



Columbia River Ecosystem Classification— Overview

**Jim O'Connor, Charles Cannon, Krista Jones,
Ian Waite, Tim Counihan, USGS**

**Charles Simenstad, Jennifer Burke, Danelle
Heathole, Mary Ramirez, University of
Washington**

**Keith Marcoe, Lower Columbia River Estuary
Partnership**

Prepared in cooperation with the University of Washington and the Lower Columbia River Estuary Partnership

Columbia River Estuary Ecosystem Classification— Concept and Application



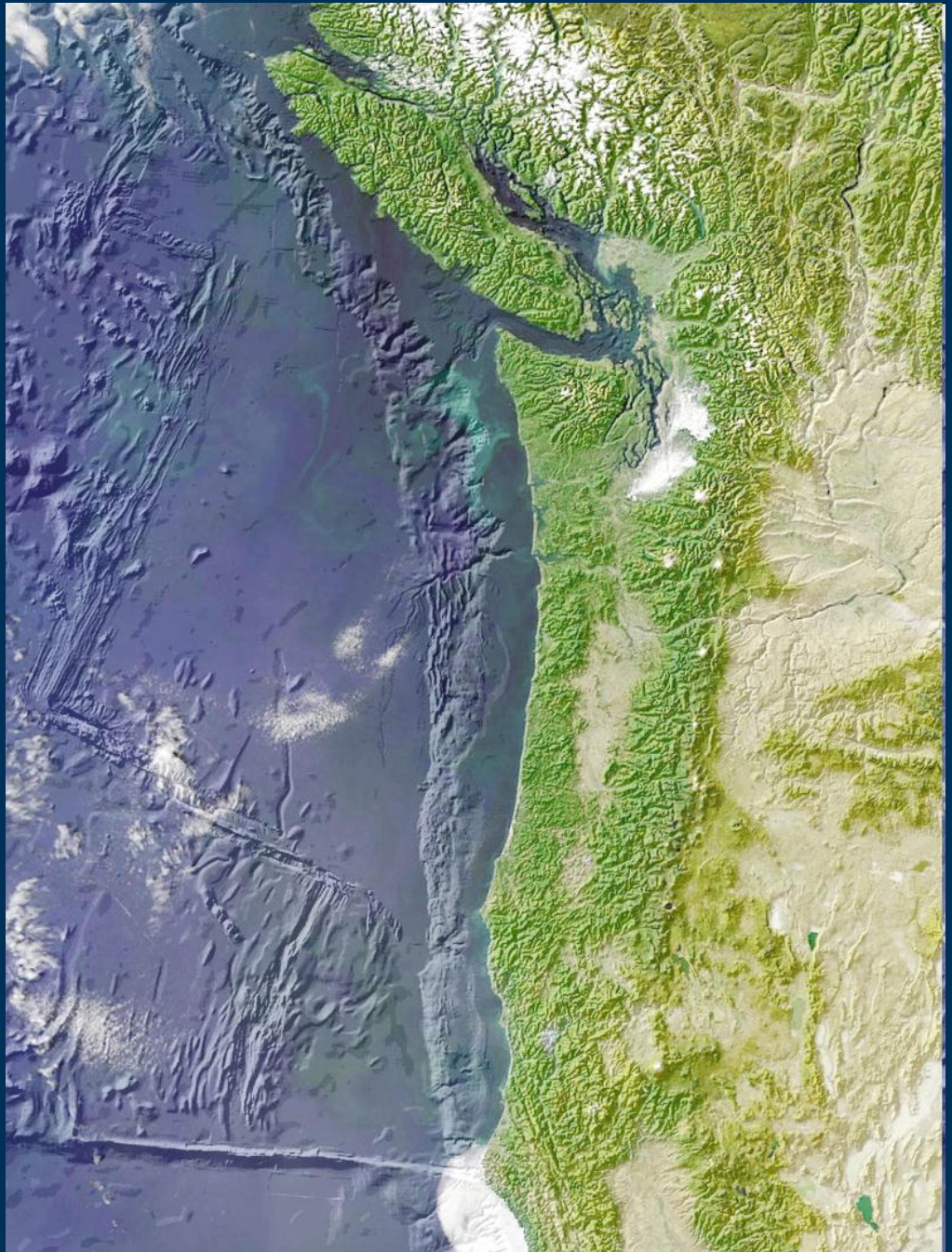
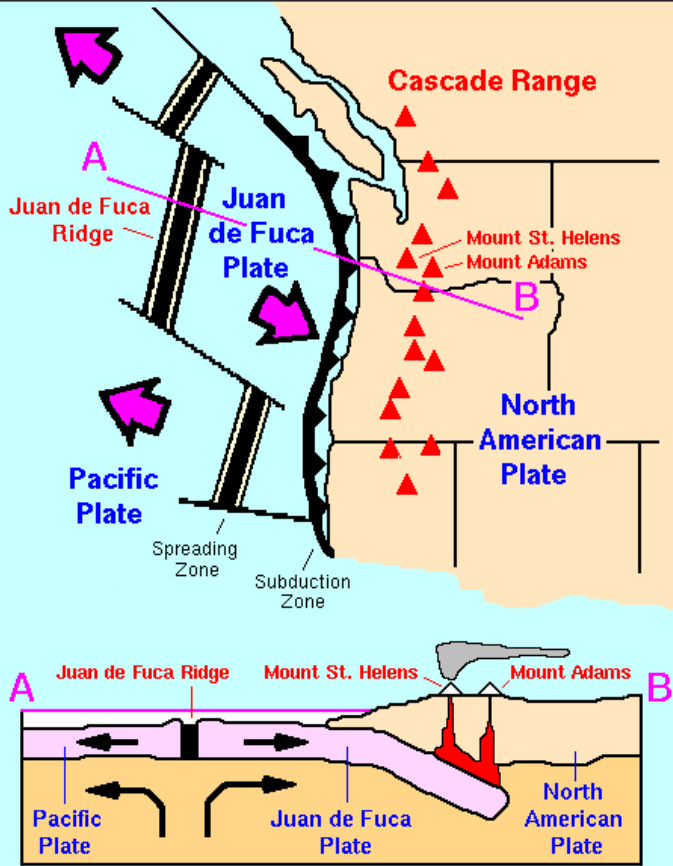
Open-File Report 2011–1228

“...a hierarchical ecosystem classification that integrates saline and tidal freshwater reaches of estuaries in order to characterize the ecosystems of large flood plain rivers that are strongly influenced by riverine and estuarine hydrology.”

Resulting in six-level mapping of 230 km of Columbia River channel and floodplain in a manner that relates channel and floodplain features to formative processes.

