Overview of Data Products and Restoration Program for the Lower Columbia River

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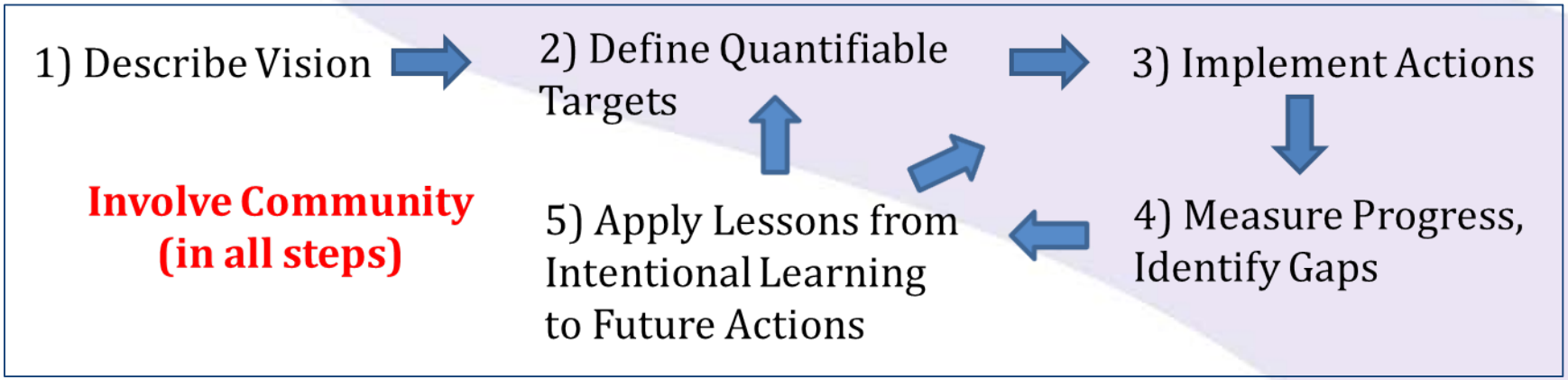
Estuary Partnership

- The lower Columbia River is part of the National Estuary Program, one of only 28 in the nation, authorized by Congress in 1987 amendments to Clean Water Act, §320
- Established in 1995 by the governors of Washington and Oregon and EPA
  - Lack of focus on the lower river and estuary
  - Bi State findings documented degradation of lower river
- Partners, inc. federal, state, and local governments; universities; non-profits; industry, etc, participate in the development and implementation of a *Comprehensive Conservation and Management Plan (Management Plan)*
  - Includes vision, actions and targets
  - Quantifiable habitat targets –
    - ✓ 19,000 acres protected or restored by 2014
    - 25,000 acres by 2025

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**

➢ How do we Measure Biological Integrity?

Biological Condition Gradient (USEPA: Davies and Jackson 2006)

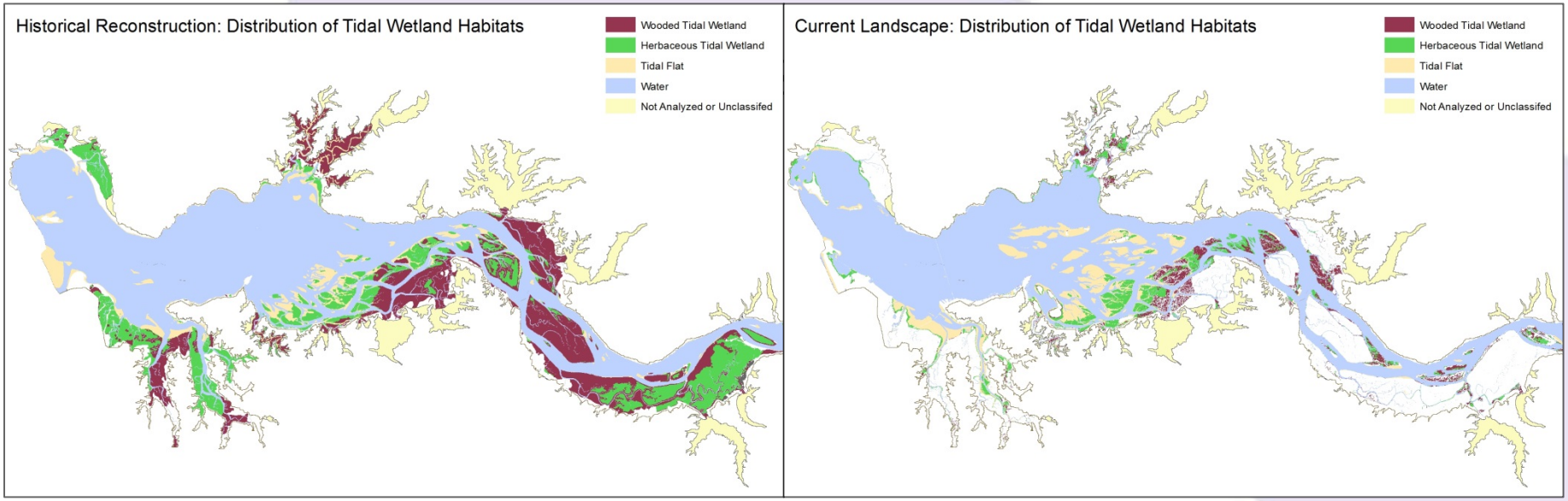
- Similar to Index of Biological Integrity (Karr 1981)
- Used in freshwater streams; USEPA adapting it to estuaries
- ***Science Community identifies key ecosystem attributes -***
  a. **Natural Habitat Diversity, Historical Habitat Mosaic**
  b. **Focal Species**
  c. **Water Quality**
  d. **Ecosystem 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

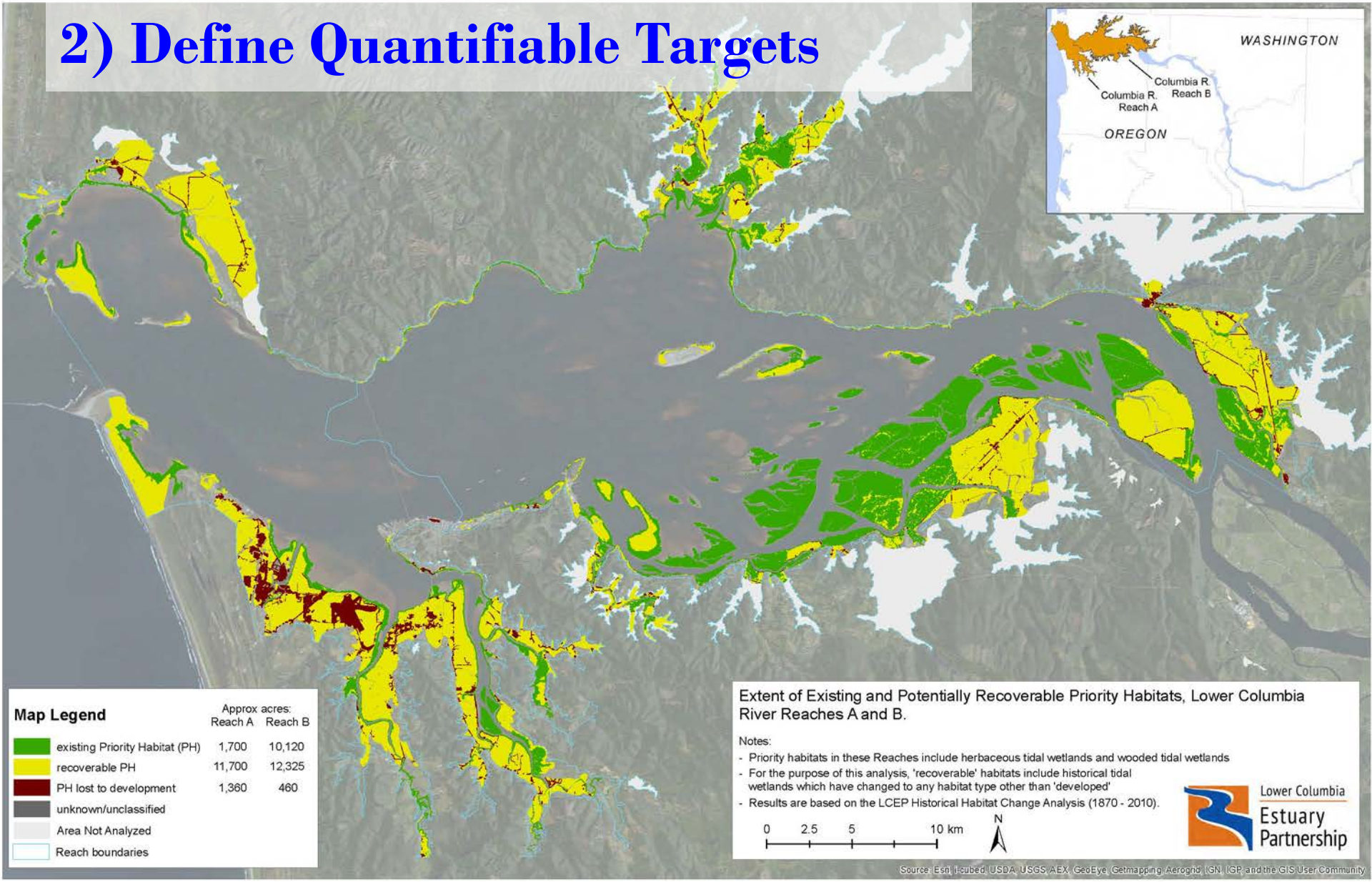
- **Integral for other attributes (e.g., focal species)**
  - Native species evolved with historic habitat conditions; restoring to those conditions should be protective of those native species
- **Completed Habitat Change Analysis comparing 1870s habitat coverage to 2010**
  - Historic habitat coverage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

