An Ecological Framework for Reviewing Compensatory Mitigation

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Some Sites Have Obvious Constraints

Some Are Less Straightforward

Lots of Guidance

Compensatory Mitigation Plan Requirements
For
Permittee Responsible Mitigation Projects
Kansas City District, Corps of Engineers
January 2010

US Army Corps of Engineers
New England District

NEW ENGLAND DISTRICT COMPENSATORY MITIGATION GUIDANCE

US Army Corps of Engineers

125XX-SPD
REGULATORY PROGRAM
STANDARD OPERATING PROCEDURE
FOR EVALUATION OF PROPOSED
COMPENSATORY MITIGATION SITES

South Pacific Division

REVISIONS SHEET

NO.	DATE	DESCRIPTION	NOTES
0	MM.DD.2014	Initial Version	

Table of Contents

1.0 Purpose: The purpose of this document is to outline the process for evaluating compensatory mitigation sites as required for processing of Department of the Army (DA) permits, mitigation bank prospectuses, and in lieu fee (ILF) mitigation plans under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, and Section 103 of the Marine Protection, Research, and Sanctuaries Act.

2.0 Applicability. This process applies to the Regulatory Program within South Pacific Division (SPD), including its four subordinate districts, Albuquerque District (SPA), Sacramento District (SPK), Los Angeles District (SPL), and San Francisco District (SPN). Subordinate offices or organizations shall not modify this procedure to form a specific procedure. This

Current Approved Version: MM.DD 2014. Printed copies are for "Information Only." The controlled version resides on the SPD QMS SharePoint Portal.

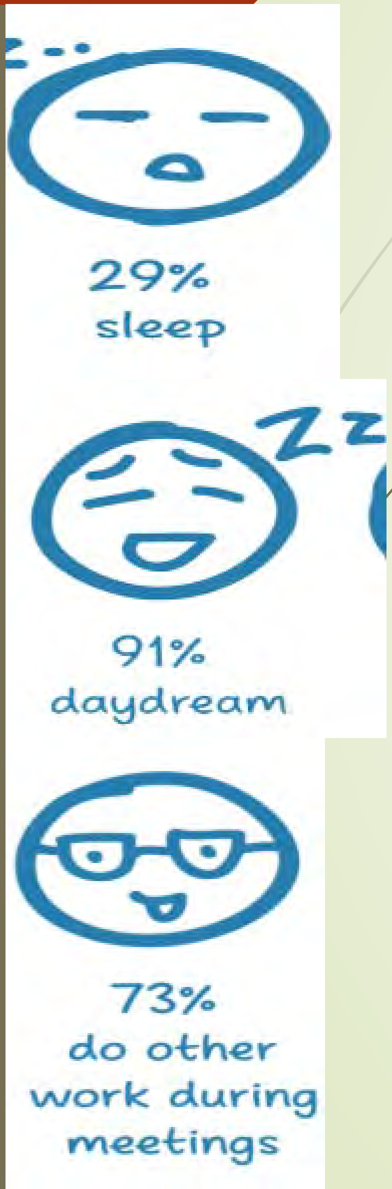
The U.S. Army Corps of Engineers' Guidance for Compensatory Mitigation and Mitigation Banking in the Omaha District

Generally focus on structure vs. process or function

Webinar Goals . . .

- ✓ Understand design elements that lead to sustainable ecological processes
- ✓ Know what to look/ask for when reviewing restoration/mitigation plans

Main Messages

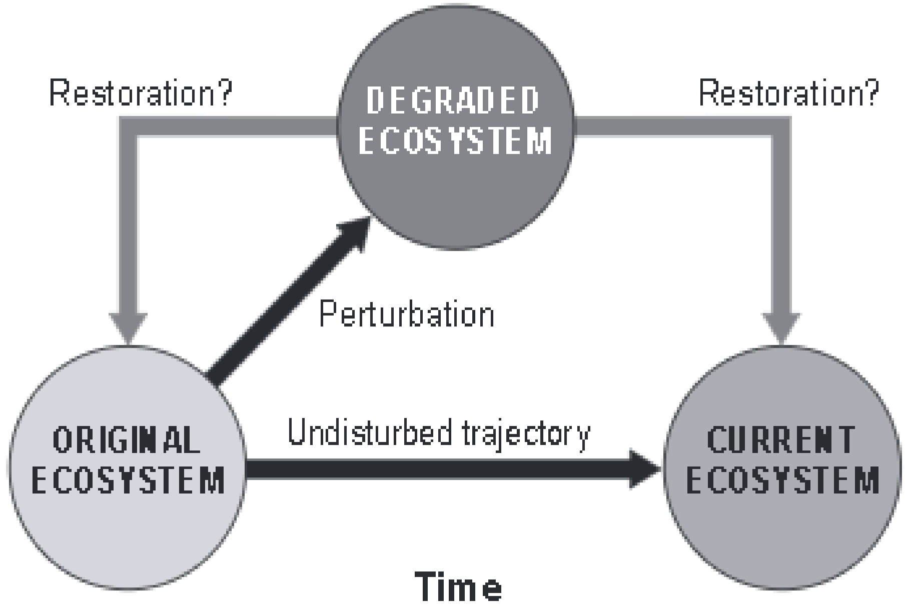


- Landscape setting drives ecological processes in wetlands.
- Wetland function reflects the integration of past and present landscape setting
- Planning successful mitigation projects begins and ends with ensuring appropriate landscape connections
- Resiliency of mitigation must consider current and likely future landscape processes