1. Ecosystem Province
 2. Ecoregion
 3. Hydrogeomorphic Reach (geologic env.)
 4. Ecosystem Complex (process domains)
 5. Geomorphic Catena (landform patches)
 6. Primary Cover Class (surface cover)
- 
- Level II and III Ecoregions,
after Bailey and Omernik

Plate Tectonics – Cascade Range



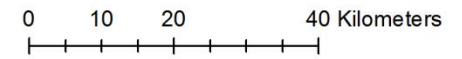
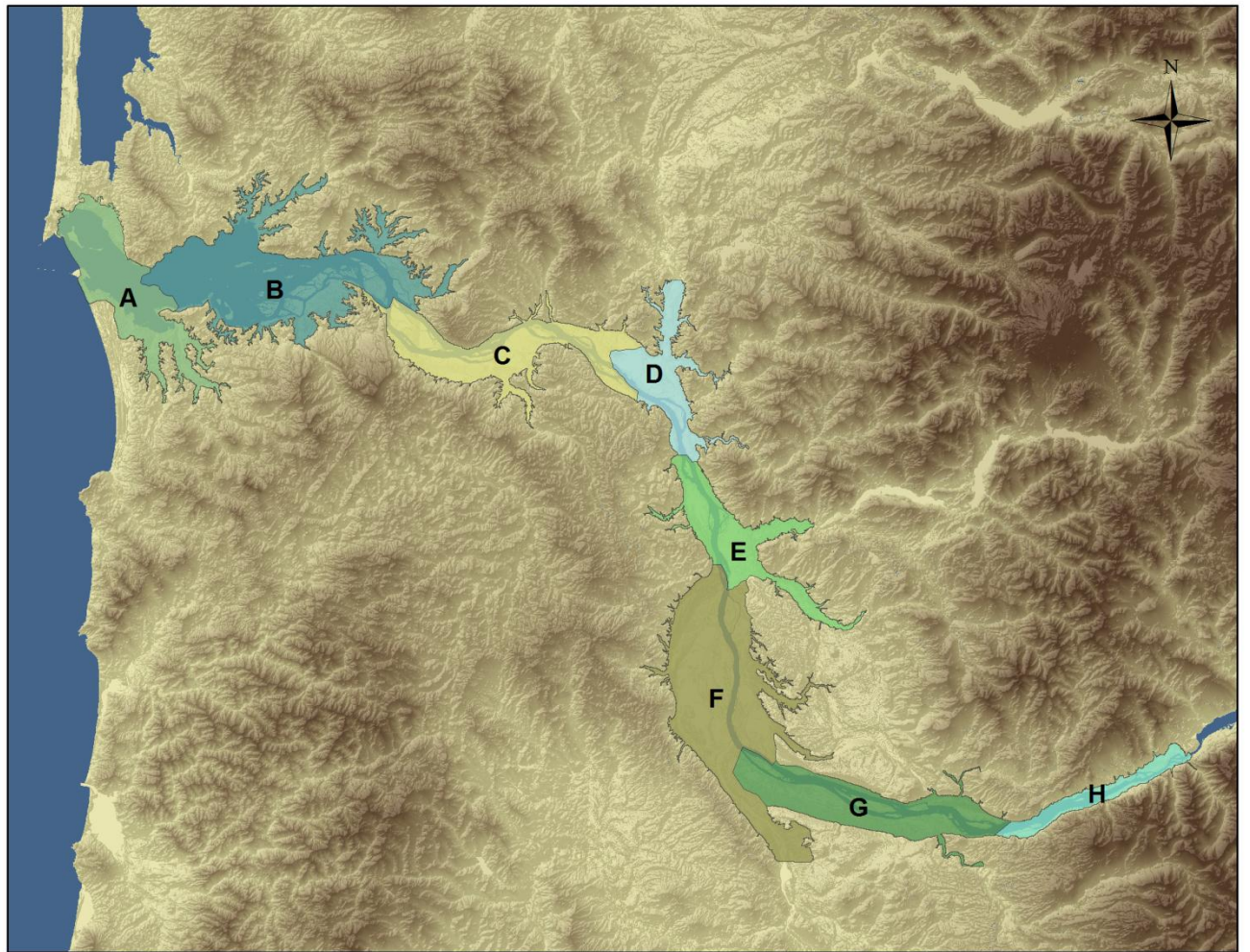
Topinka, USGSICVD, 1999, Modified from: Tilling, 1985, Volcanoes: USGS General Interest Publication







Hydrogeomorphic Reaches



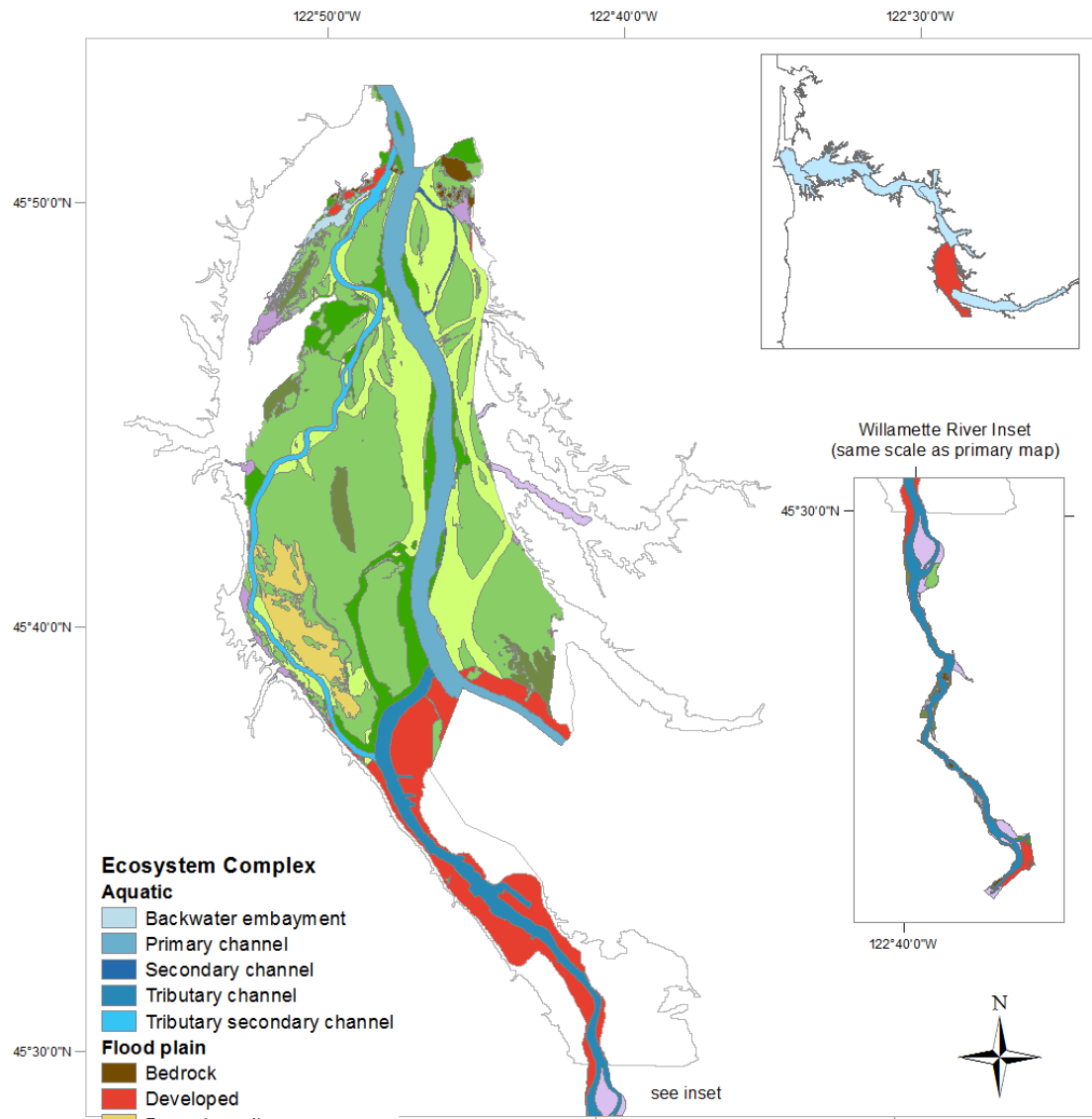
- Hydrogeomorphic Reach**
- A - Coastal Lowlands Entrance-Mixing
 - B - Coastal Uplands Salinity Gradient
 - C - Volcanics Current Reversal
 - D - Western Cascades Tributary Confluences
 - E - Tidal Flood Plain Basin Constriction
 - F - Middle Tidal Flood Plain Basin
 - G - Upper Tidal Flood Plain Basin
 - H - Western Gorge

