Scappoose Bay Watershed Council, others
  - **Reference Sites**
    - Characterize conditions of various habitats to use as “targets” for restoration actions
    - Estuary Partnership, PNNL, CREST
  - **Cumulative Effects of Restoration**
    - Assess effects of restoration on ecosystem-wide basis
    - USACE, PNNL, NOAA Fisheries, CLT, CREST and others
- **Critical Uncertainties Research**

Ecosystem Monitoring Project

- ✓ **Estuary Partnership , NOAA, USGS, PNNL—funded by BPA**
- ✓ **Coordinated Habitat, Fish, and Prey Monitoring:**
  - ✓ Vegetation monitoring (% cover along transects, species list, elevation)
  - ✓ Water quality (data loggers) and sediment (grain size along transects)
  - ✓ Fish sampling (species richness, abundance, CPUE, stock id, length, weight, stomach contents, otoliths for growth rates, marked/unmarked)
  - ✓ Fish prey (taxonomy, abundance, biomass, terrestrial versus aquatic origin)




Action Effectiveness Monitoring (AEM)

- Research to determine effects of an action or suite of actions on fish performance and/or habitat conditions
- Assess ecosystem benefits and uncertainties affecting restoration success
- Support adaptive management of restoration by regional partners

Coordinated Regional Effort

AEM for individual restoration projects

- NOAA Fisheries (multiple sites)
- CREST, Columbia Land Trust , Scappoose Bay Watershed Council, Ash Creek Forest Management, Parametrix
- Coordinated by the Estuary Partnership

Cumulative Effects Study

- Measuring hydrology, channel morphology, vegetation, fish presence and community structure, and flux of nutrients and organic matter
- Developing monitoring protocols (Roegner et al. 2008)

Reference Site Study

- Measuring hydrology, channel morphology, vegetation, elevation profiles, and sediment accretion

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Coordination to ensure:

✓ **Data are comparable across sites and time for similar types of actions and habitats**

✓ **Results are scalable**

Reference Sites Study

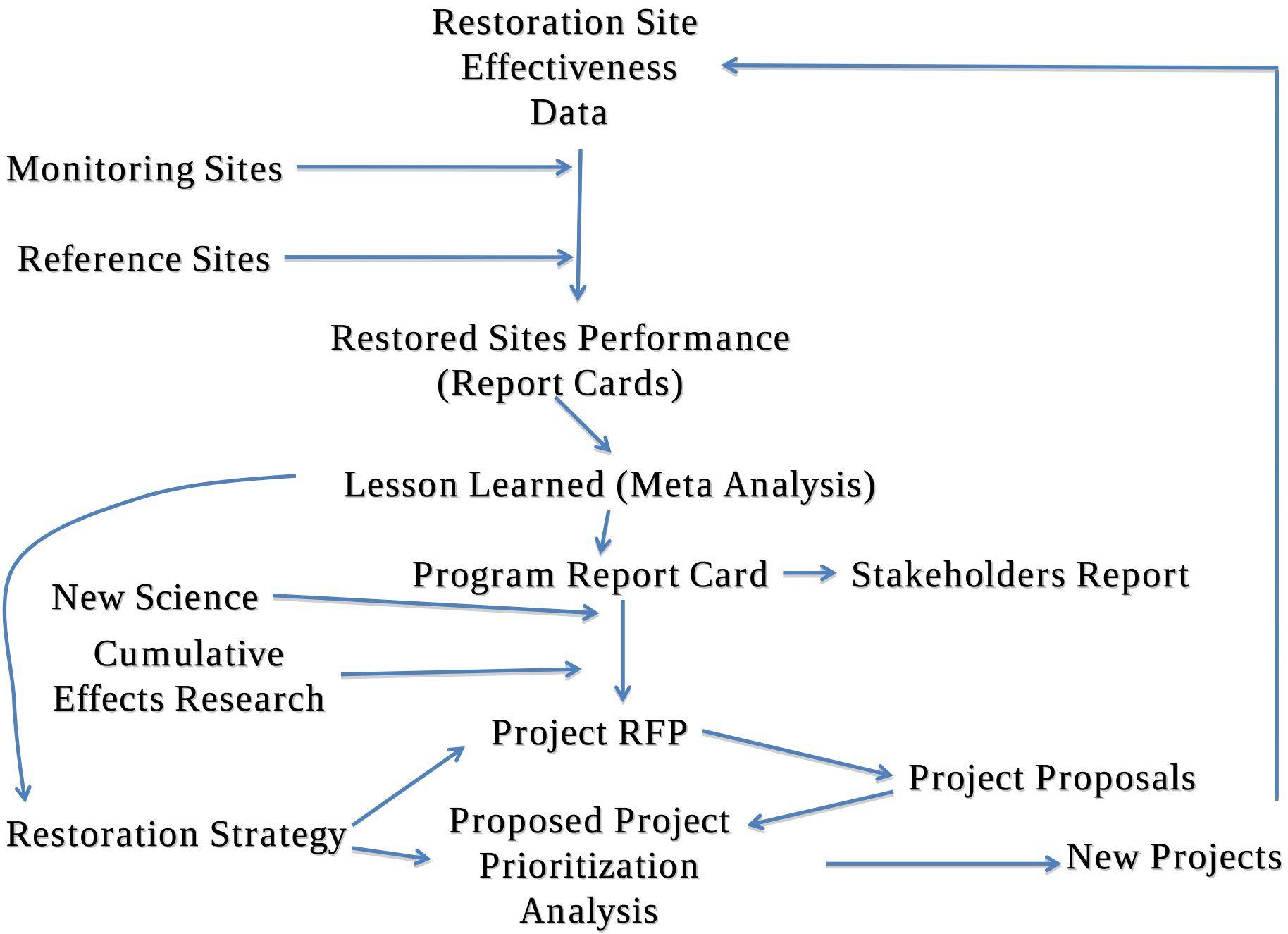
- Goal - use standard monitoring protocols to assess structure of suite of tidal freshwater wetland habitats
  - use these as an indicator of function and condition
- Provide a template of patterns and development rates that can be expected over time at restored sites
- Provide an endpoint of potential structure & function of restoration actions
- ~41 sites – > 4 sites in each of 8 reaches of estuary
- 3 major habitat types—emergent marsh, Sitka spruce swamp, and riparian forested wetland
- Cross-over with Ecosystem Monitoring Project