Caveats and Considerations

- Move beyond *landscape setting* to ensuring ***landscape connection***
- Wetland typology matters in determining appropriate landscape connections
- Respect and understand the past, but you cannot recreate the past – ***don't try***!
- You may not be able to achieve "reference" condition – ***set reasonable expectations***!
- Restoring upland processes is often an important c
- Things may not always go as planned
  - be prepared for only partial achievement of desired func
  - embrace adaptive restoration and ***take the "long view***"

Focus is on wetlands. Similar concepts apply for streams, with some important differences



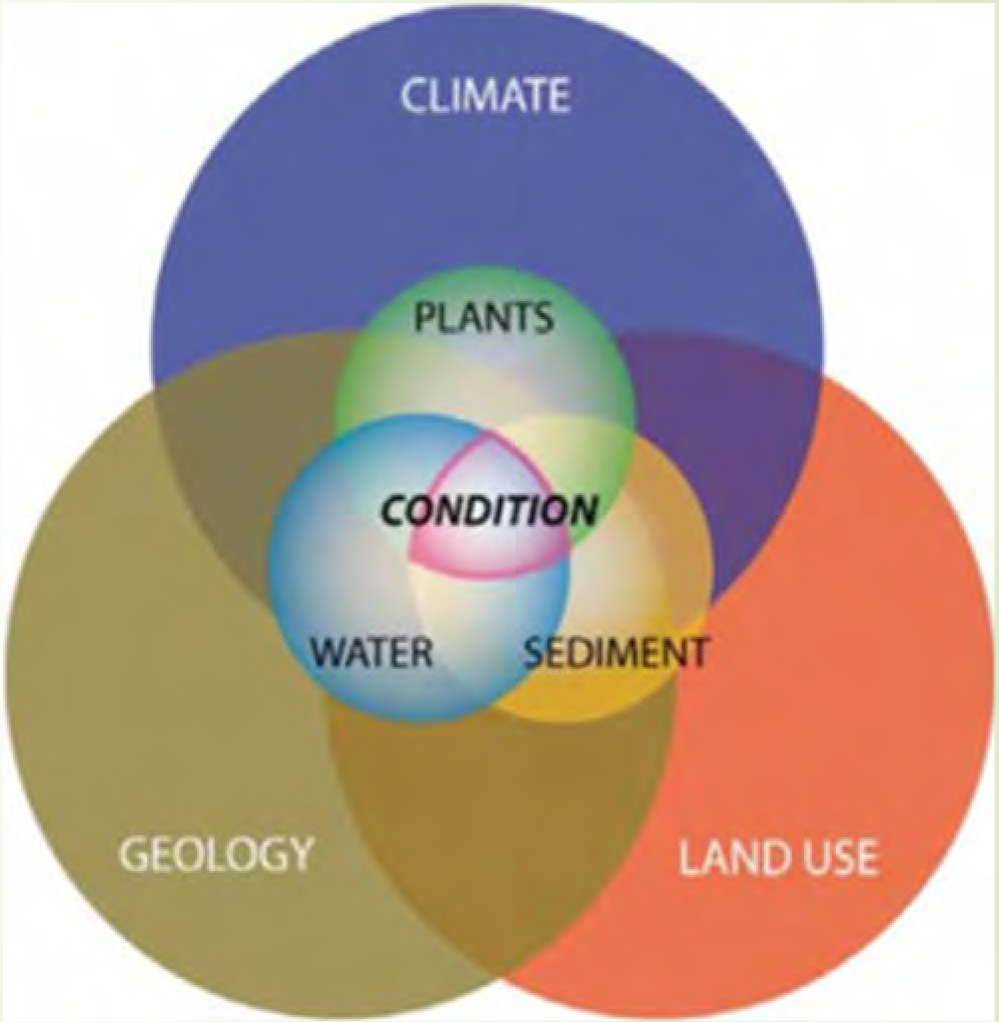
Harris and Van Diggelen 2006

Roadmap for Today's Presentation

- Part 1 – Landscape Connections
- Part 2 – Classification
- Part 3 – Providing Context Through Reference
- Part 4 – Challenges of Timing