Columbia River Estuary Ecosystem Classification Level 3 Hydrogeomorphic Reaches

Map created by M.F. Ramirez and C.A. Simenstad,
University of Washington, School of Aquatic and Fishery Sciences,
Data Source: Digital elevation model courtesy of USGS.
Outline boundary courtesy of Earth Design Consultants, Inc.

Ecosystem Complexes

Process Domains



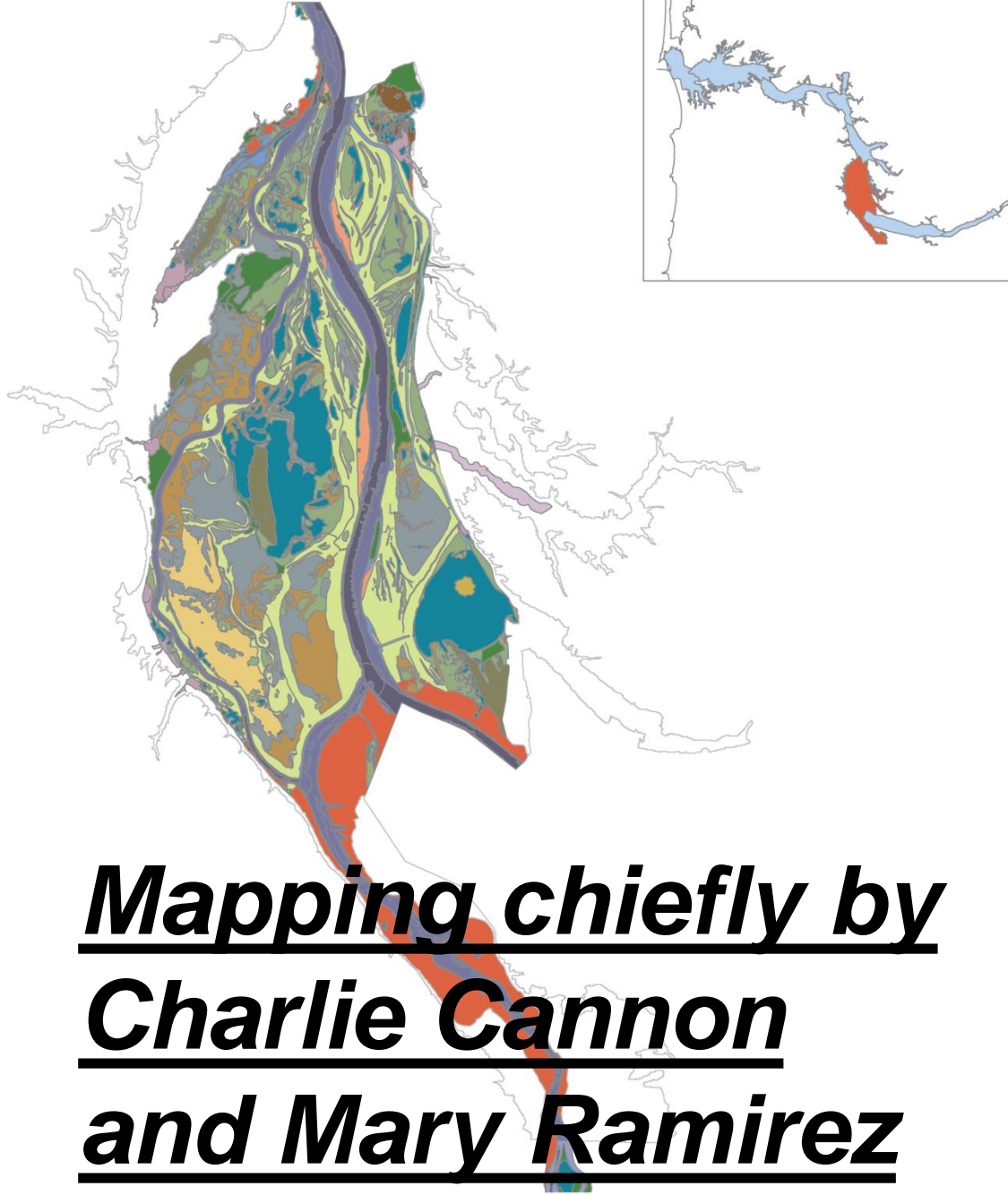
**Columbia River Estuary Ecosystem Classification
Level 4 Ecosystem Complex**

Map created by C. Cannon and J. O'Connor, U.S. Geological Survey;
D.W. Heatwole and C.A. Simenstad, University of Washington,
School of Aquatic & Fishery Sciences





Geomorphic Catenae



Mapping chiefly by
Charlie Cannon
and Mary Ramirez

Landforms

3. Hydrogeomorphic Reach (geotectonic env.)

--tectonic and geologic events and processes of the last few thousand to several million years