Historical Habitat Change (2011)

- GIS comparison of late 1800's Office of Coast Survey topographic sheets and 2010 land cover data
- Quantifies changes in spatial distribution of habitat types



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) 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*

2) Draft Targets - Next Steps

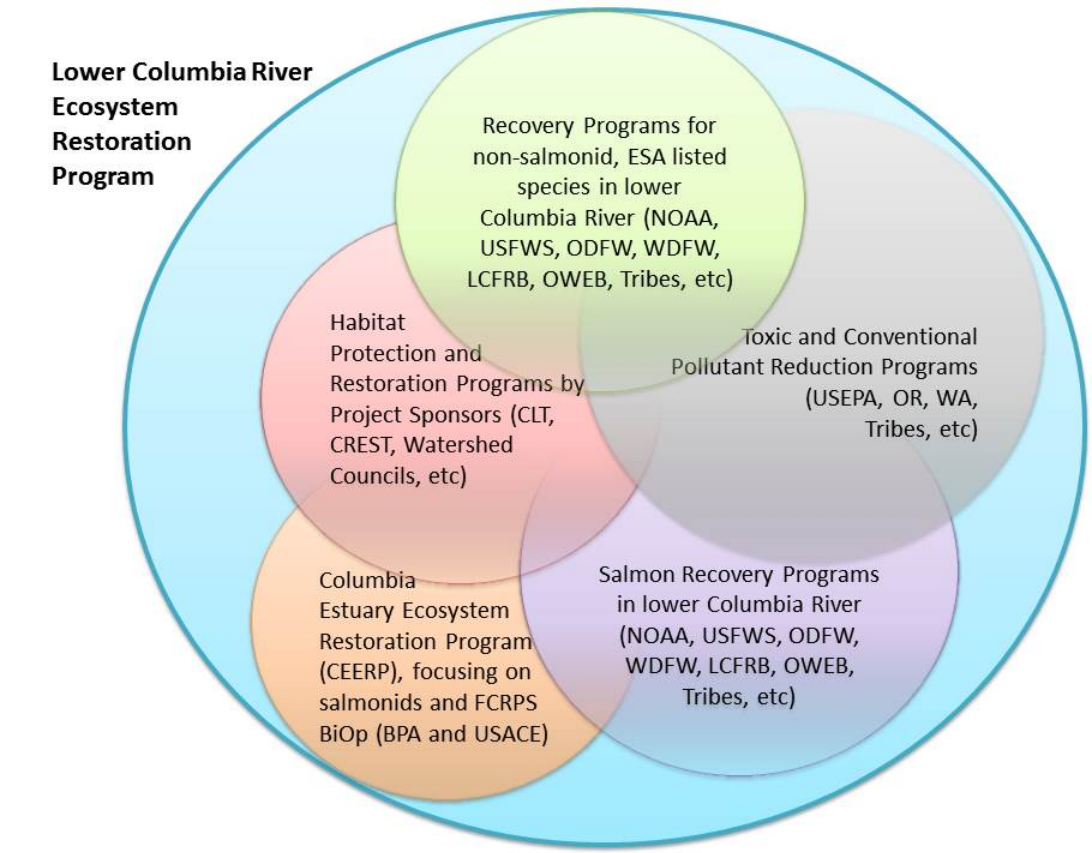
- **Identify minimum size criterion for larger "reserves" and small patches of habitats**
  - Encourage implementation of anchor areas
- **Identify minimum number of occurrences of habitats by region**
- **Identify gaps in habitats, key corridors**
- **Determine if these targets are protective of common 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***

Estuary Partnership Restoration Prioritization Strategy

- Framework for the Estuary Partnership and regional partners to carry out ecosystem based habitat restoration in a scientifically sound manner.

- Part of the larger **Lower Columbia River Ecosystem Restoration Program**



Key Estuary Partnership Data Products

Data Set	Development Purpose	Year	Web Access?
***Historical Habitat Change**	Restoration Prioritization Strategy	2011	Yes
***Juvenile Salmonid Habitat Suitability Index**	Restoration Prioritization Strategy	2012	Yes
***Columbia White Tailed Deer Habitat Suitability Index**	Restoration Prioritization Strategy	2012	2014
Columbia Estuary Ecosystem Classification	Monitoring Site Selection, Restoration	2012	Yes
Lower Columbia Terrain Model	Seamless Elevation Data	2010	No
Restoration Project Inventory	Restoration Activity Tracking	2013	Yes
Shoreline Georeferenced Video and Feature Inventory	Shoreline Characterization	2006	No

Restoration Prioritization Strategy data components

Multiple lines of evidence approach, including the following GIS data layers:

1. **Historical Habitat Change Analysis *(complete)***
2. **Juvenile Salmonid Habitat Suitability Index *(complete)***
3. **OR and WA Priority Tributaries *(complete)***
4. **Columbia White-tailed Deer Habitat Suitability (*draft*)**
5. **Priority Habitats for Pacific Flyway (*planned*)**
6. **Priority Toxic Contaminant Clean-up Sites (*draft*)**
7. **Climate Change Effects (*planned*)**

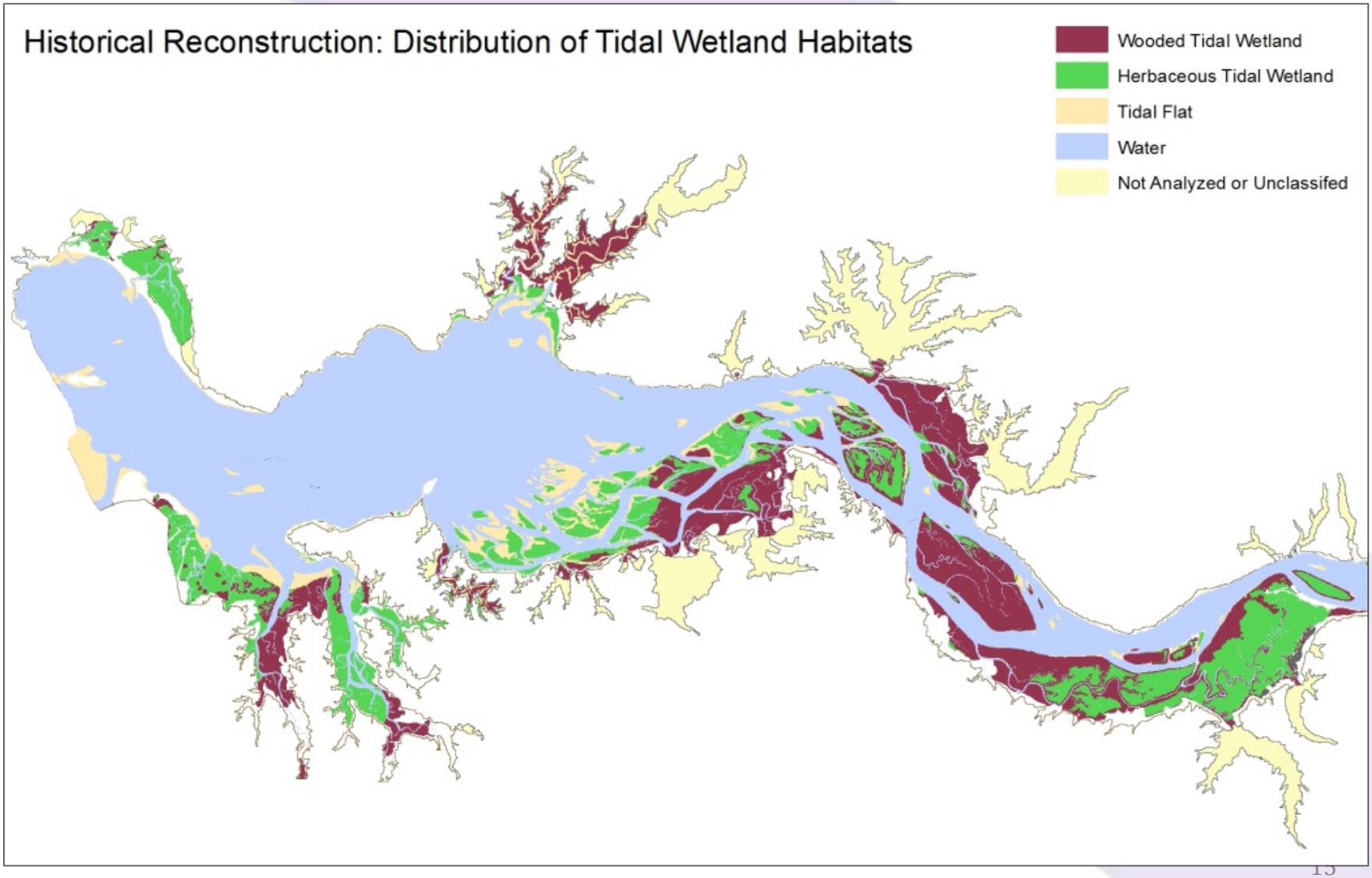
http://www.estuarypartnership.org/habitat-restoration-strategy