Sitka Spruce Swamp

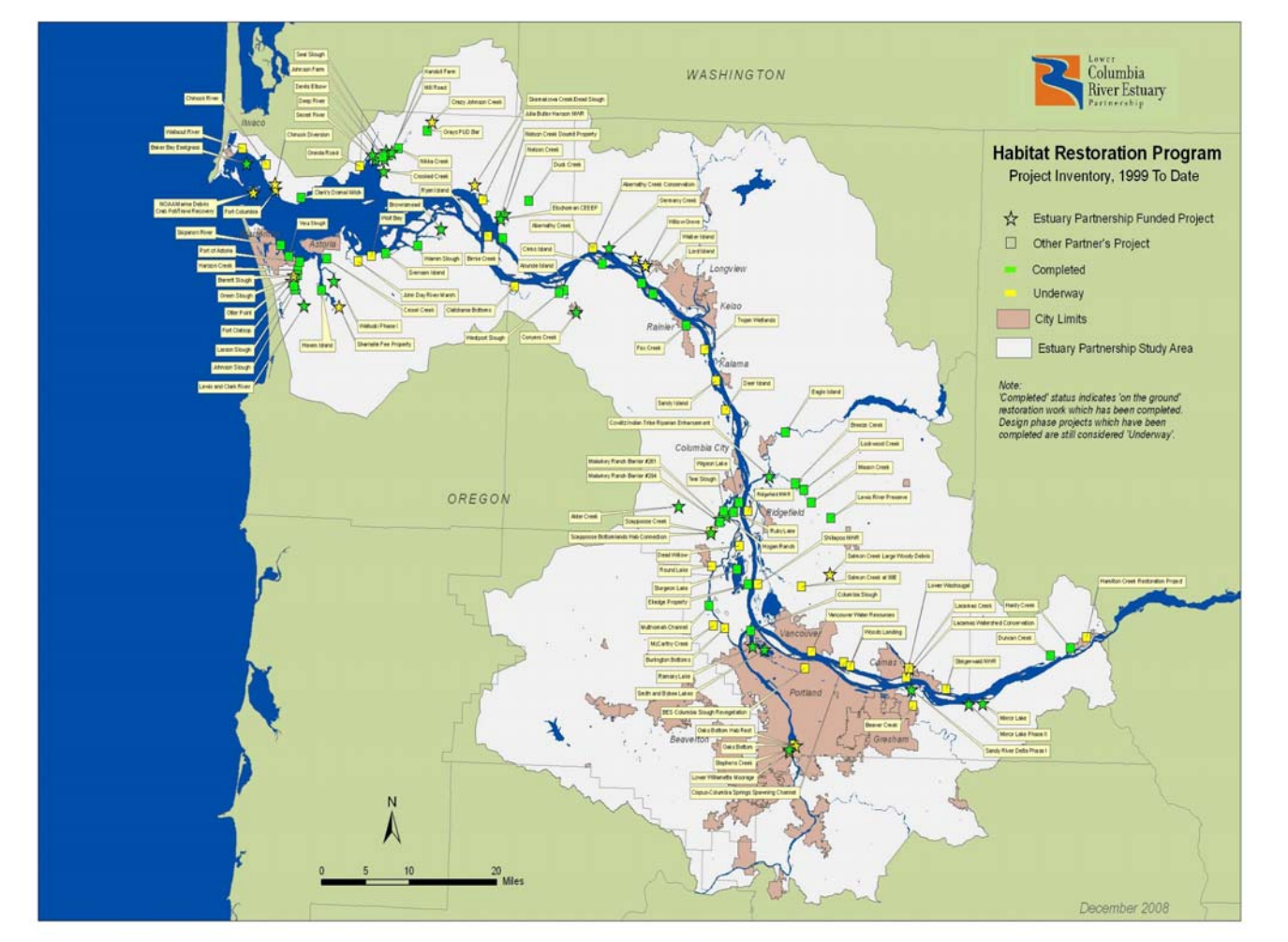
Meta Analysis Results Summary-Are the response variables trending in the desired direction?