4. Ecosystem Complex (process domain)

--processes and events of the last few hundred to thousands of years

5. Geomorphic Catena (landform)

--processes and events of the last few decades to hundreds of years

6. Primary Cover Class (surface cover)

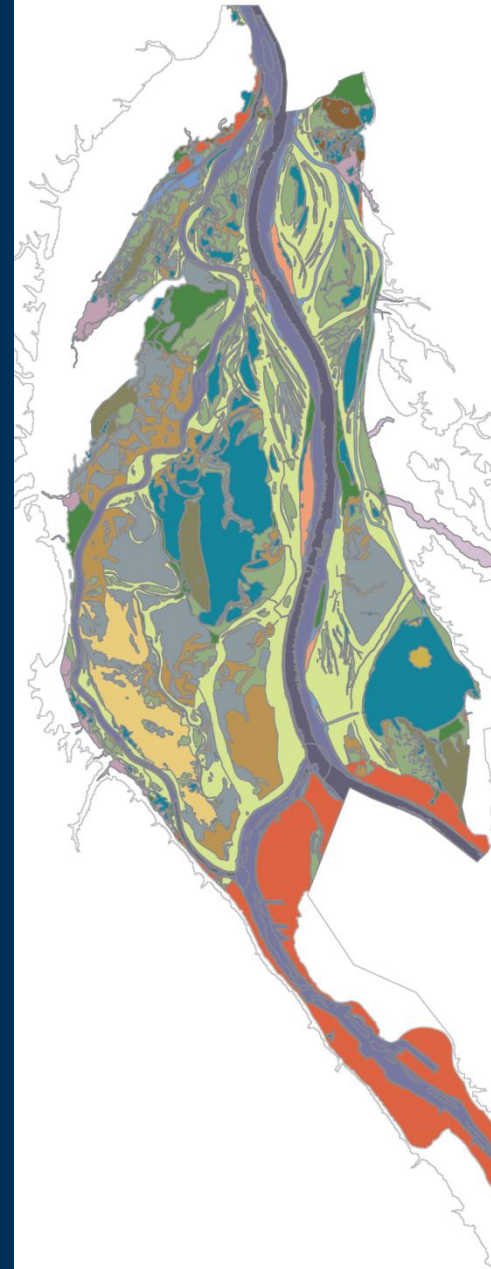
--current vegetative conditions

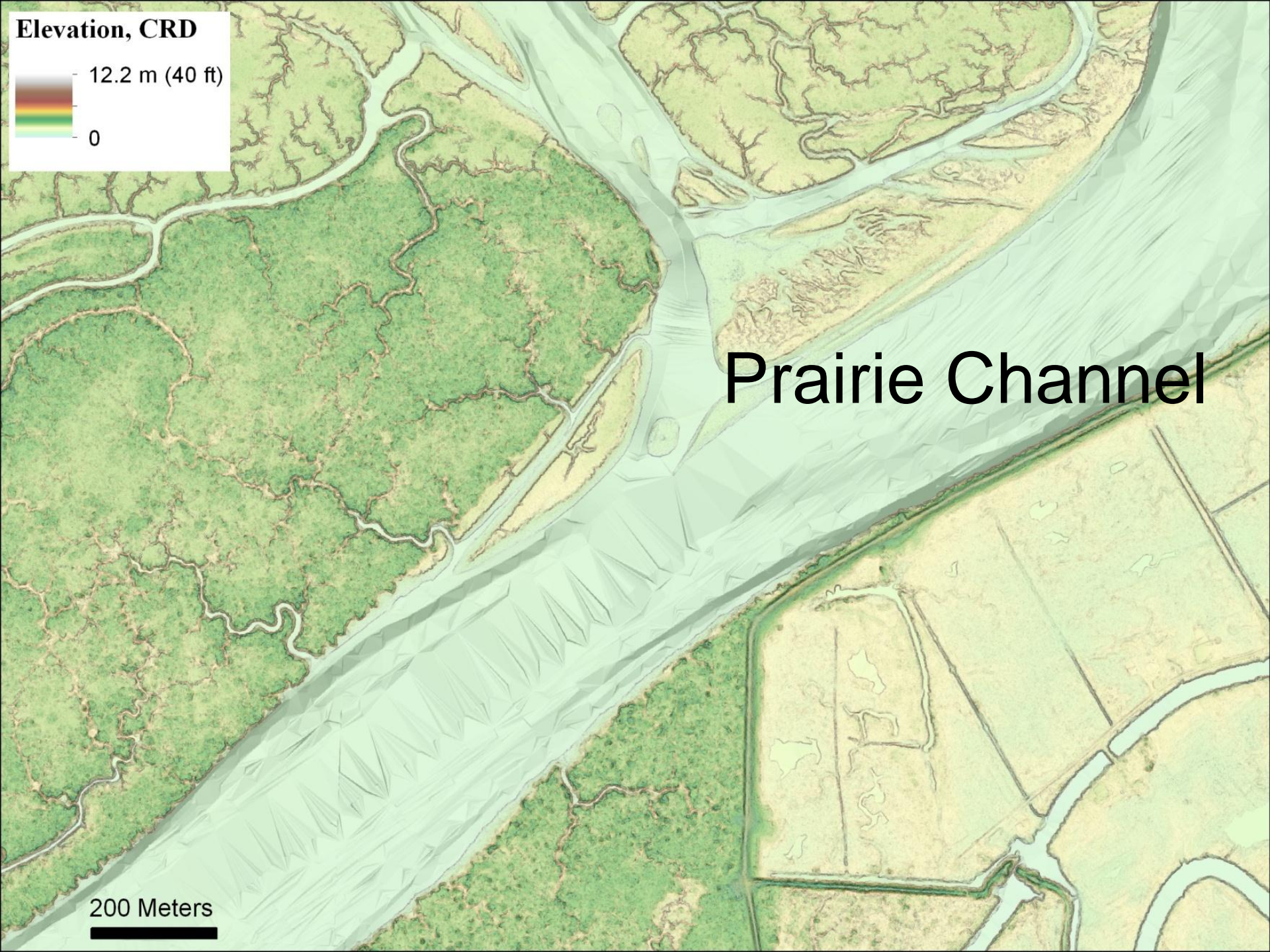
Aquatic:

Mainly *rule-based* on basis of bathymetry

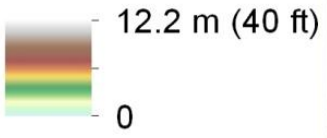
Terrestrial (and Anthropogenic):