Historical Habitat Change Analysis

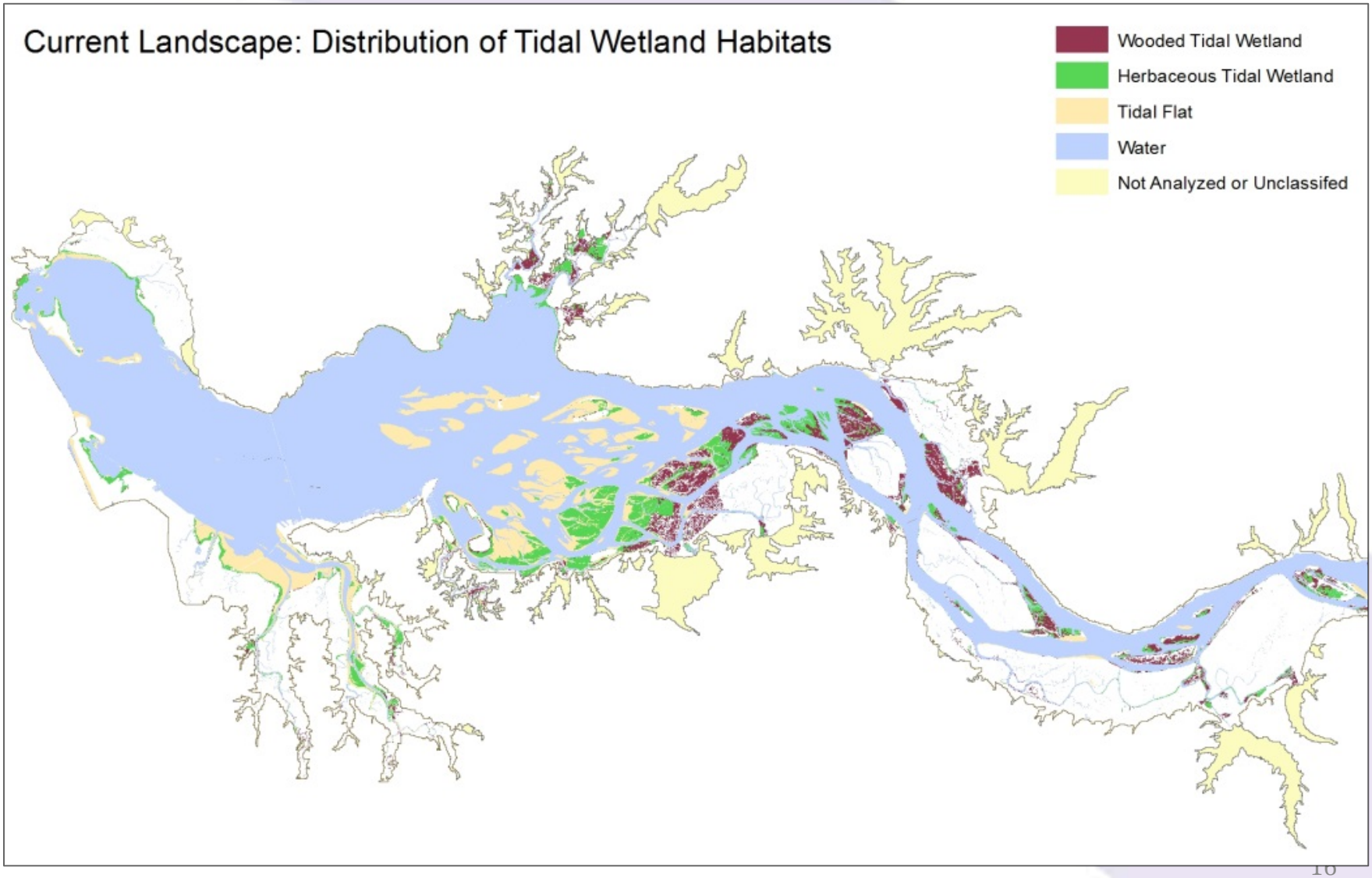
- GIS comparison of late 1800's Office of Coast Survey topographic sheets and 2010 land cover data.
- Quantifies changes in spatial distribution of habitat types.
- Integral piece of information for general restoration:
  - Restoring historical habitat diversity should be beneficial to multiple native species

http://www.estuarypartnership.org/historical-habitat-change

Historical Habitat Change Analysis



Historical Habitat Change Analysis



Historical Habitat Change Analysis

- Quantifying changes in habitat allows us to prioritize which habitats should be recovered, and/or protected.

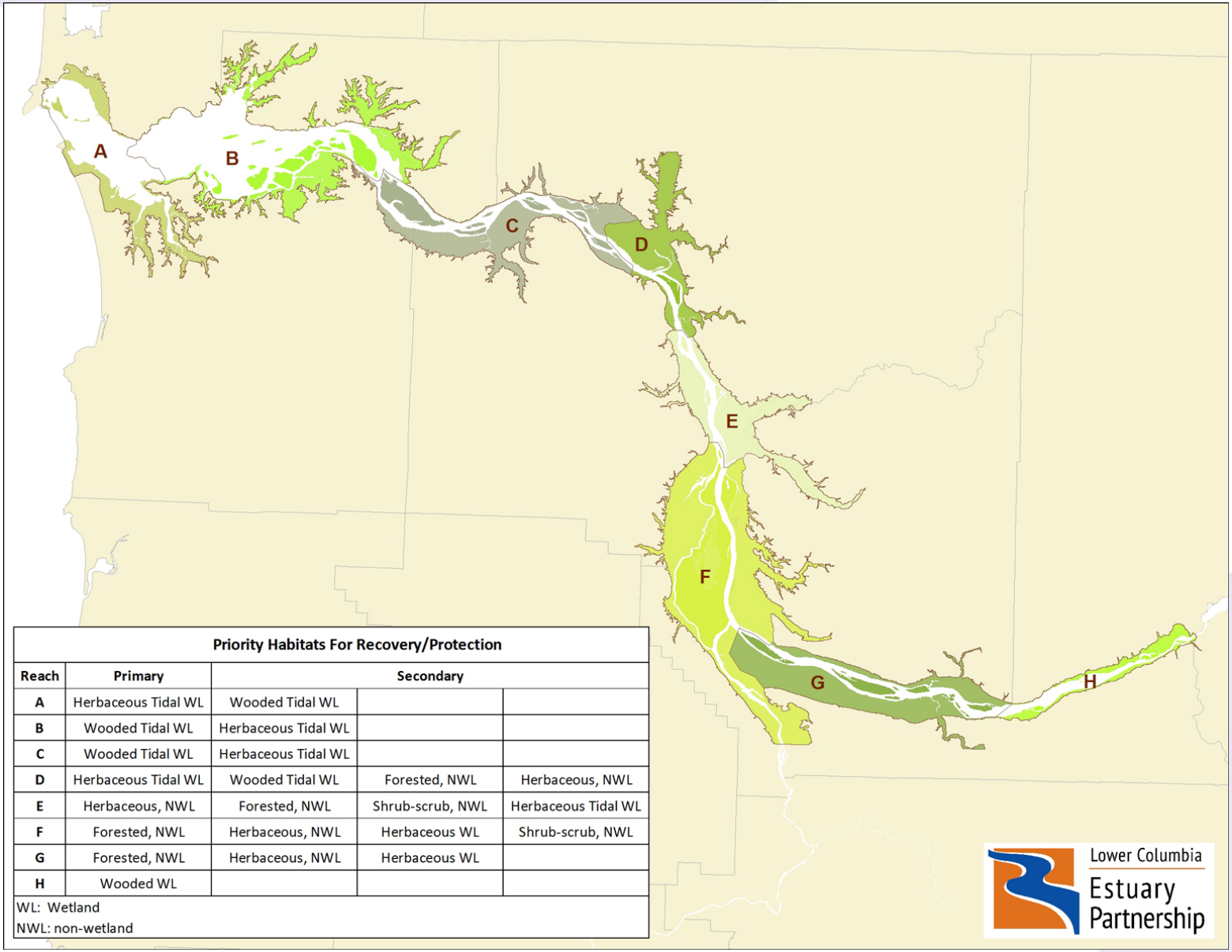
- Prioritize habitats for different areas of the river which can be categorized by their predominant vegetation types:
  - Areas where large losses of predominant vegetation have occurred
  - Areas where those habitat types were historically rare may also be important.

Historical Habitat Change Analysis

Priority habitats for restoration/protection as determined by the Estuary Partnership Science Work Group

Reach	Priority Habitats			
	1	2	3	4
A	herbaceous tidal WL	wooded tidal WL		
B	wooded tidal WL	herbaceous tidal WL		
C	wooded tidal WL	herbaceous tidal WL		
D	herbaceous tidal WL	wooded tidal WL	forested	herbaceous
E	herbaceous	forested	shrub-scrub	herbaceous tidal WL
F	forested	herbaceous	herbaceous WL	shrub-scrub
G	forested	herbaceous	herbaceous WL	
H	wooded WL			