Landscape Connections

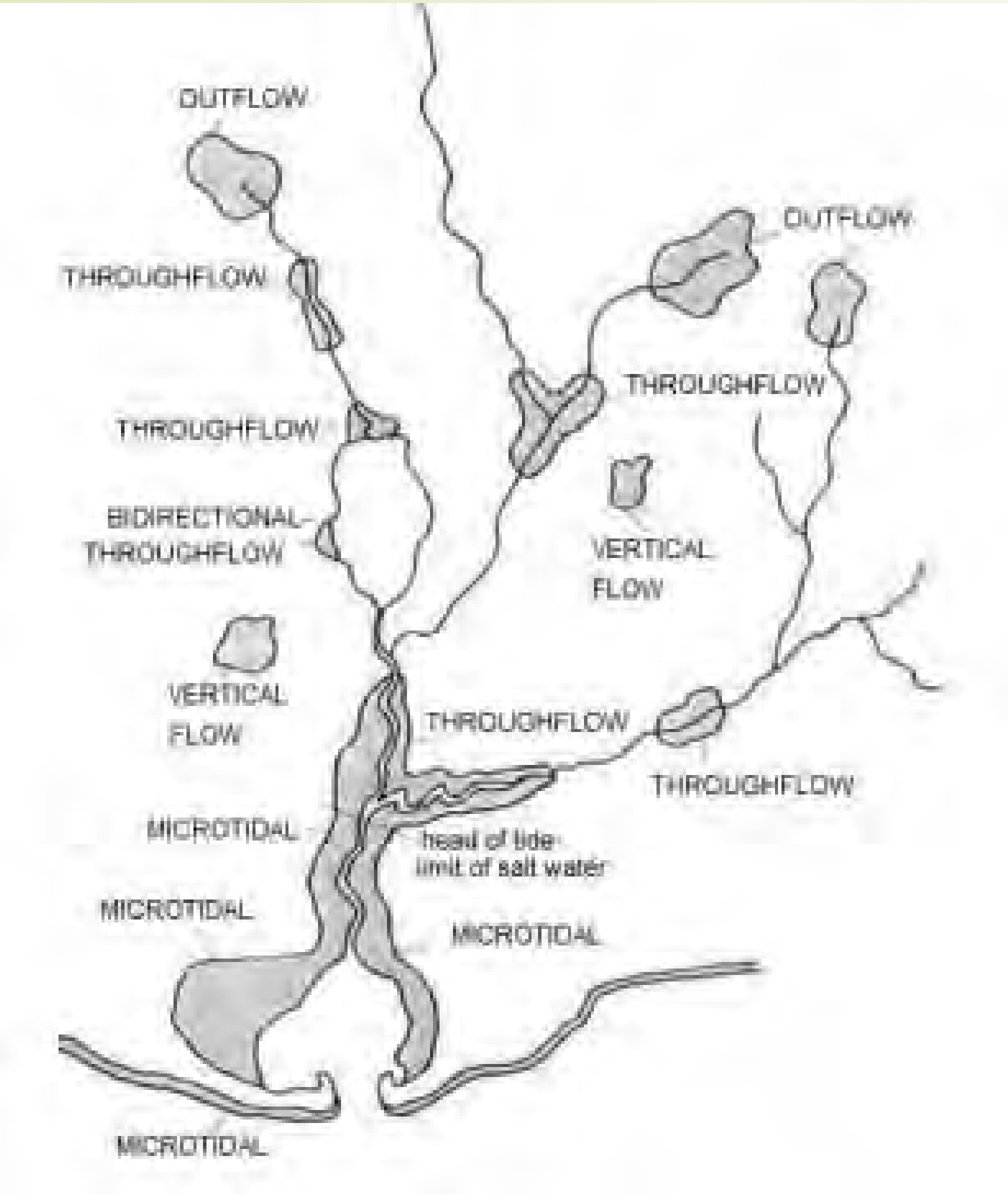
Wetland position in the landscape and the ***associated physical and biological connections*** are the largest determinant of successful restoration.