Interpretative on basis of topography, soils, geology, and aerial photography



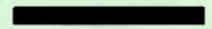


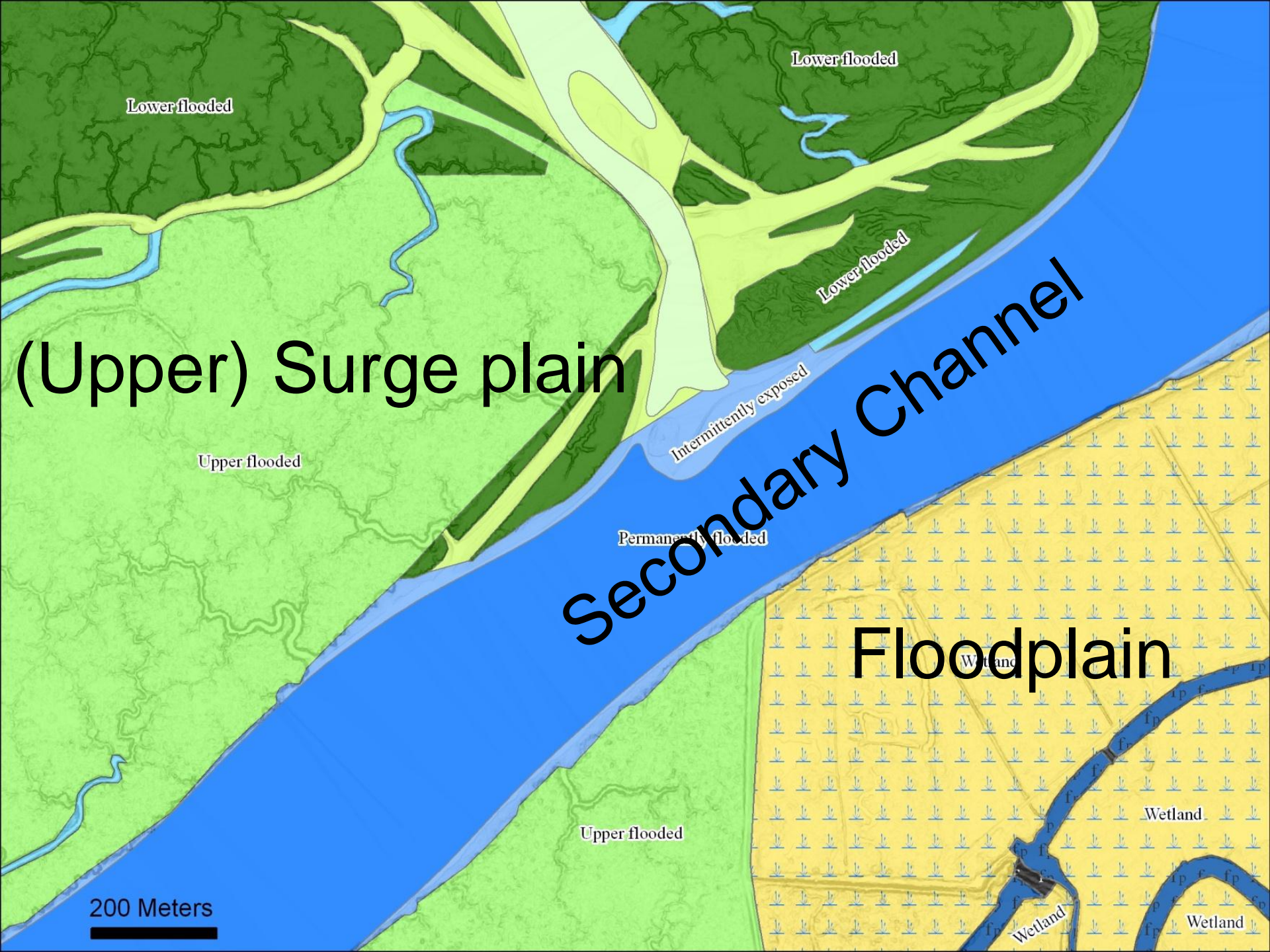
Elevation, CRD



Prairie Channel

200 Meters





Lower flooded

Lower flooded

Lower flooded

(Upper) Surge plain

Upper flooded

Intermittently exposed

Secondary Channel

Permanently flooded

Floodplain