	Photo Point	Water Temperature	Sediment Accretion Rate	Juvenile Salmon Presence
Crims Island	Yes	--	Yes	Yes
Ft. Clatsop	--	Cooler in Summer	--	Yes
Johnson Property	Yes	--	--	Yes
Kandoll Farm	Yes	Cooler in Summer	Yes	Yes
Vera Slough	Yes	--	--	No

*Programmatic Report Card


Restoration Site Effectiveness Data
Monitoring Sites
Reference Sites
Restored Sites Performance (Report Cards)
Lesson Learned (Meta Analysis)
Program Report Card
Stakeholders Report
New Science
Cumulative Effects Research
Project RFP
Project Proposals
Restoration Strategy
Proposed Project Prioritization Analysis
New Projects

Restoration Project Implementation

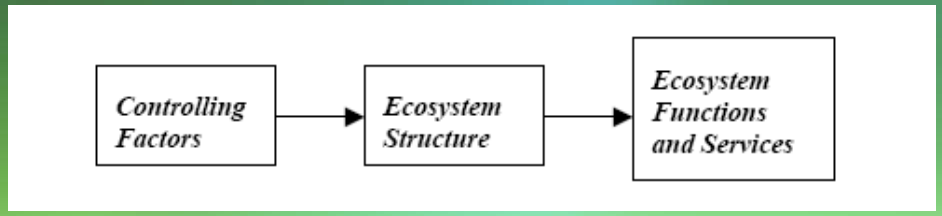


Integration of the experience of implementers within the estuary, including CLT, CREST, SBWC, USFWS, LCRWC, PC Trask, USFWS, DU and others.

Restoration Project Types

Focus on restoring processes and structure that leads to quality habitat and functional benefits

- Hydrology
- Depth/Sediment Dynamics
- Access to Habitat
- Complexity/Diversity
- Habitat Type



Thom, Wellman (1996)

Habitat Impacts within the Estuary:

- **Significant declines in emergent marsh and tidal swamp habitats**
- **Off-channel habitats cut off**
- **Reduction in flow, access to habitats**
- **Decreases in habitat complexity**
- **Resulting in rearing, spawning, and refuge habitat loss for ESA listed species**
- **Restoration of these habitats should help improve these species' abundance and sustainability**

Restoration of Controlling Processes: Hydrology

- Opportunities within historic floodplain
- Requires available land (Acquisition)
- Land use and community concerns
- Technical challenges
- Can be costly

Restoration of Controlling Processes: Bathymetry/Hydrology

- Creative approached being investigated
- Land base is available
- Technical challenges
- Costly