Historical Habitat Change Analysis

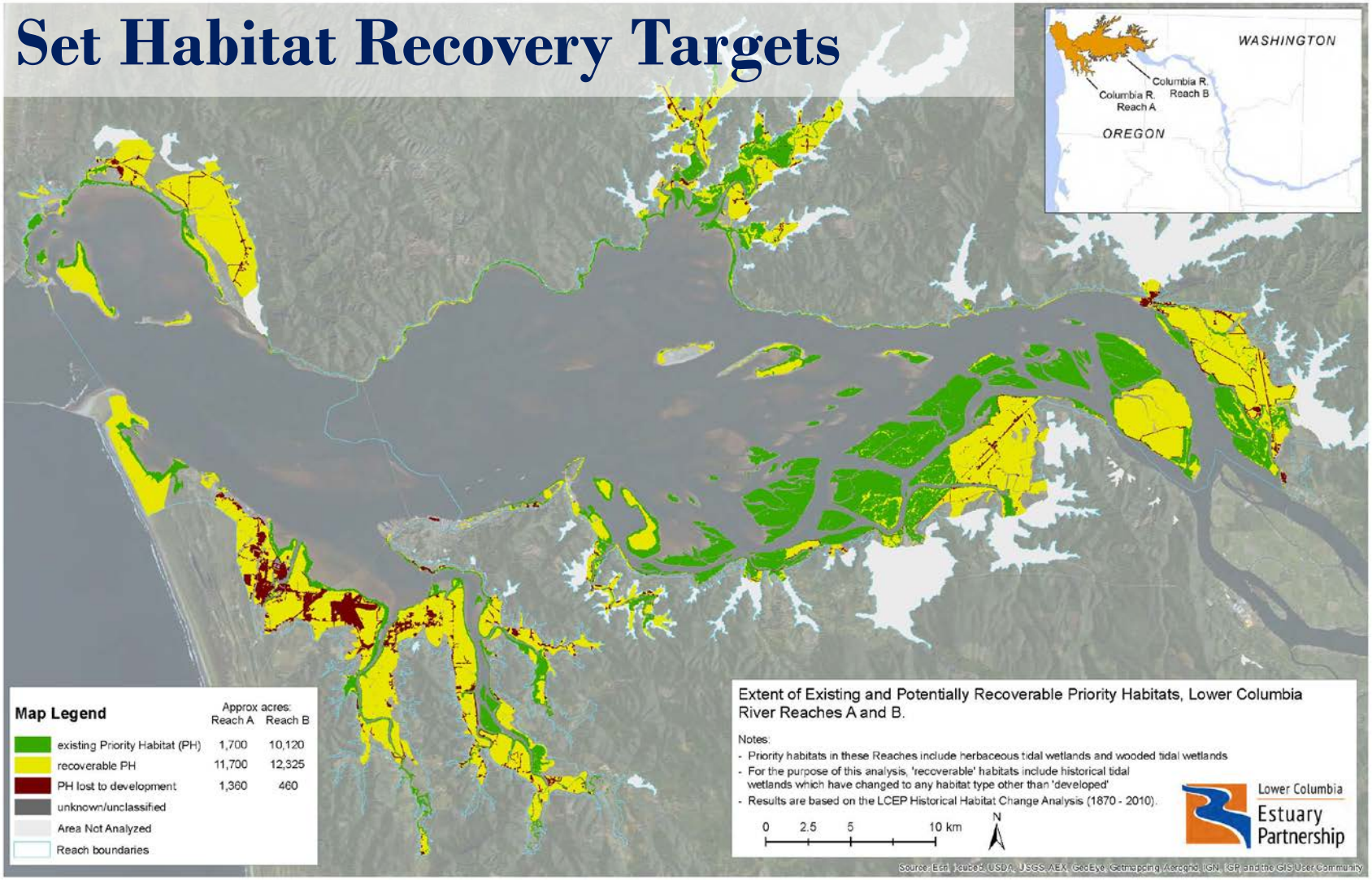


Priority Habitats For Recovery/Protection				
Reach	Primary	Secondary		
A	Herbaceous Tidal WL	Wooded Tidal WL		
B	Wooded Tidal WL	Herbaceous Tidal WL		
C	Wooded Tidal WL	Herbaceous Tidal WL		
D	Herbaceous Tidal WL	Wooded Tidal WL	Forested, NWL	Herbaceous, NWL
E	Herbaceous, NWL	Forested, NWL	Shrub-scrub, NWL	Herbaceous Tidal WL
F	Forested, NWL	Herbaceous, NWL	Herbaceous WL	Shrub-scrub, NWL
G	Forested, NWL	Herbaceous, NWL	Herbaceous WL	
H	Wooded WL			

WL: Wetland
NWL: non-wetland

Historical Habitat Change Analysis

Current land cover data provides information on 'recoverable' habitat



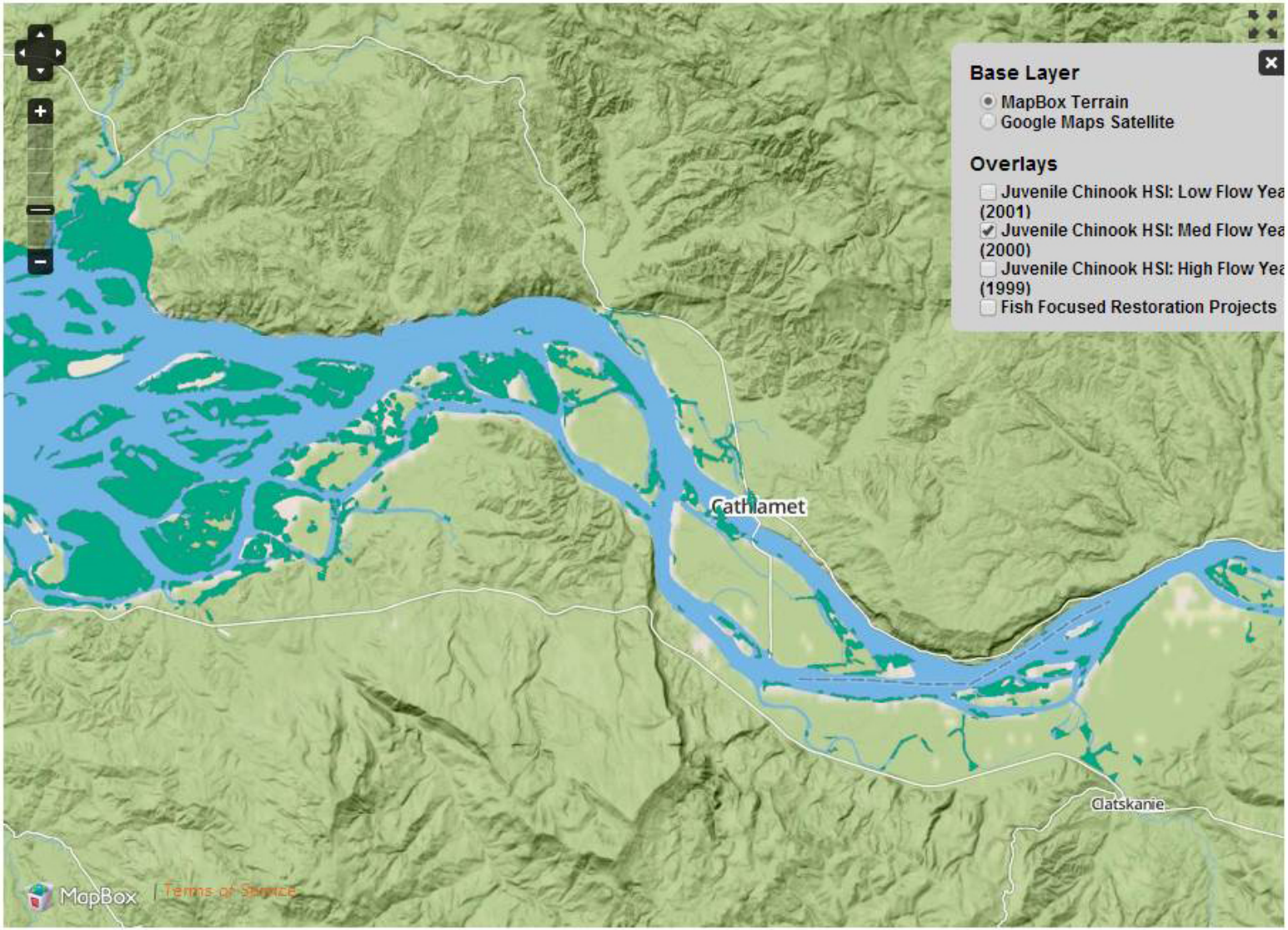
Juvenile Salmonid Habitat Suitability

- Predicts suitable in-water locations for supporting juvenile salmonids, based on established depth, temperature, and current velocity threshold values.
- Uses depth, current and temperature outputs from OHSU Virtual Columbia River simulation model.
- Predicts suitable habitats for varying flow conditions.

http://www.estuarypartnership.org/habitat-suitability-index-hsi-model-juvenile-chinook-salmon

Juvenile Salmonid Habitat Suitability

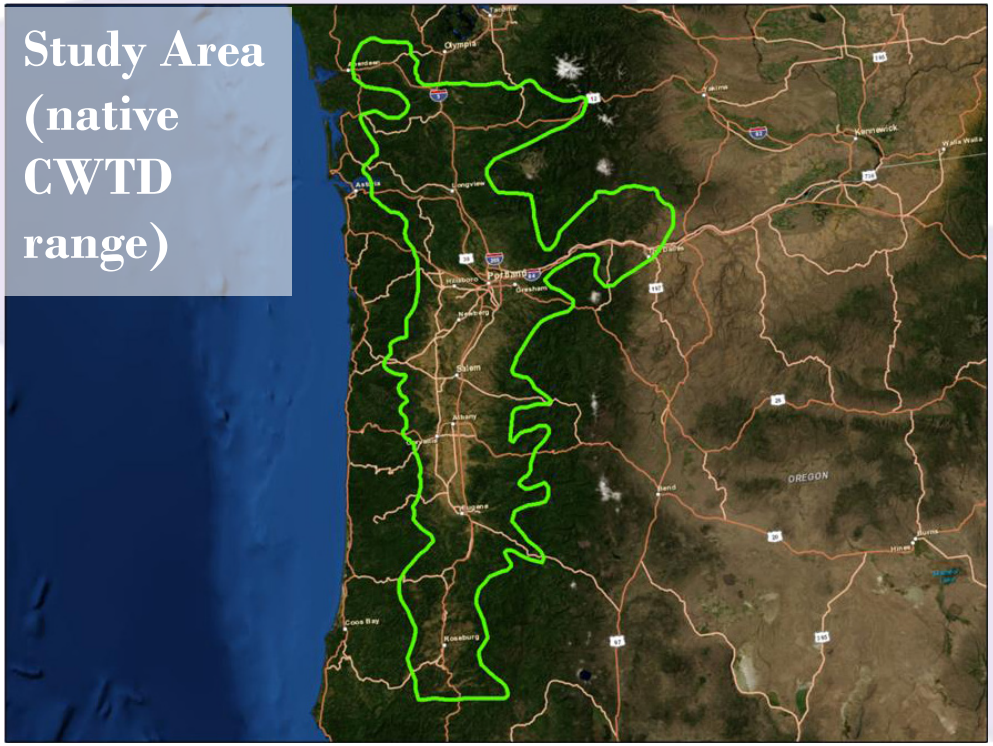
Suitable areas polygons, for medium flow year:



Columbia White Tailed Deer Habitat (2013)

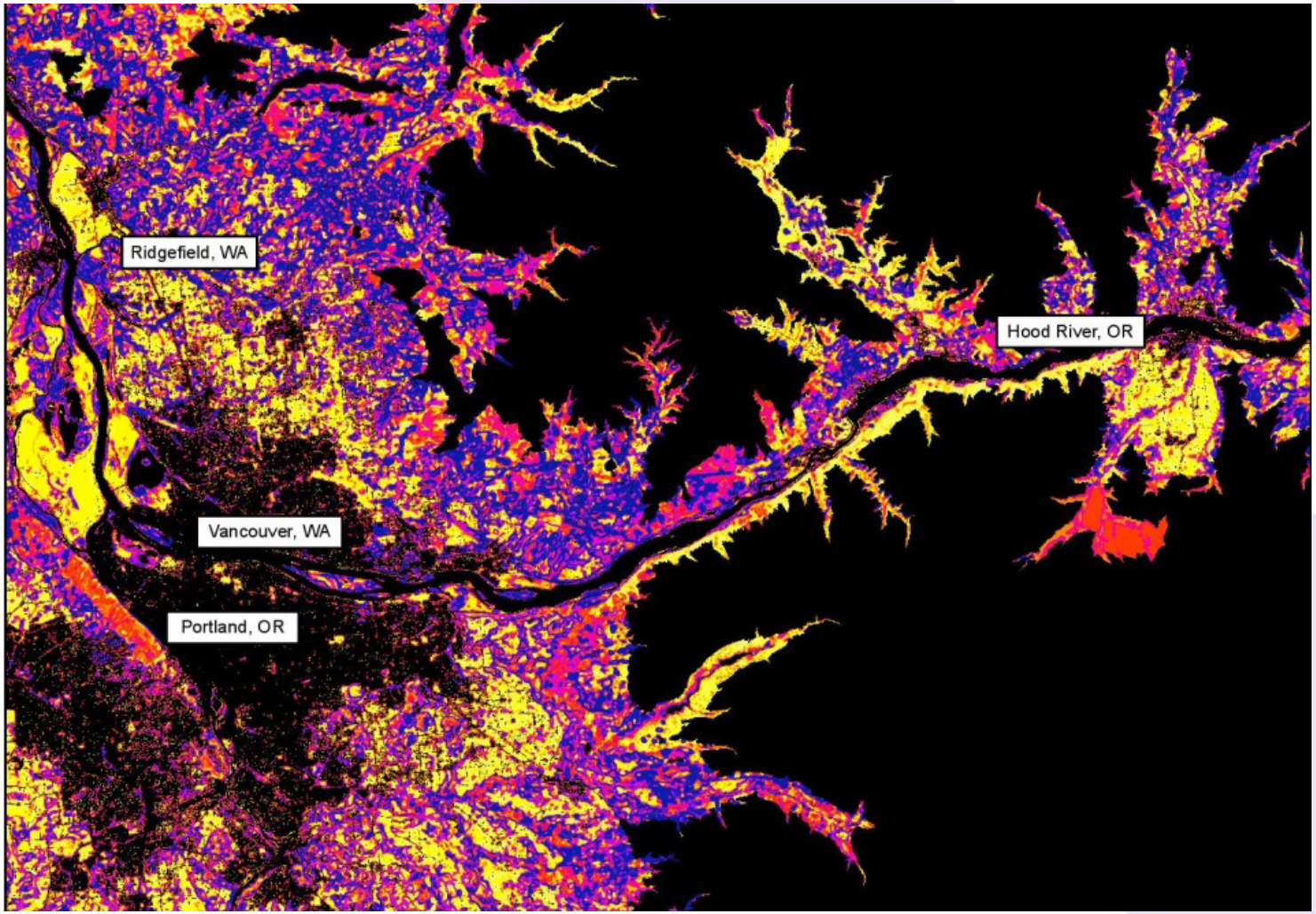
- Predicts suitable habitats for potential re-introduction of ESA listed Columbia White Tailed Deer.

- Based on reclassification (distance and density) of USGS National Landcover Data Set.



Columbia White Tailed Deer Habitat (2013)

GIS model output (purple = high suitability, yellow = low)



Columbia Estuary Ecosystem Classification

- Multi-year collaboration between the Estuary Partnership, USGS and the University of Washington.
- Hierarchical series of 6 geospatial data sets which describe controlling physical and biological processes that shape the lower River and floodplain.
- Layers represent processes which operate at different time and spatial scales:
  - Lower levels: longer time periods, larger spatial areas
  - Higher levels: shorter time periods, smaller spatial areas

http://www.estuarypartnership.org/columbia-river-estuary-ecosystem-classification

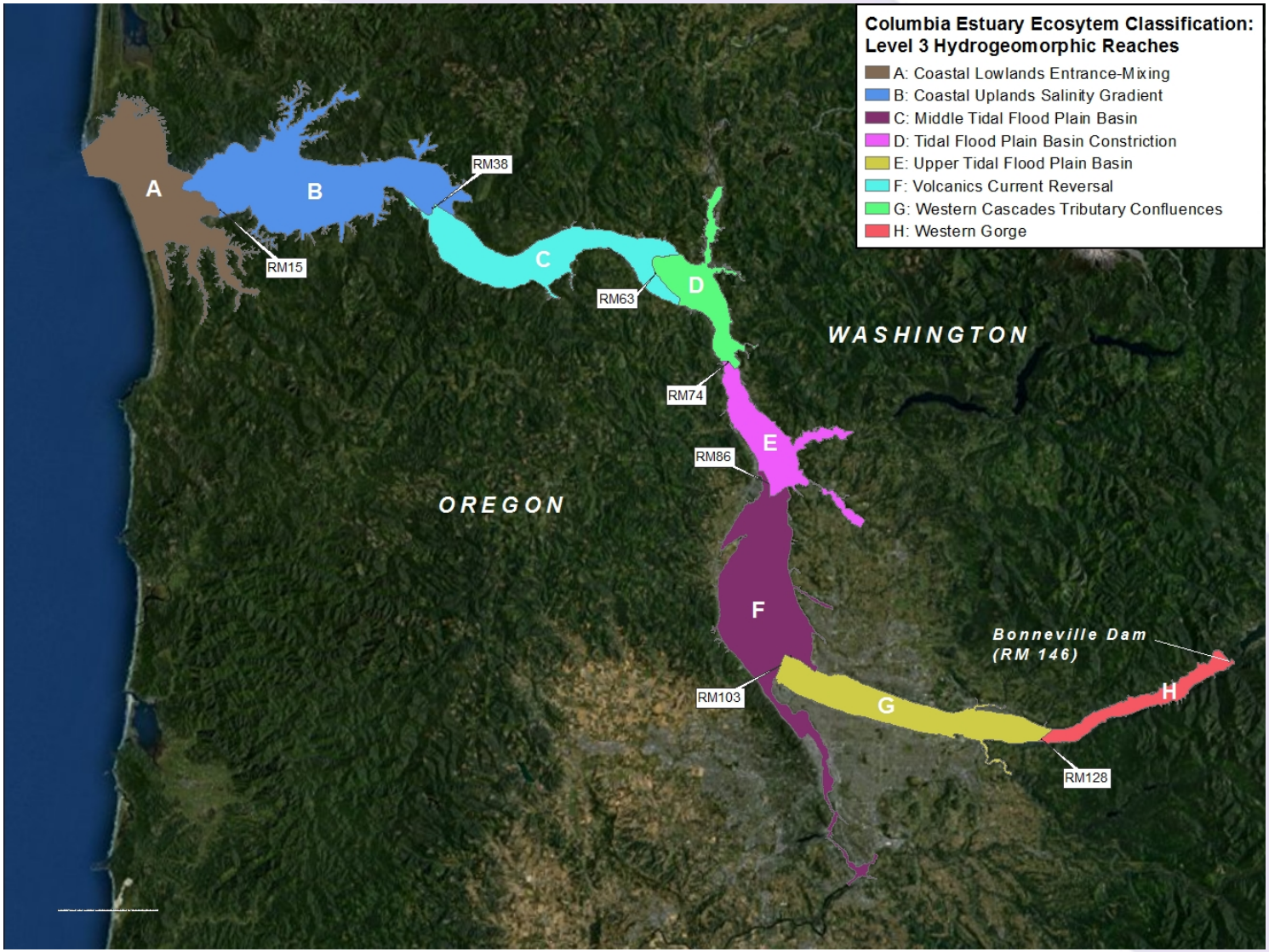
Columbia Estuary Ecosystem Classification

Level	Description	Examples of Features
3	**Hydrogeomorphic Reach**: large scale tectonic and fluvial processes including salinity, current reversal.	Zones of salinity mixing, salinity gradient, major tributary confluences.
4	**Ecosystem Complex**: geomorphic processes and geologic events over the holocene period.	River channels, floodplains, tributary deltas, terraces.
5	**Geomorphic Catenae**: individual landforms created over the last 2k years.	Shallow water, deep channel, tidal channels, wetlands, channel bars.
6	**Land Cover**: biological and anthropogenic processes operating on surface vegetation, over decadal or shorter timescales.	Herbaceous, forested, and shrub wetlands, deciduous/ coniferous forests, sand, mud
Cultural Features	Artificial landscape features created by human activity.	Levees, dredge material deposits, road/railroad fill

Note: Levels 1 & 2 are taken directly from US EPA Ecosystem Provinces and Ecoregions