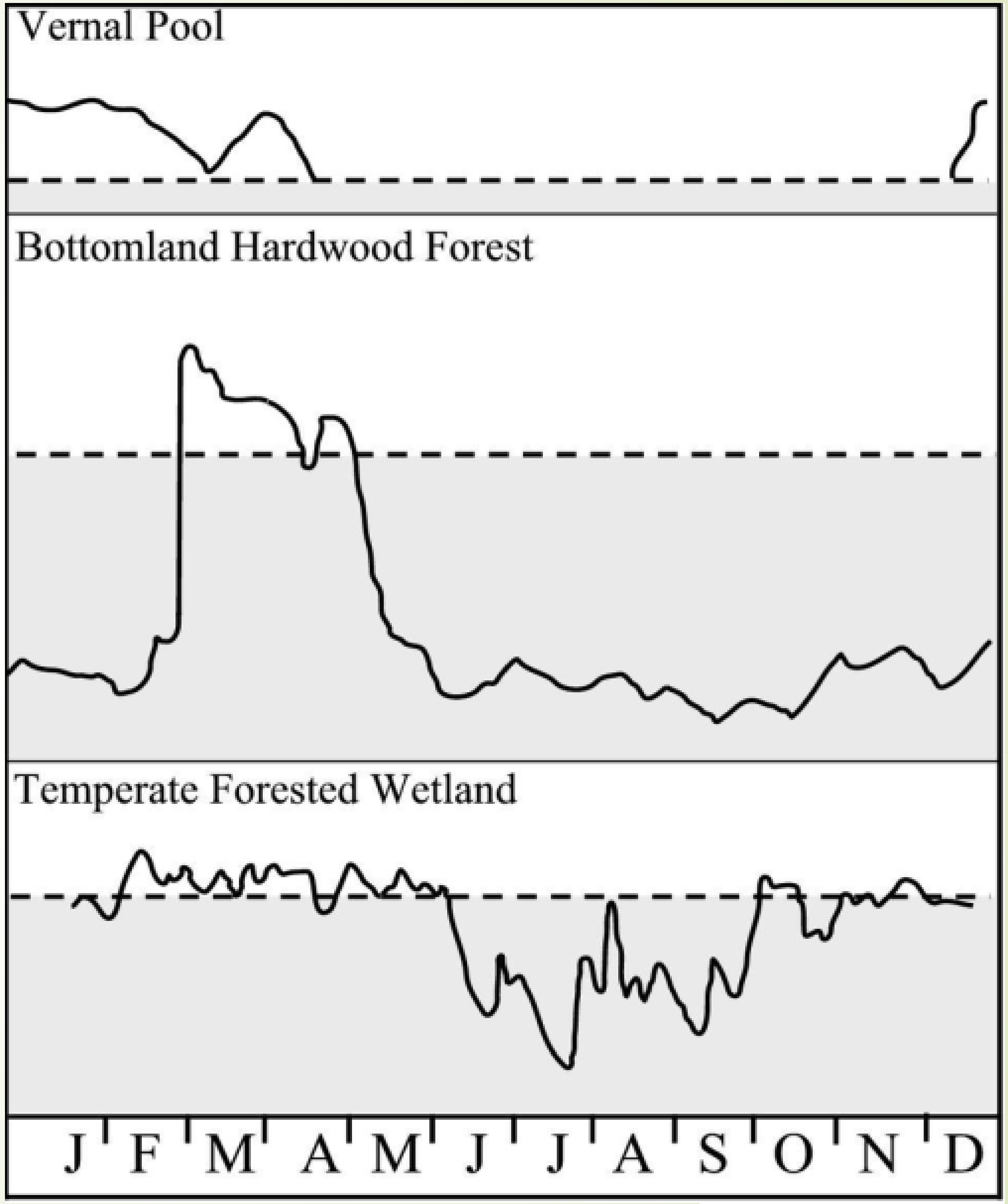
Importance of Landscape Connections

- Contribution to hydrologic cycle
  - surface and subsurface hydrologic connections
- Materials processing (e.g. nutrients, carbon, sediment)
  - soil structure and associated microbial community, sufficient time, and appropriate redox conditions (largely a function of hydrology)
- Habitat support
  - connectivity to adjacent uplands and proximity to related wetlands (e.g. refugia, migration, critical area requirements)