Wetland

Wetland

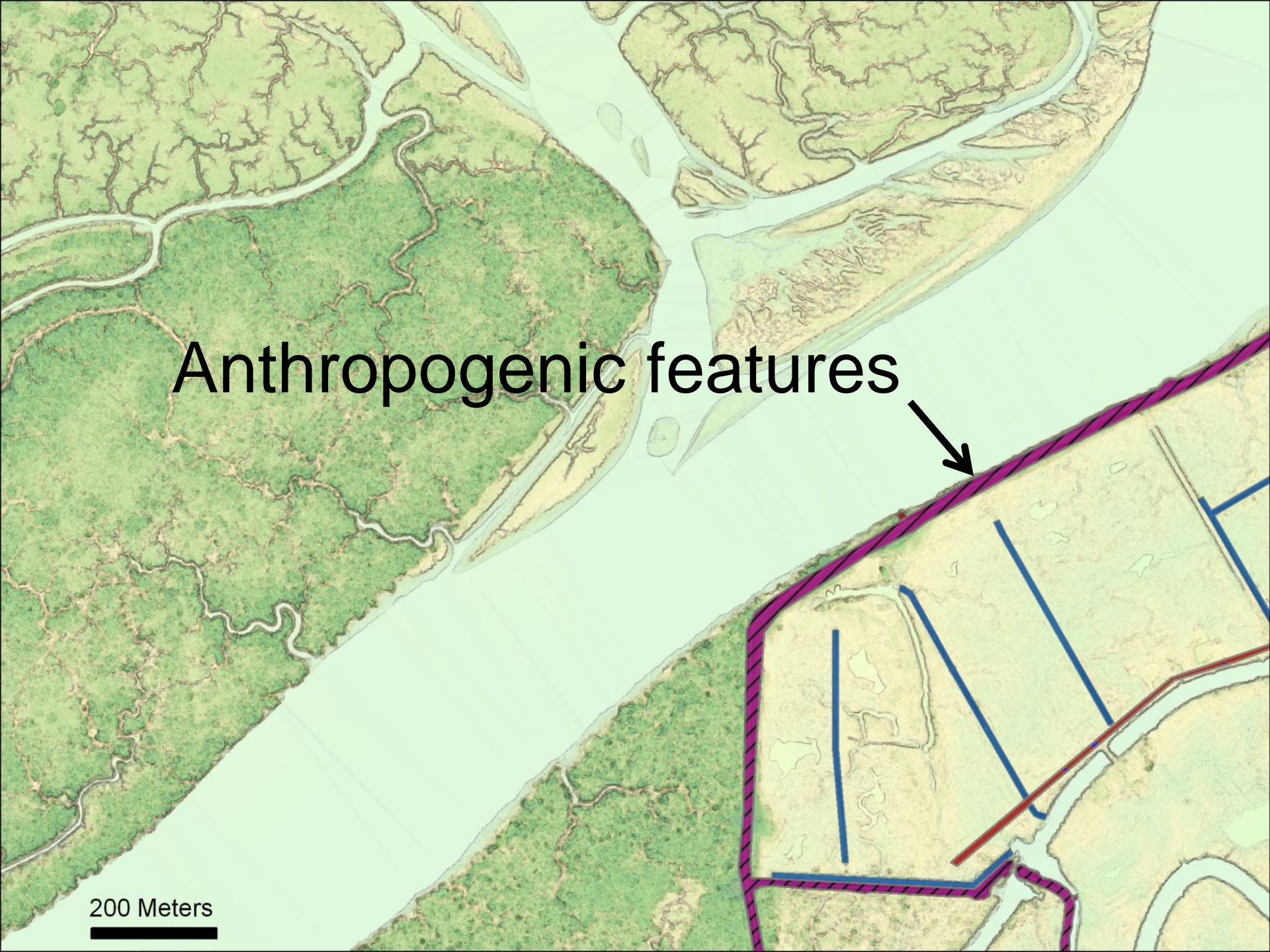
Wetland

Wetland

200 Meters

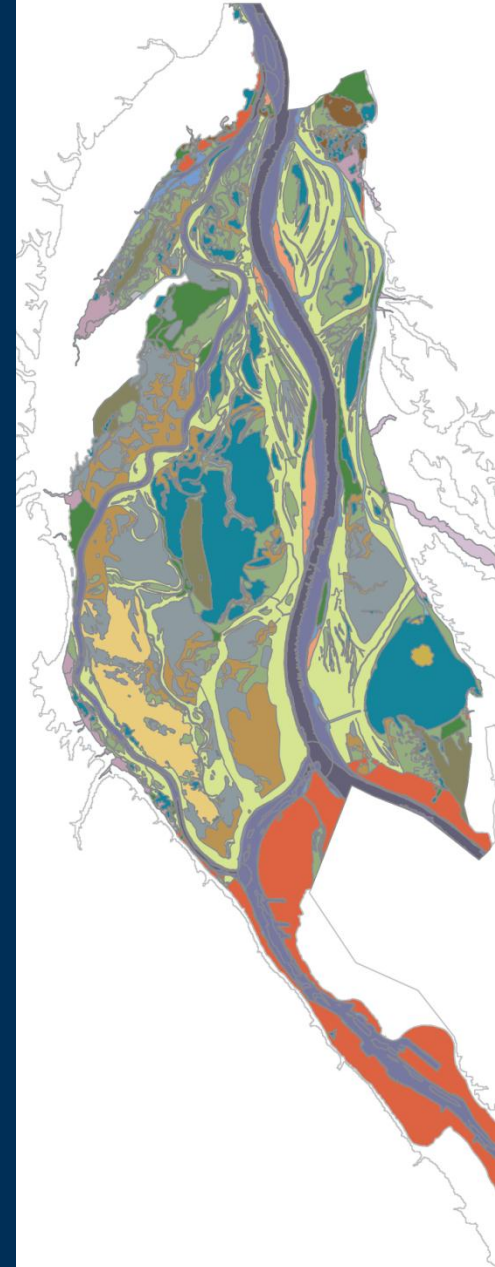
Anthropogenic features

200 Meters

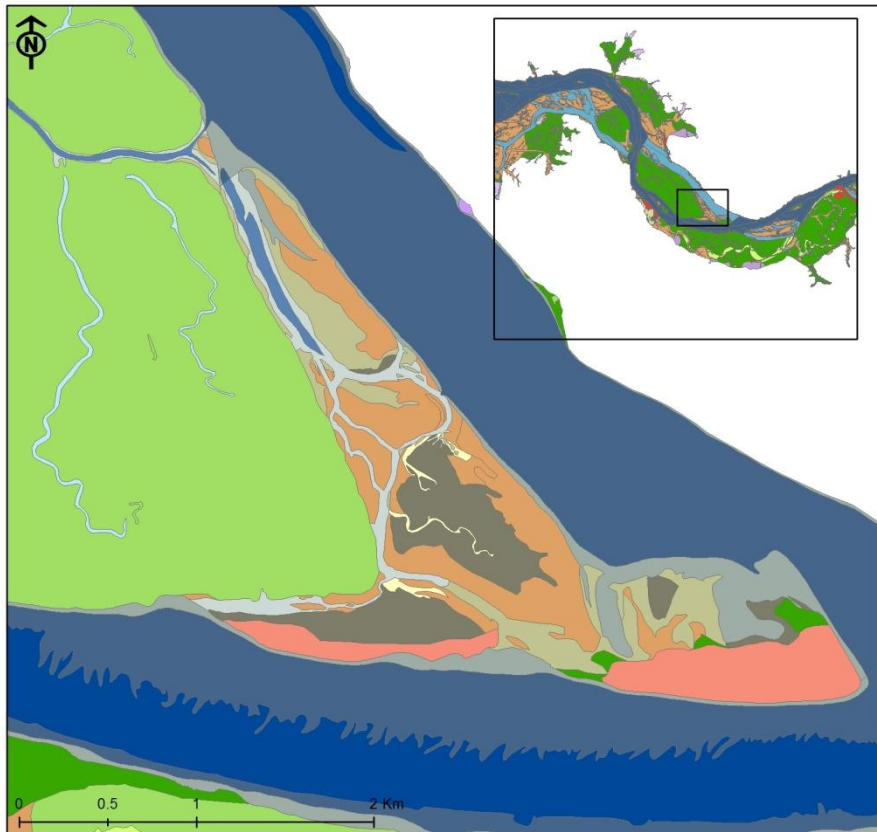


A basis for monitoring

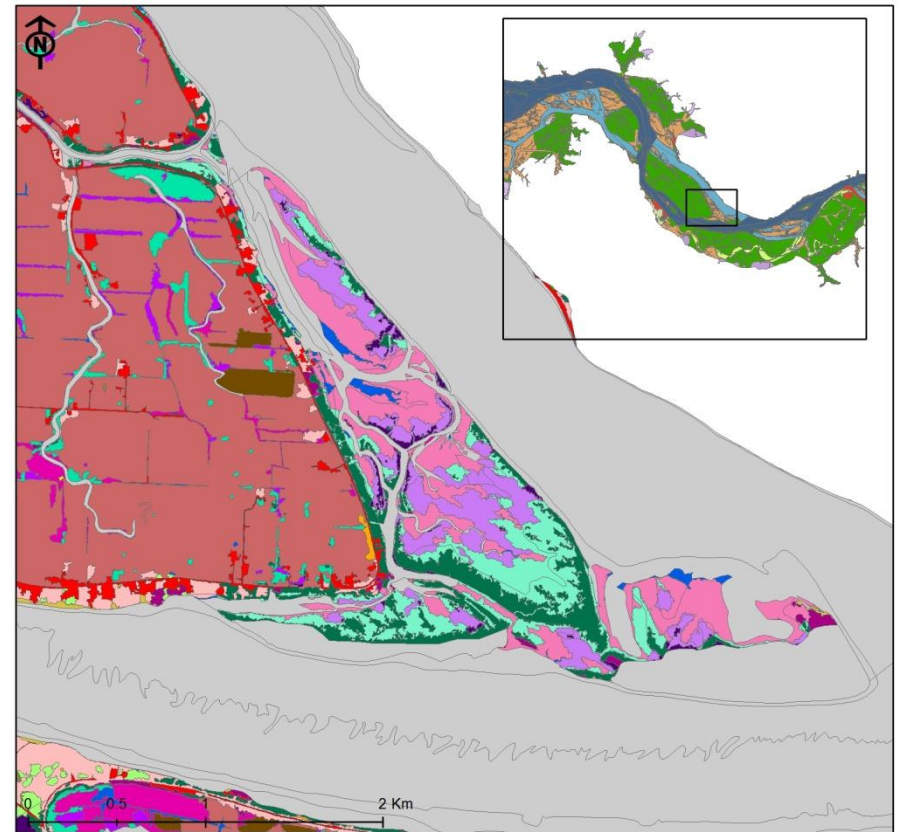
- A census of current conditions
- A process-based framework for sampling and analysis