Columbia Estuary Ecosystem Classification

Level 3 – Hydrogeomorphic Reaches



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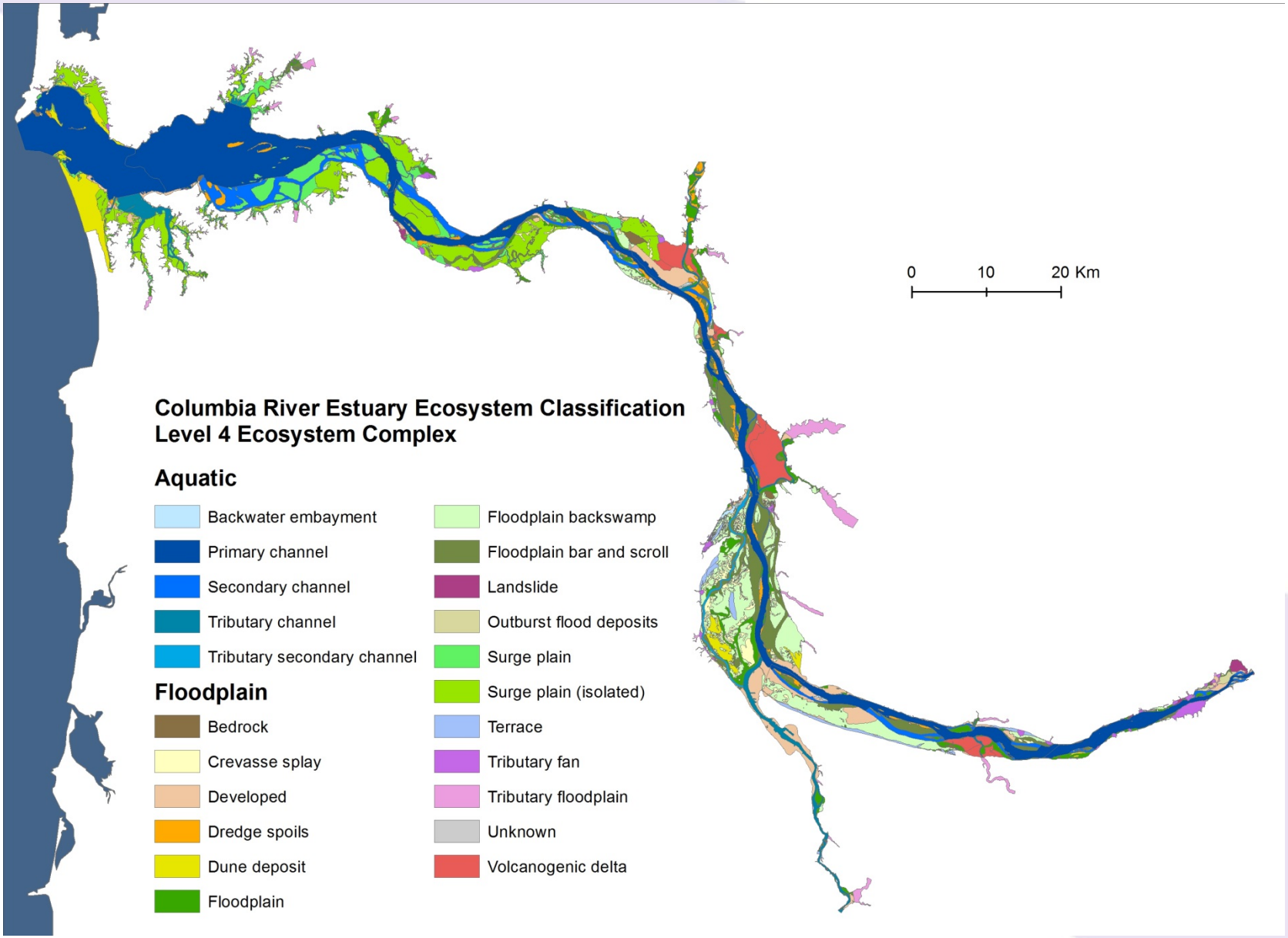

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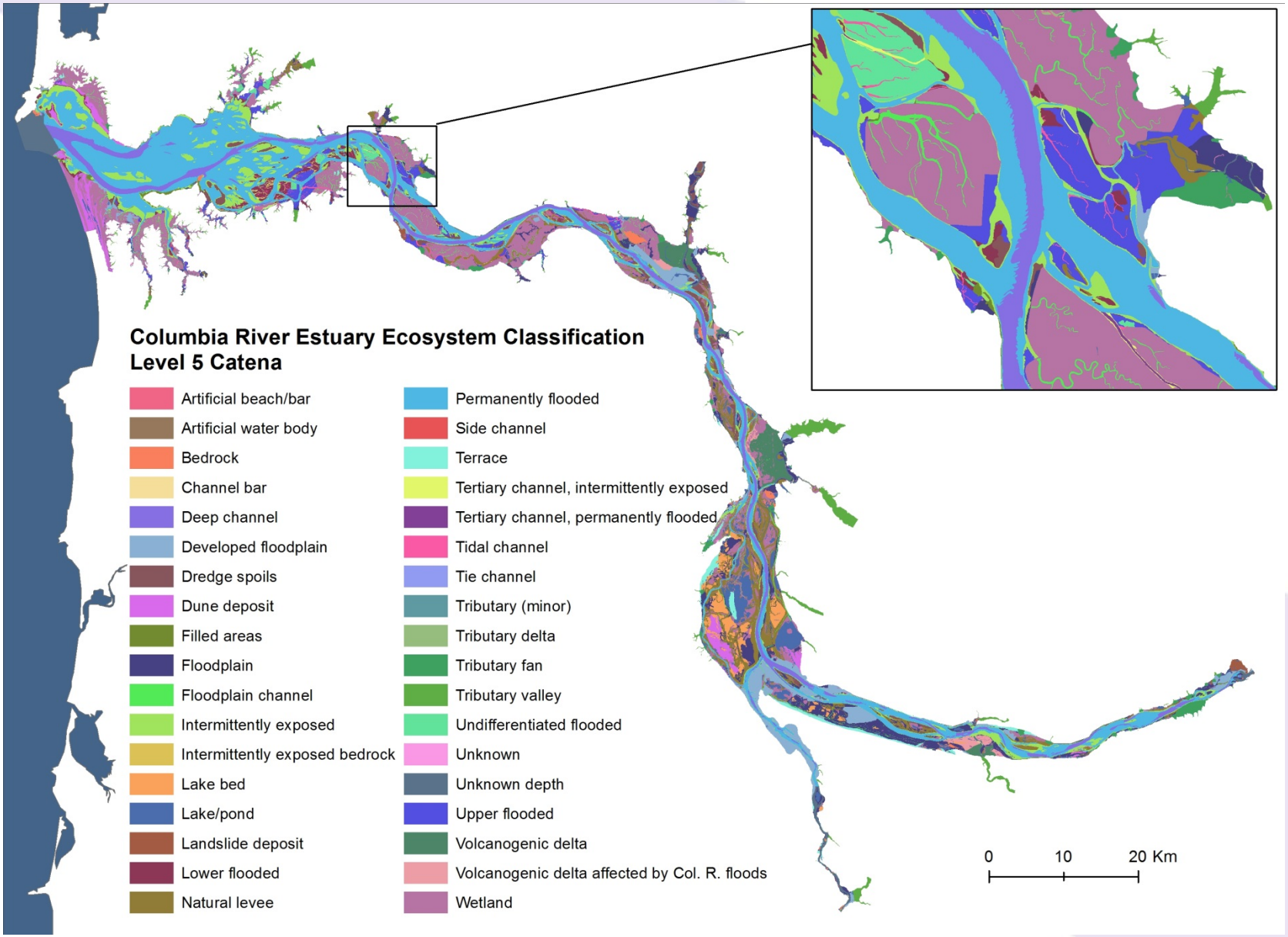
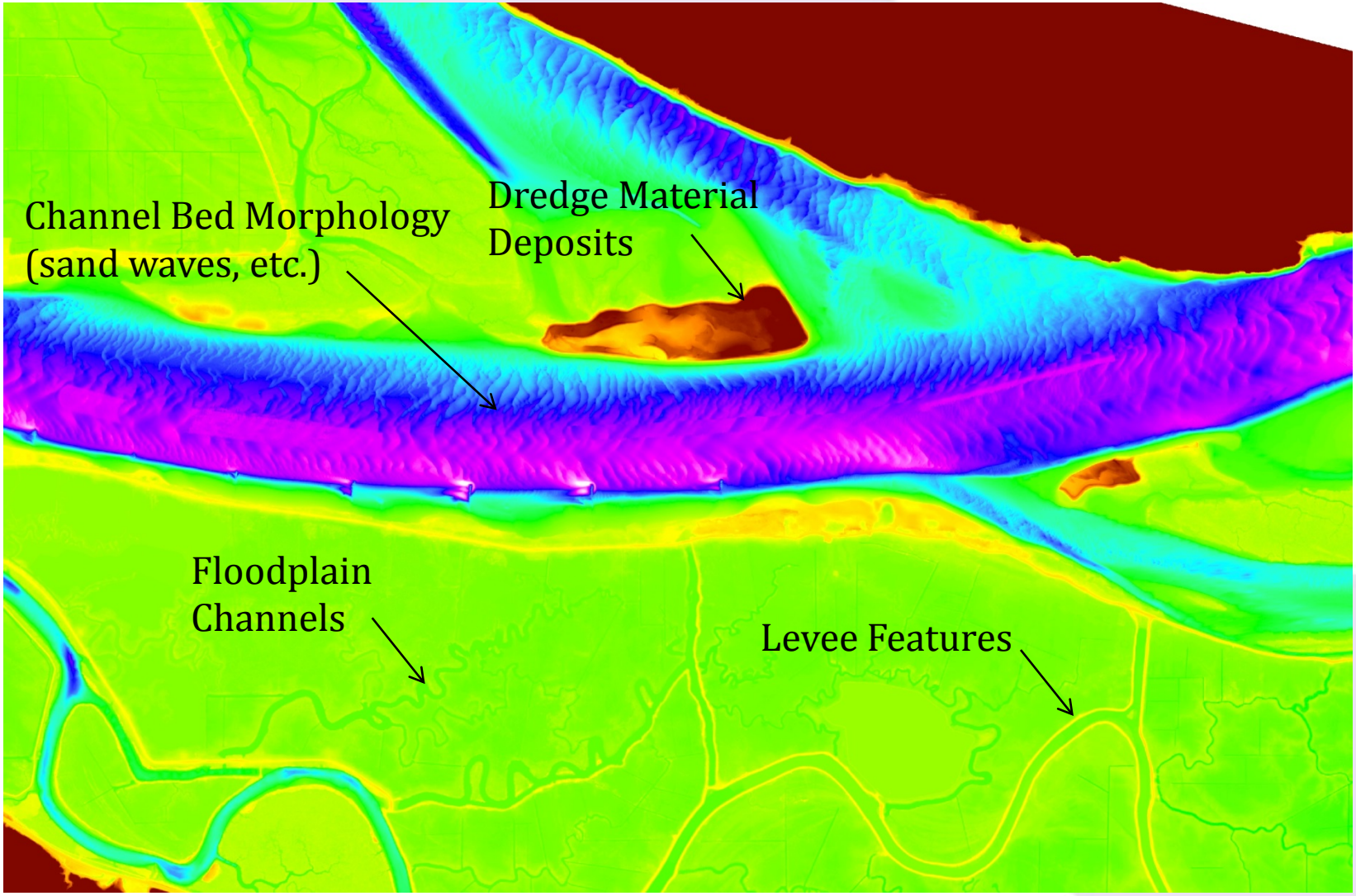