Restoration of Habitat Access

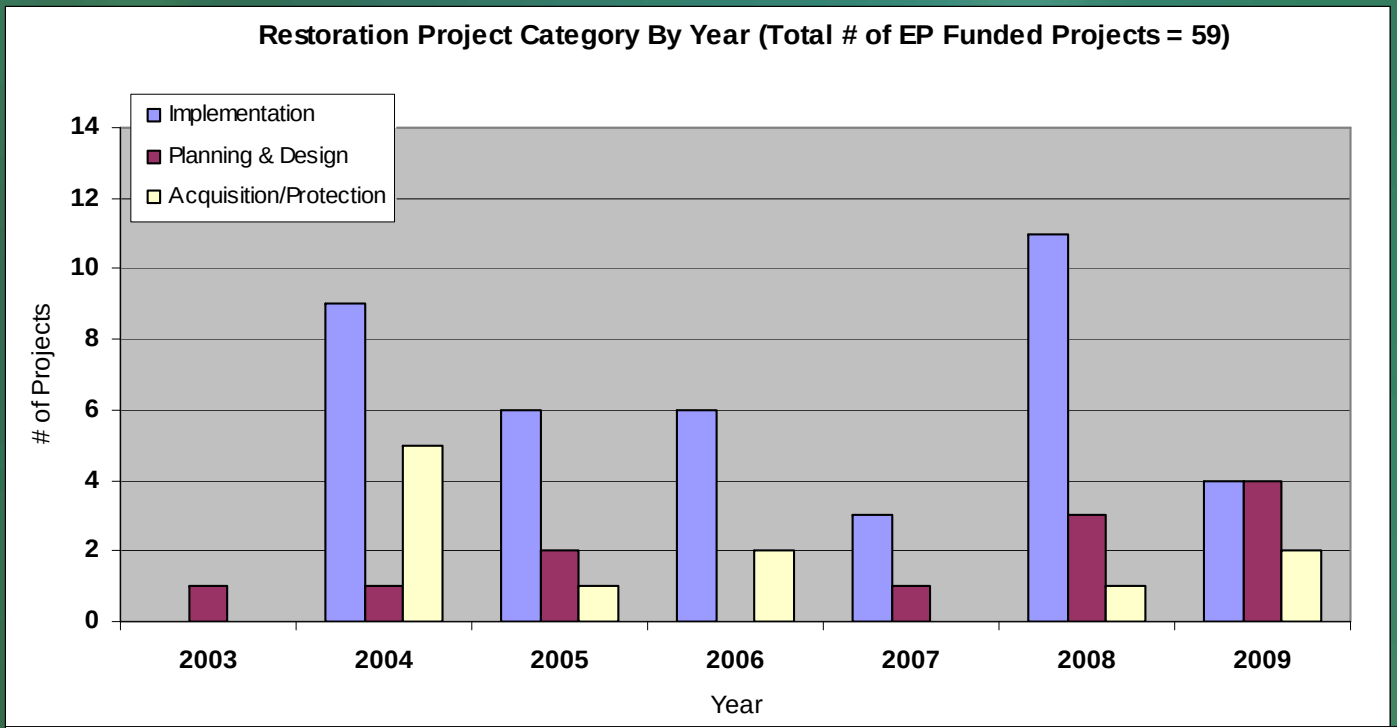
Partial Reconnection options exist

- A compromise between interests
- Uncertain benefits – site specific
- Offers flexibility and opportunity

Access to Habitat best gained through hydrologic restoration

Restoration of Habitat Structure

- Requires willing landowner
- Localized, scalable projects
- Variety of approaches