Landscape - Hydrology Connections



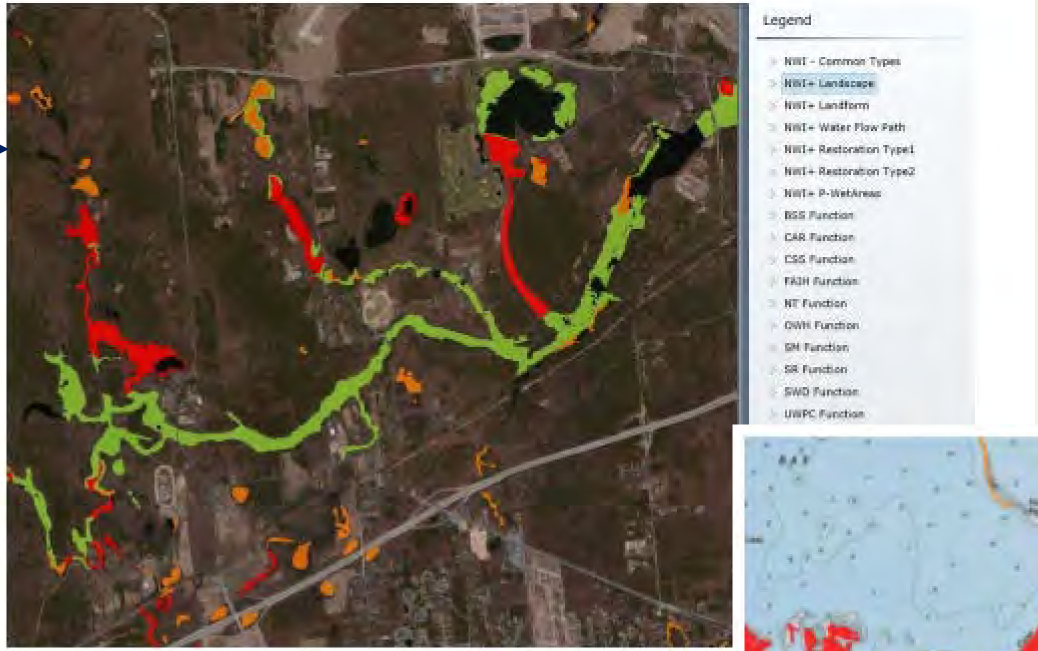
Tiner, McGuckin, and Herman. 2015



Dittbrenner 2015

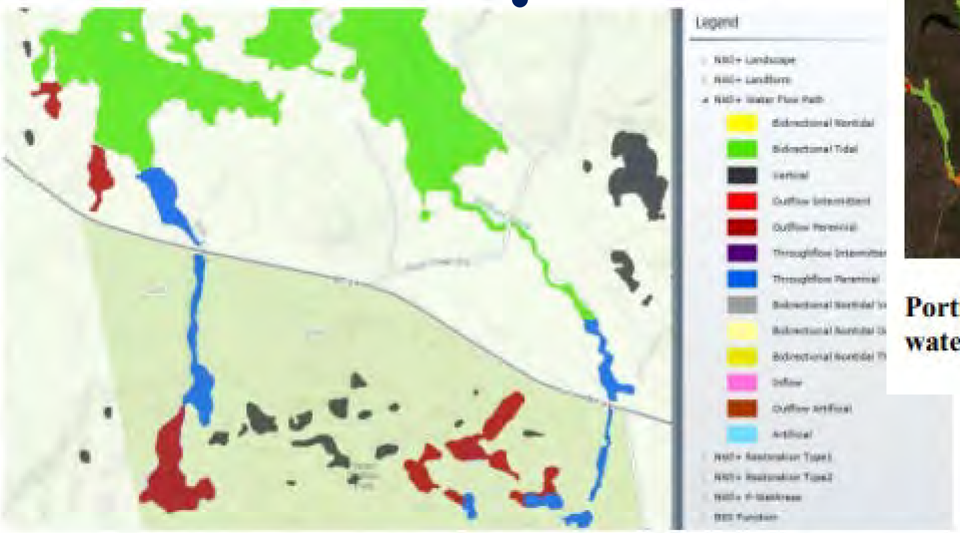
Landscape – Biogeochemistry Connections
Landscape – Biology Connections

Biology

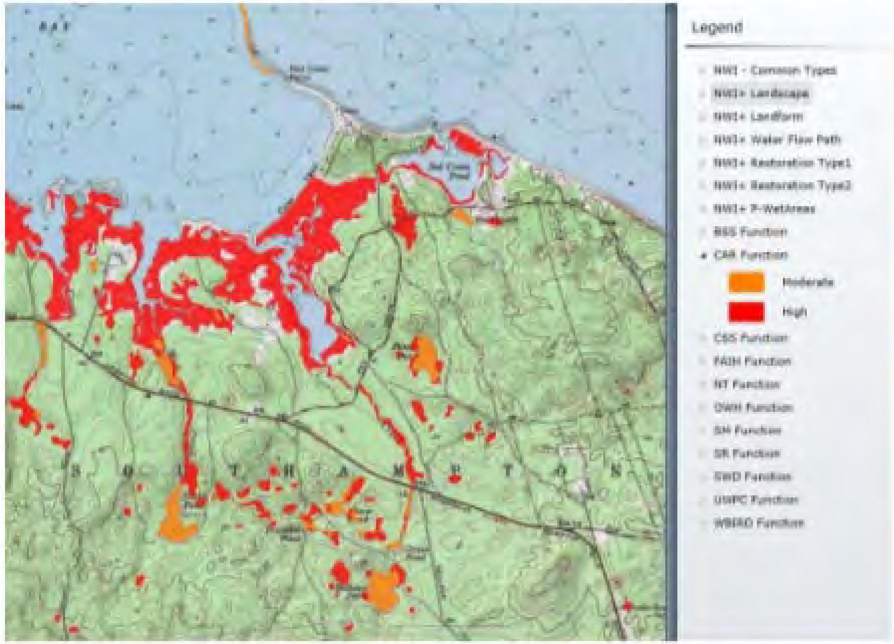


Portion of online map showing wetlands of significance for waterfowl and waterbirds. (Base map - aerial image)

Hydrology



Portion of online map showing wetlands and waters classified by water flow path. (Base map – generalized topographic map)