Lower Columbia River Terrain Model

- High resolution elevation data set developed by the US Army Corps of Engineers, in collaboration with the Estuary Partnership.
- Includes the most current LiDAR topographic data and bathymetric data sets.
- Complete coverage of lower Columbia floodplain.

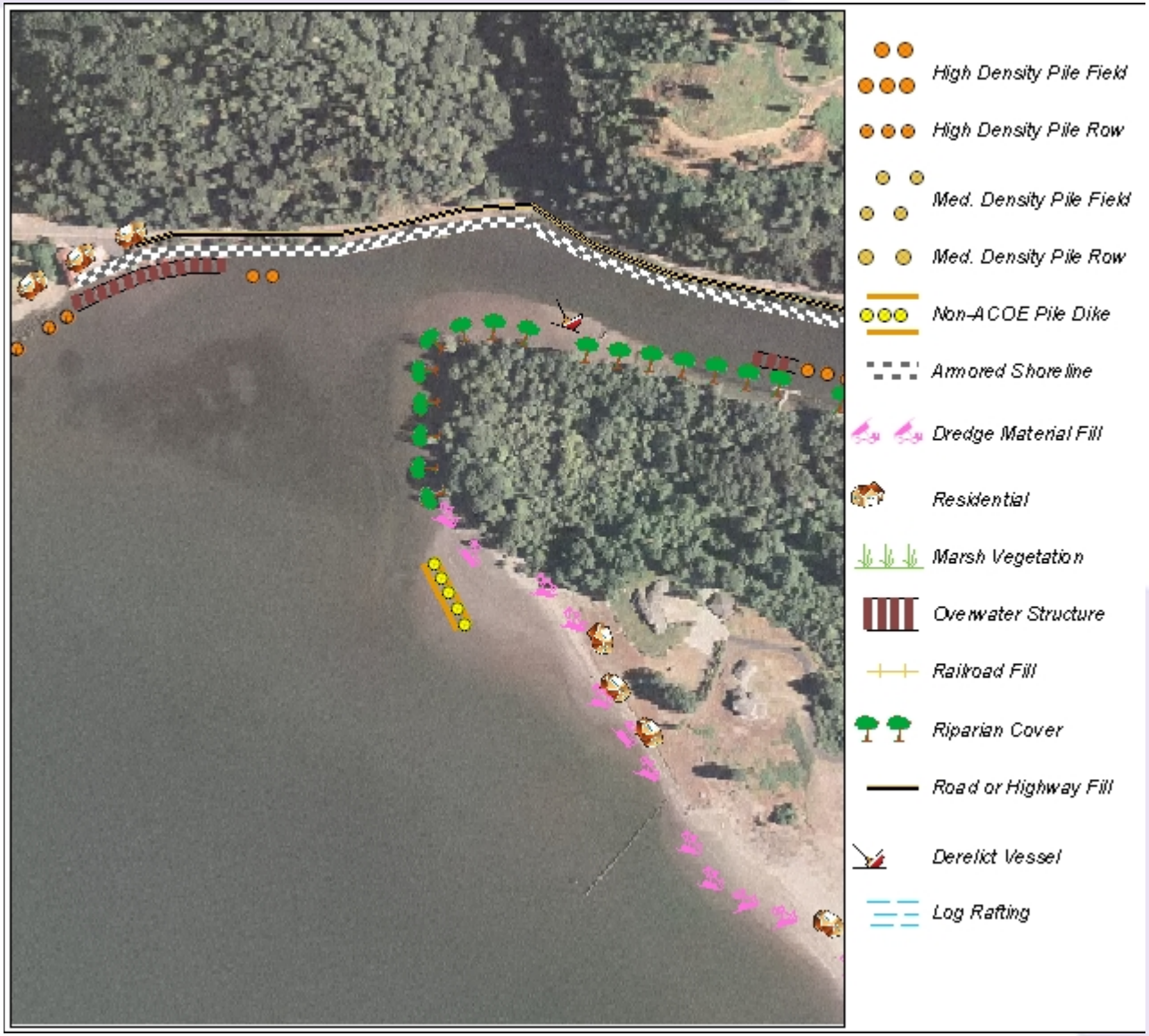
Lower Columbia River Terrain Model



Digital Shoreline Inventory

- Includes approximately 605 miles of georeferenced video collected from July 2005 – October, 2006.
- Approximately 90-95% coverage of the mainstem lower Columbia, and portions of major tributaries including the Youngs, Lewis & Clark, Clatskanie, and Willamette Rivers.
- Viewable in ArcGIS with proprietary add-on tool.
- Converted viewable shoreline information to a geodatabase of line features describing shoreline characteristics.

Digital Shoreline Inventory

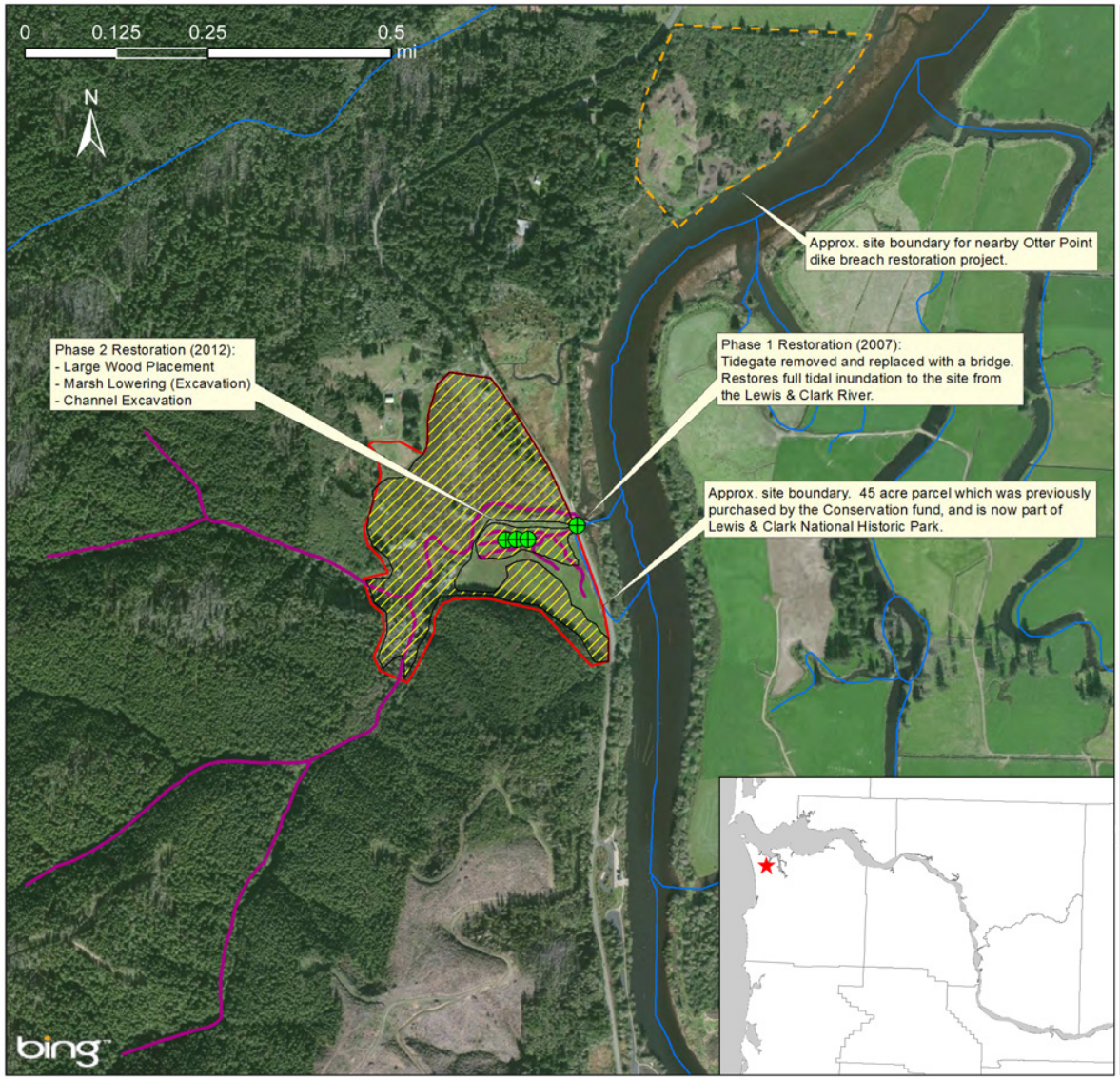


Restoration Project Inventory

- Detailed tracking of all Estuary Partnership restoration activity in geodatabase.
- Includes approximately 75 projects, and additional limited detail for another 175 partner projects.
- Project details include:
  - acres and miles acquired and restored
  - restoration activity types and locations
  - acres of tidal reconnection.
- Accessible online, including project details, available data and reports, and site maps (where available).