A basis for analysis



Geomorphic Catena



Landcover Class

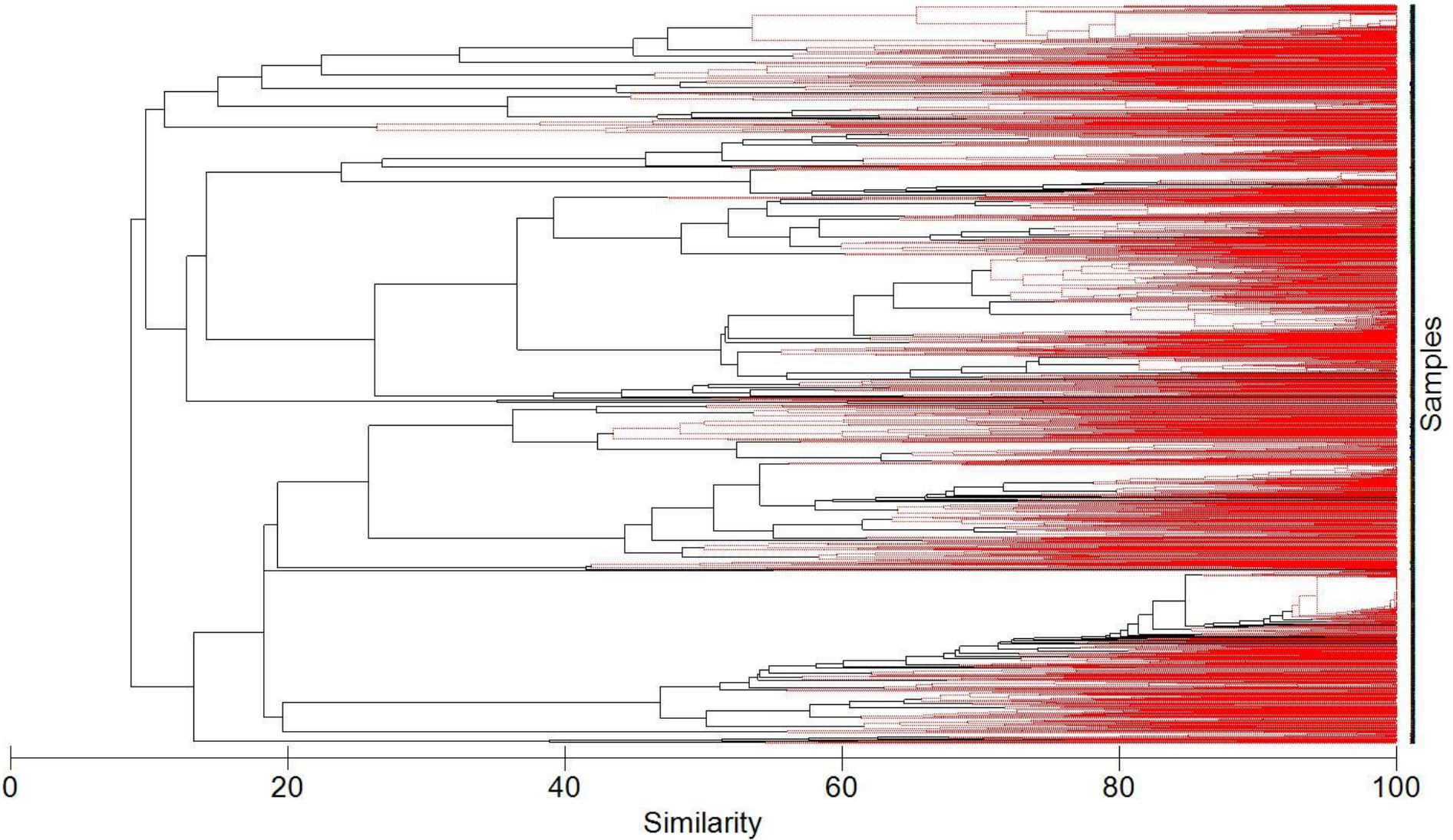


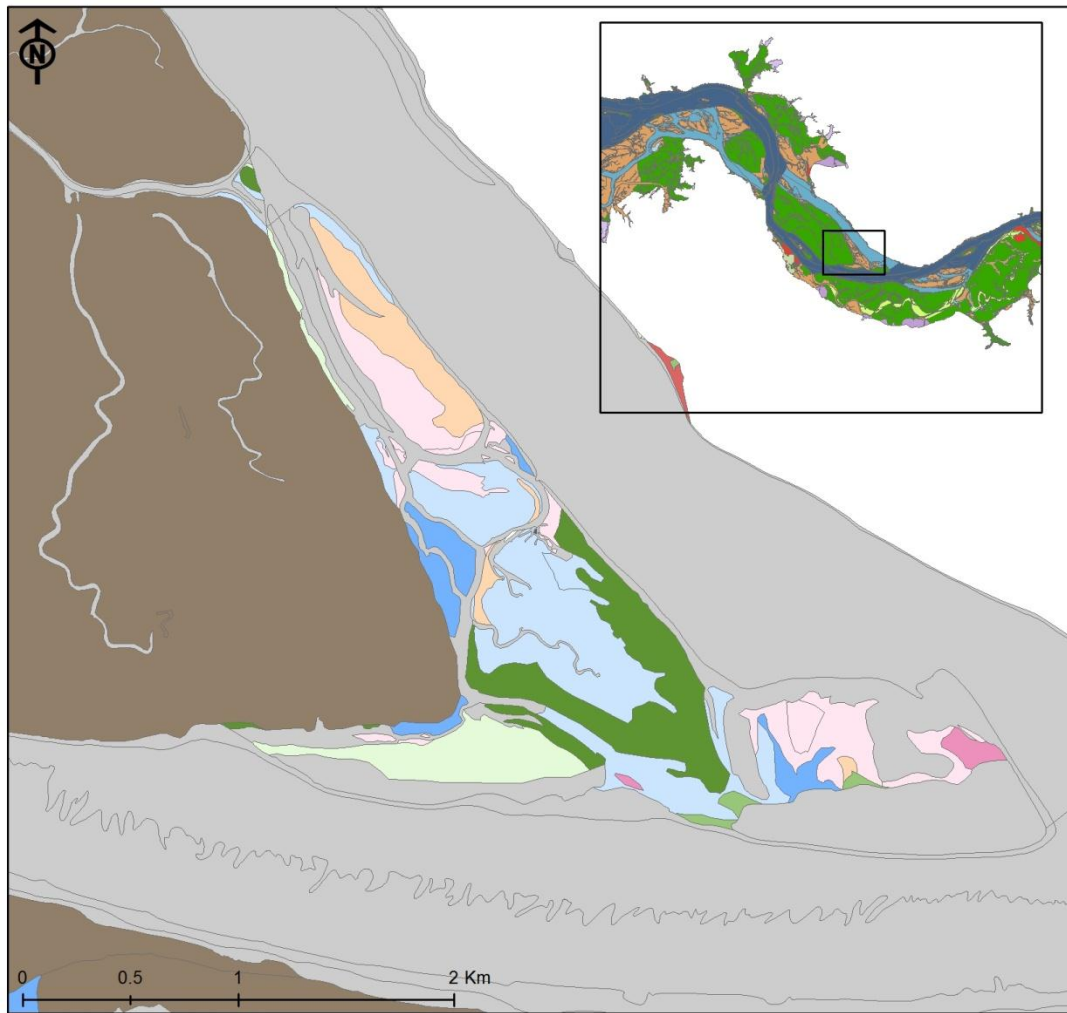
Cluster dendrogram for 'Wetland' polygons (samples)

- A total of 1730 Wetland samples were analyzed for their proportional composition of land cover classes.
- Hierarchical clustering separates samples into statistically distinct groups (solid black lines) through the 'Similarity Profile' permutation test (SIMPROF).