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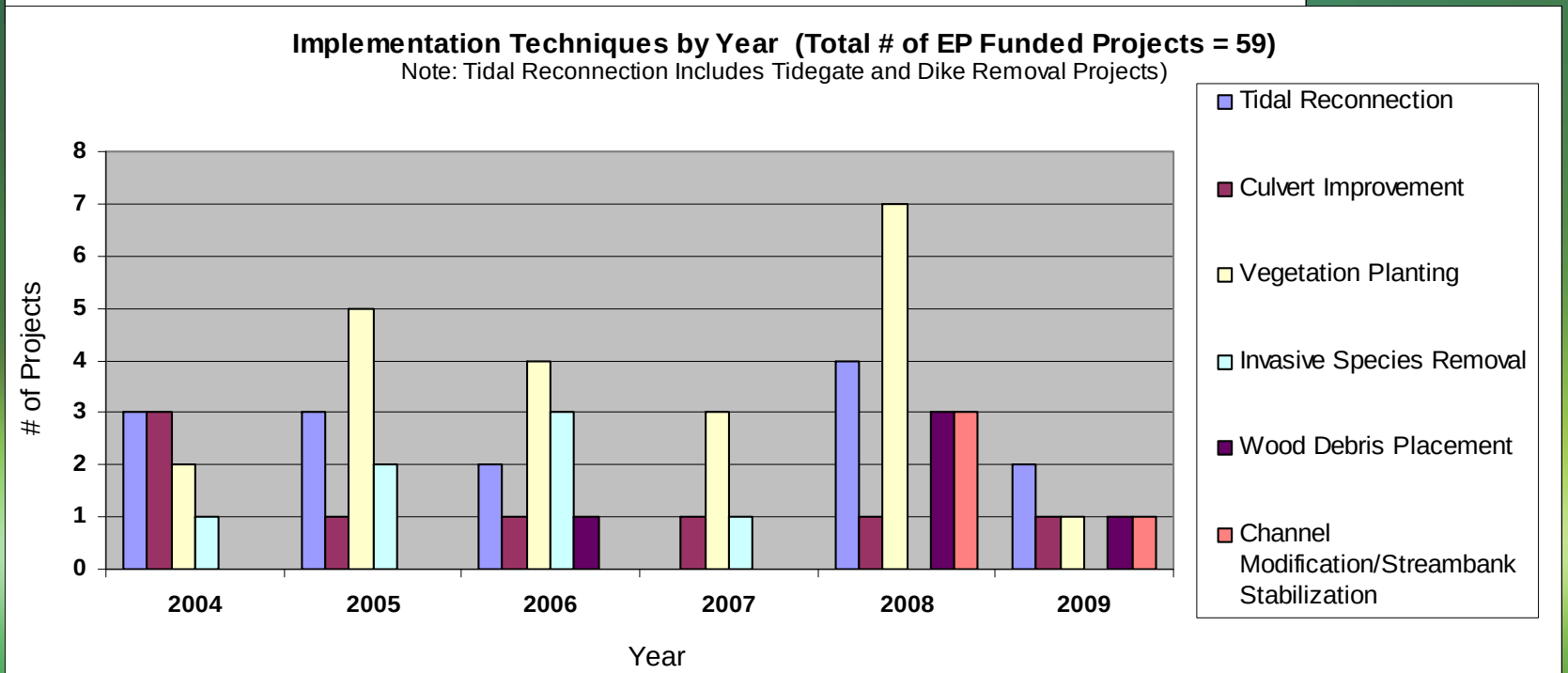
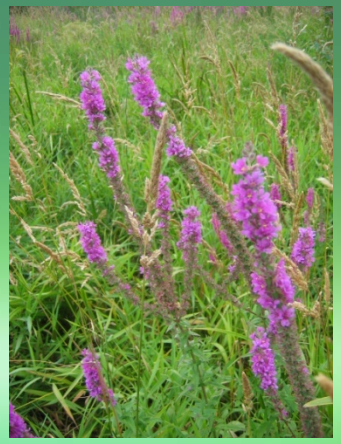


Issues Faced by Practitioners: Physical and Ecological Constraints

- Floodplain Fragmentation
- Water Quality
- Channel Aggradation
- Channel connectivity
- Hydromodifications
- Invasive Species
- Infrastructure



Issues Faced by Practitioners: Practical Concerns

- Securing Land
- Project Development
- Competing Goals
- Competing Interests
- Funding
- Design
- Outreach and community support
- Permitting
- Construction/Implementation
- Monitoring and Maintenance

Issues Faced by Practitioners: Practical Concerns

Project Activity	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Landowner Contact												
Conceptual Project Design												
Grant Funding - Application												
Grant Contracting												
Outreach												
Acquisition - Appraisal												
Acquisition - Due Diligence												
Acquisition - Closing												
Project Design - 30%												
Permitting - Regulatory Approval												
Final Design												
Construction Contracting												
Construction Implementation												
Post-Construction Monitoring and Maintenance												

Practical Options for Success

- Think long term
- Integrate strategic planning and prioritization
- Approach projects in phases
- Be willing to invest in Development with the understanding that not all project come to fruition
- Build flexibility into funding structure
- Support technical needs
- Community outreach on a regional scale
- Community outreach on a local, project-specific scale
- Invest in long-term operation and maintenance for restoration projects

Contacts for More Information:

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