Restoration Project Inventory

Sample Restoration Site Map:



Project:
Fort Clatsop/
Colewort Creek

Sponsor: CREST

Phase 1 Restoration Completed in 2007

Phase 2 Restoration Completed in 2012

Site Location:
46.1285 N
123.88052 W

Map Legend

- Approx. Project Boundary
- Location of Restoration Action
- Approx. Area of Affected Acres
- Approx. Boundary of Nearby Restoration Project

USGS NHD Stream Lines:

- Affected by Restoration
- Other Stream

Notes:

Post-restoration effectiveness monitoring has been ongoing.

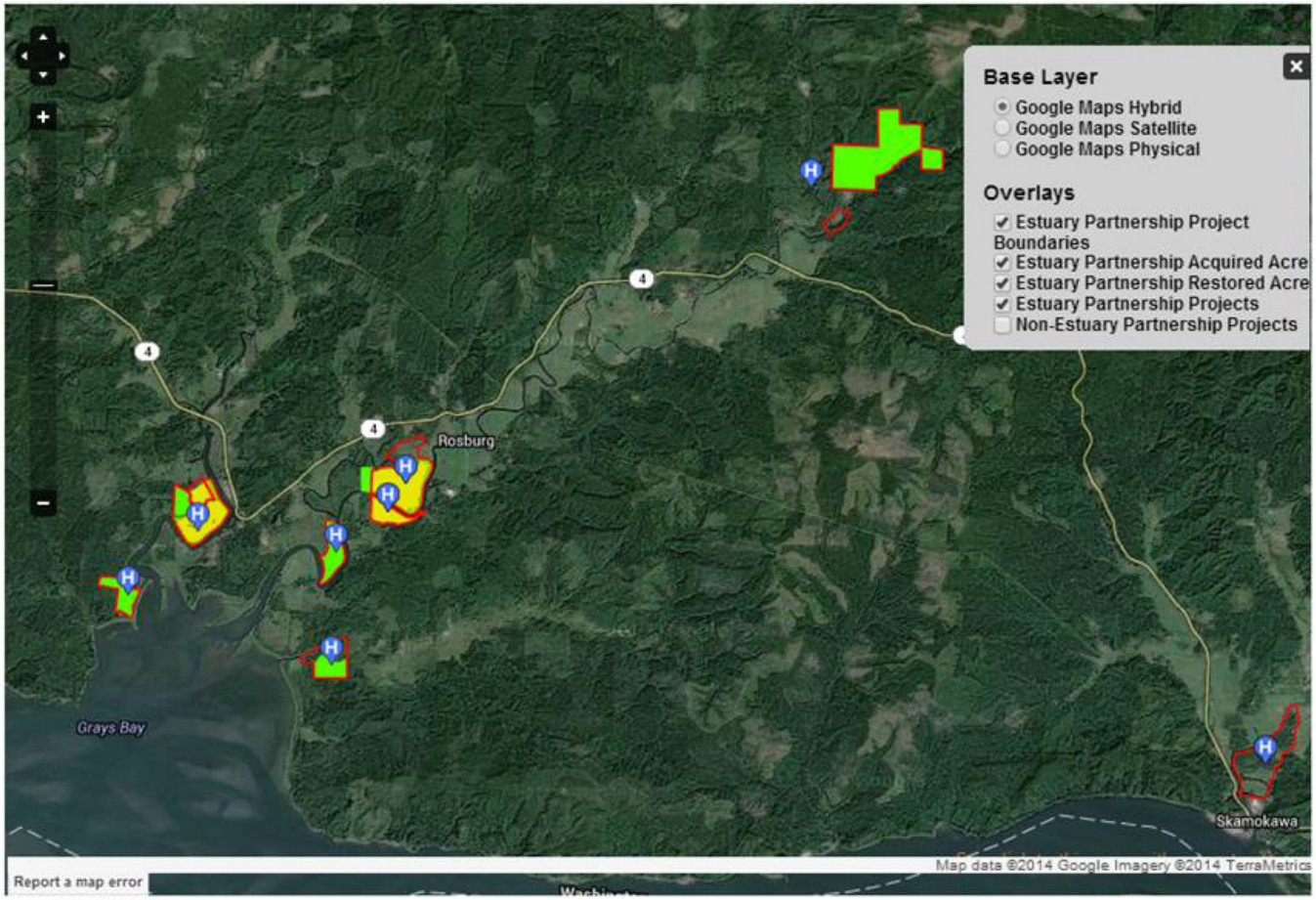
Map created: December 11, 2013

Lower Columbia Estuary Partnership

Restoration Project Inventory

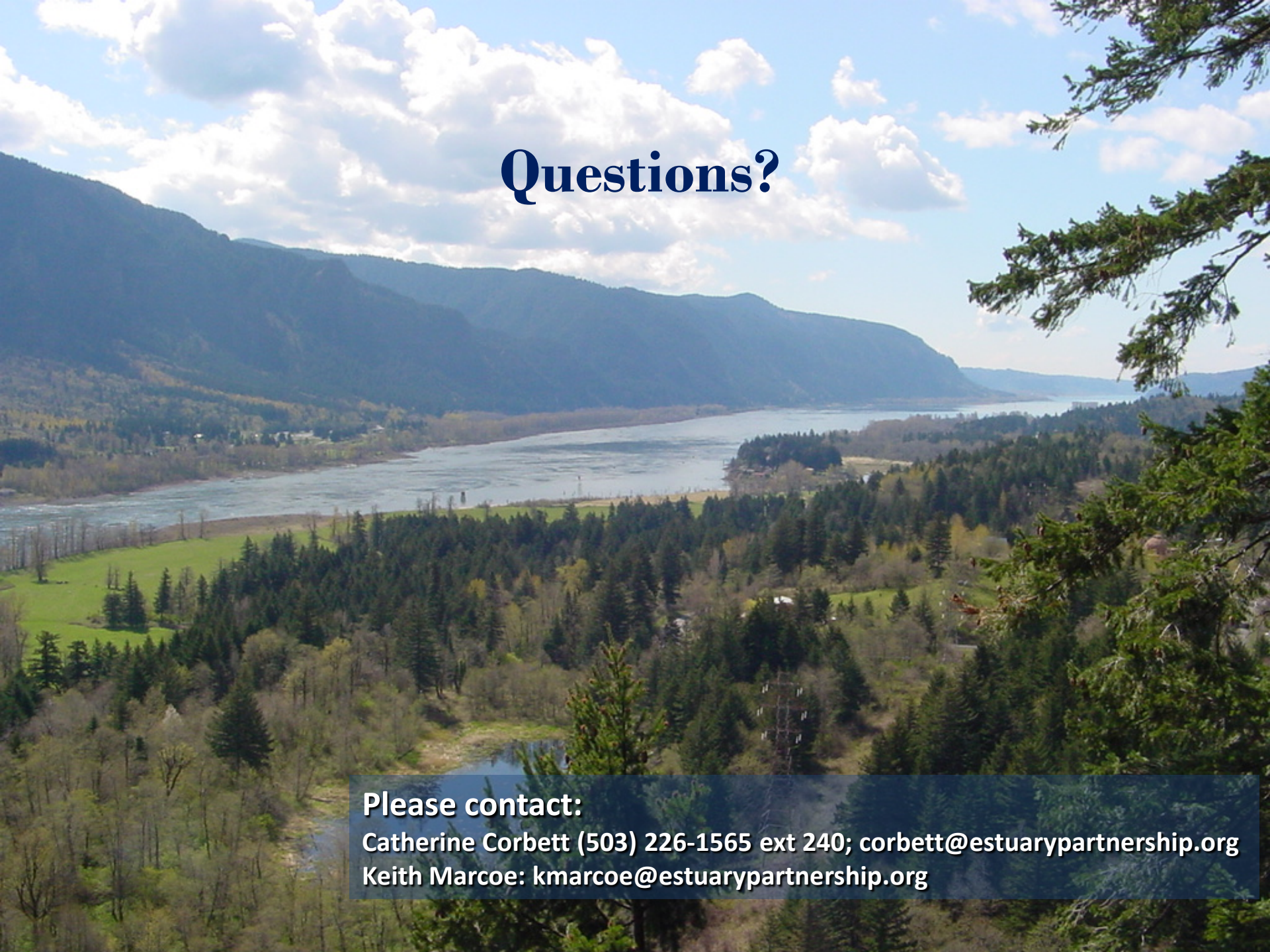
Online Project Inventory:

Map - Habitat Restoration



About This Map

This map includes all habitat restoration projects within the Estuary Partnership study area for which we have compiled information. Specific project details may be obtained by clicking on a desired project icon. By using the filter categories to the right of the map, users can isolate projects associated with desired metrics.



Questions?

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