Group average

Transform: Square root
Resemblance: S17 Bray Curtis similarity





<ul style="list-style-type: none"> ■ Catena not included in Subcatena Analysis 	<ul style="list-style-type: none"> ■ Herbaceous non-wetland ■ Herbaceous wetland ■ Herbaceous wetland - non-tidal ■ Herbaceous wetland - tidal ■ Herbaceous wetland - diked ■ Scrub-shrub non-wetland ■ Scrub-shrub wetland ■ Scrub-shrub wetland - non-tidal ■ Scrub-shrub wetland - tidal ■ Scrub-shrub wetland - diked ■ Mixed non-wetland forest ■ Mixed wetland forest ■ Mixed wetland forest - non-tidal 	<ul style="list-style-type: none"> ■ Mixed non-wetland vegetation ■ Mixed wetland vegetation ■ Mixed wetland vegetation - non-tidal ■ Mixed wetland vegetation - tidal ■ Mixed wetland vegetation - diked ■ Aquatic vegetation ■ Unvegetated ■ Unvegetated - mud ■ Unvegetated - sand ■ Open water ■ Agriculture ■ Developed ■ Unclassified
---	---	--

Subcatena
 --coherent
 groupings of
 catenae
 (landforms)
 and cover
 types

1. Ecosystem Province

2. Ecoregion

Level II and III Ecoregions,
after Bailey and Omernik

3. Hydrogeomorphic Reach (geologic env.)

4. Ecosystem Complex (process domains)

5. Geomorphic Catena (landform patches)

6. Primary Cover Class (surface cover)

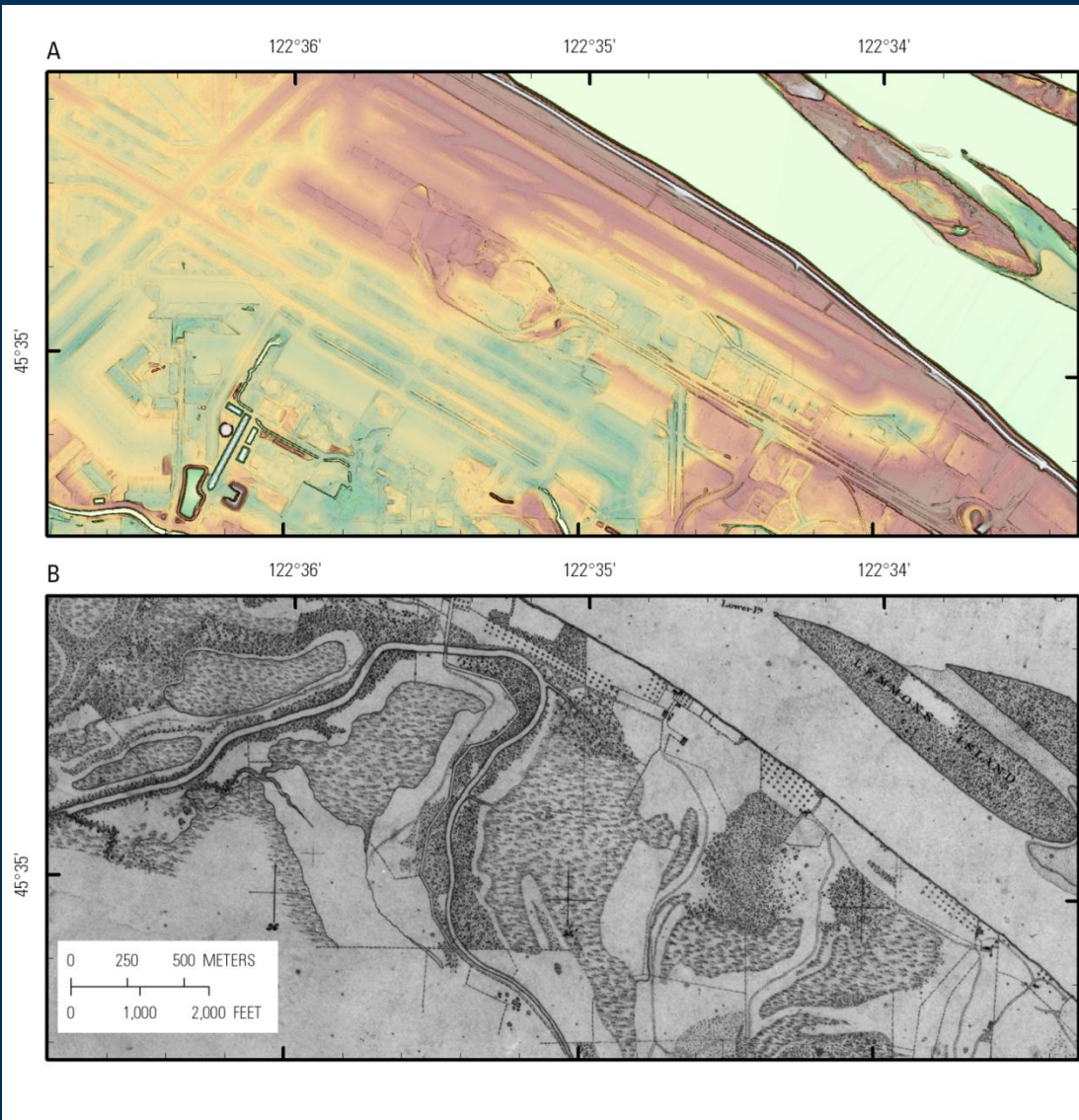
7. Subcatena (landform-cover groupings)

8. Fish Catena (habitat units)

9. ??

Better understand alterations

- Historical analysis
- Direct findings



123°34'20"

123°34'10"

123°34'

123°33'50"

123°33'40"

123°33'30"

46°13'

46°12'50"

46°12'40"

46°12'30"

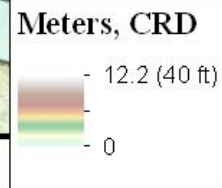
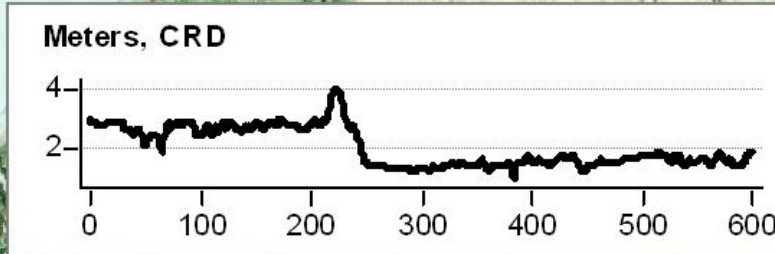
Prairie Channel

subsidized floodplain

Floodplain

Surge plain

tidal floodplain



1:10,000

Relate places to processes

- ...relic processes or events
(volcanism, landslides)
- ...historical processes
(large floods, channel migration)
- ...ongoing processes
(smaller floods, sed. loads, dredging, diking)
- ...changes in process regime
(flow, sediment, sea level)

Status

- Concept published (open-file 2011-1228)
<http://pubs.usgs.gov/of/2011/1228/>
- Mapping in review (available Summer, 2012)
- Summary report; 2013
- Many future options...