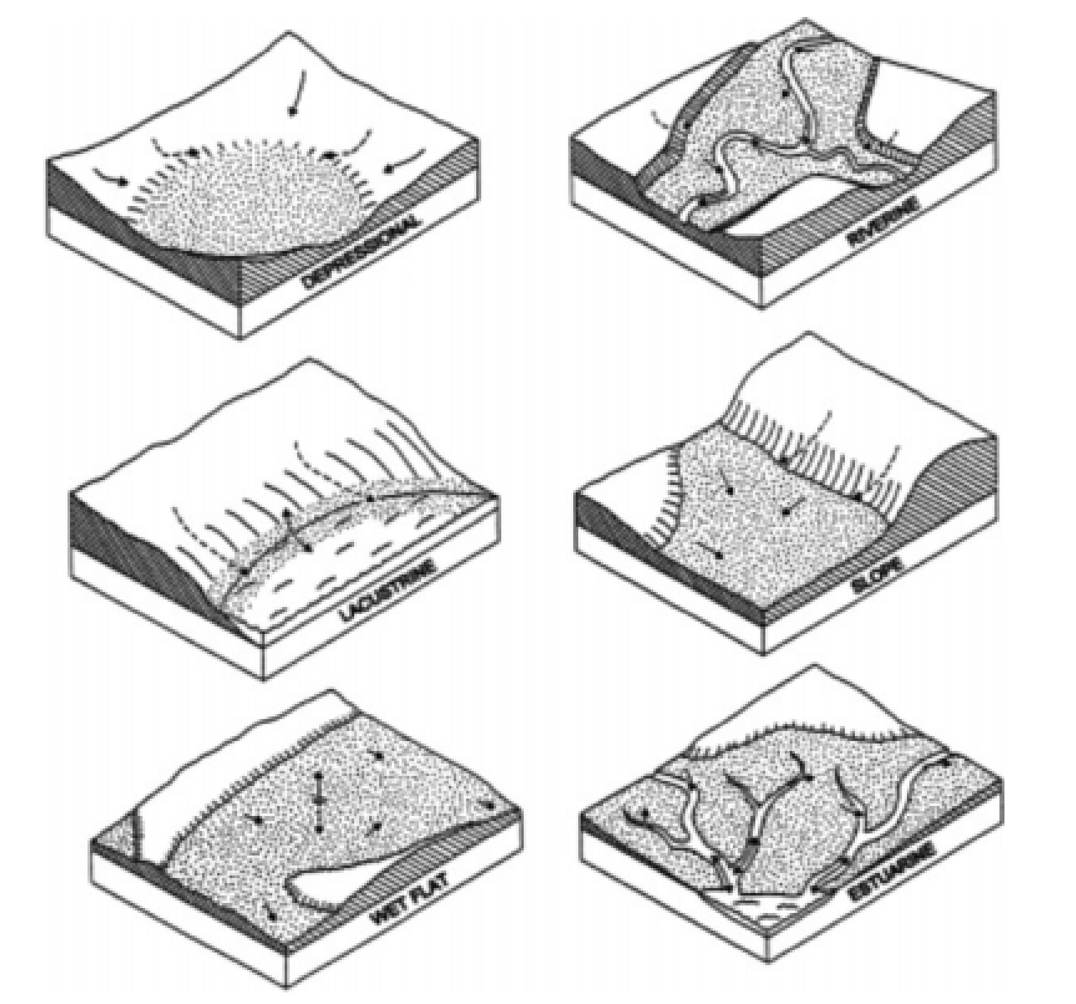


Portion of online map showing potential wetlands of significance for carbon sequestration. (Base map – U.S.G.S. topographic map)

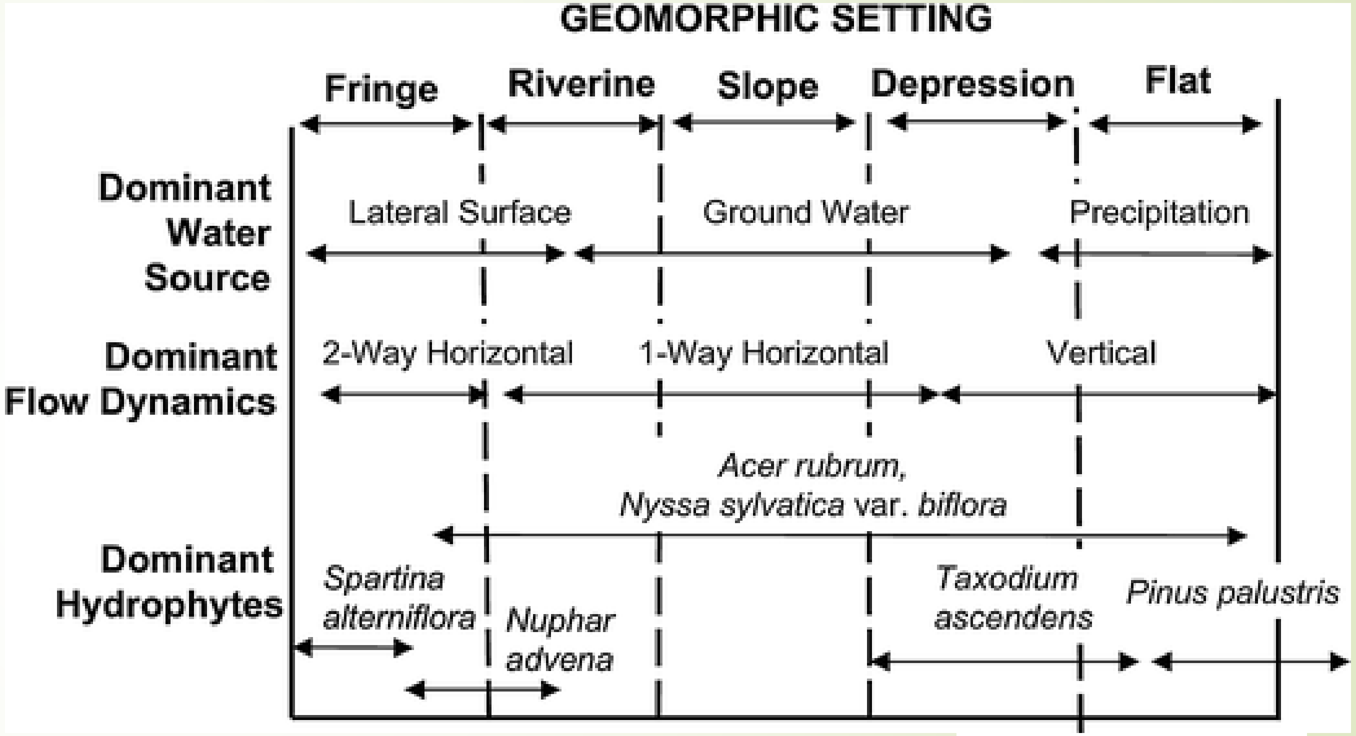
Biogeochemistry

Tiner, McGuckin, and Herman. 2015

How Do I Determine the “Right” Landscape Connections? → CLASSIFICATION



Brinson and Malvarez, 2002
Davis et al. 2013



Brooks et al. 2011

Hydrogeomorphic (HGM) classification describes the appropriate wetland type based on landscape position + water source + hydrodynamics → ***landscape connections***

2.2 Depressional wetland in Lincoln County, Oklahoma

.6 Riverine wetland created from a beaver (*Castor canadensis*) impoundment in Seminol
ty, Oklahoma

2.5 Slope wetland (groundwater-fed seep) in Okfuskee County, Oklahoma

2.8 Organic soil flat (*Sphagnum* bog) in Hancoc

2.7 Mineral soil flat on an old alluvial terrace disconnected from overbank flooding i
hita Mountains of Oklahoma

2.4 Estuarine fringe salt marsh in Queens County, New York (Published with kind

2.3 Lacustrine fringe wetland adjacent to a reservoir in Logan County, Oklahoma

Landscape connection → class → functions

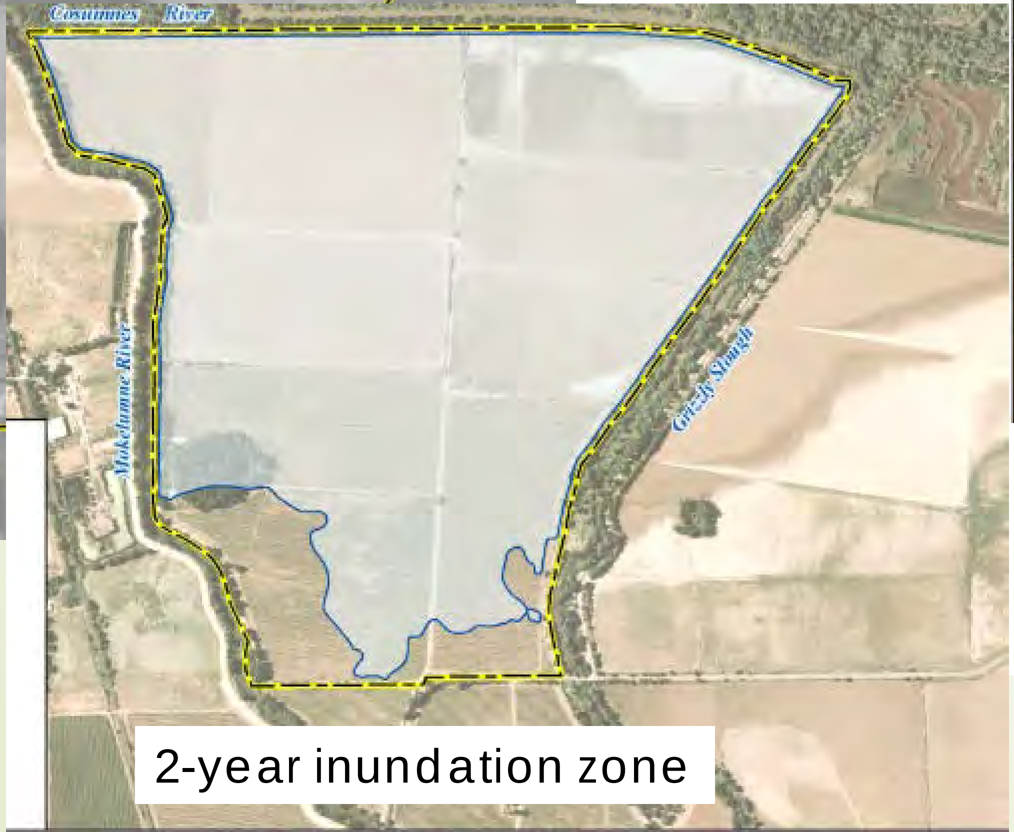
Davis et al. 2013

How Do I Ensure Landscape Connection?

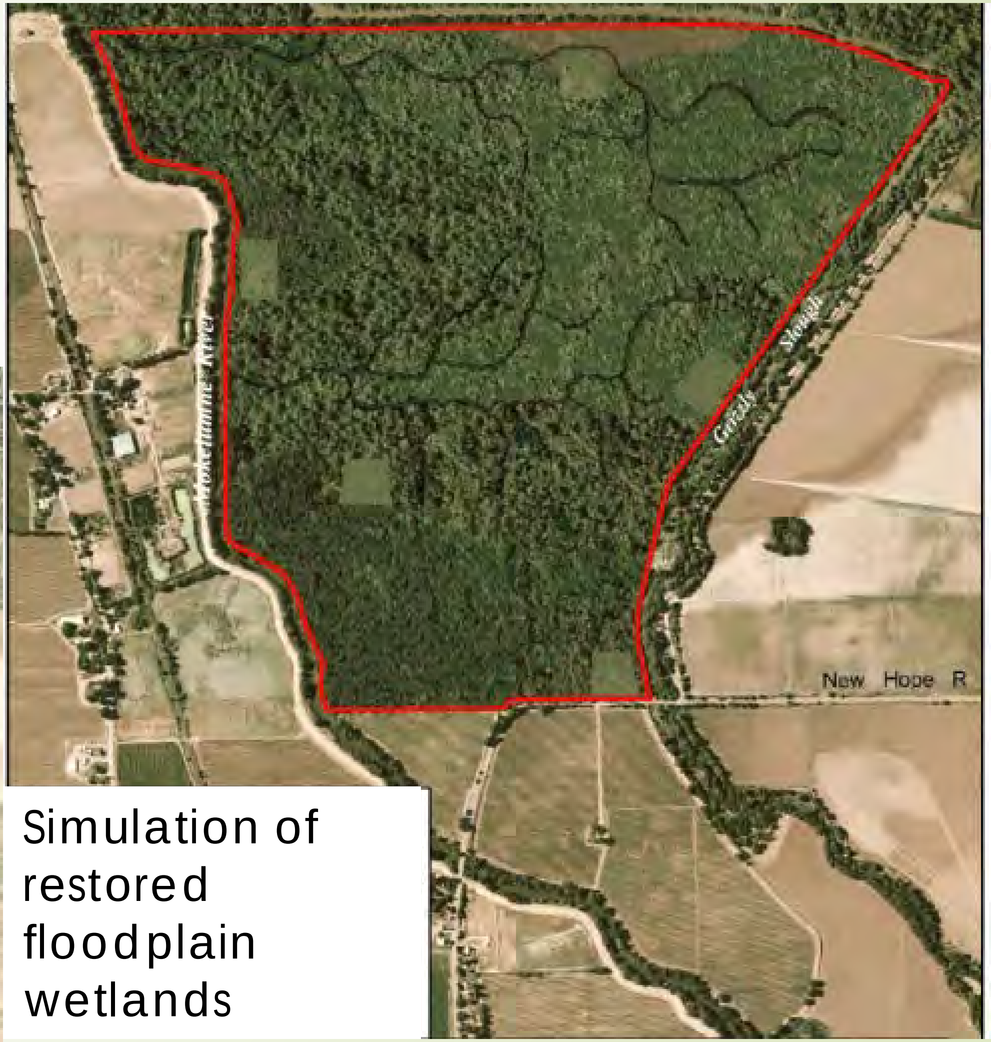
- Wetland type is appropriate for its position in the landscape
- Intact and sustainable hydrologic connections
  - Hydrodynamics are consistent with wetland HGM class (landscape connections)
- Soil properties are appropriate for the wetland HGM class
- Landscape connections promote movement of materials & organisms
  - Wetland-upland connections promote resiliency

Appropriate Landscape Position: Riverine Floodplain Wetlands


Historic (1929) conditions

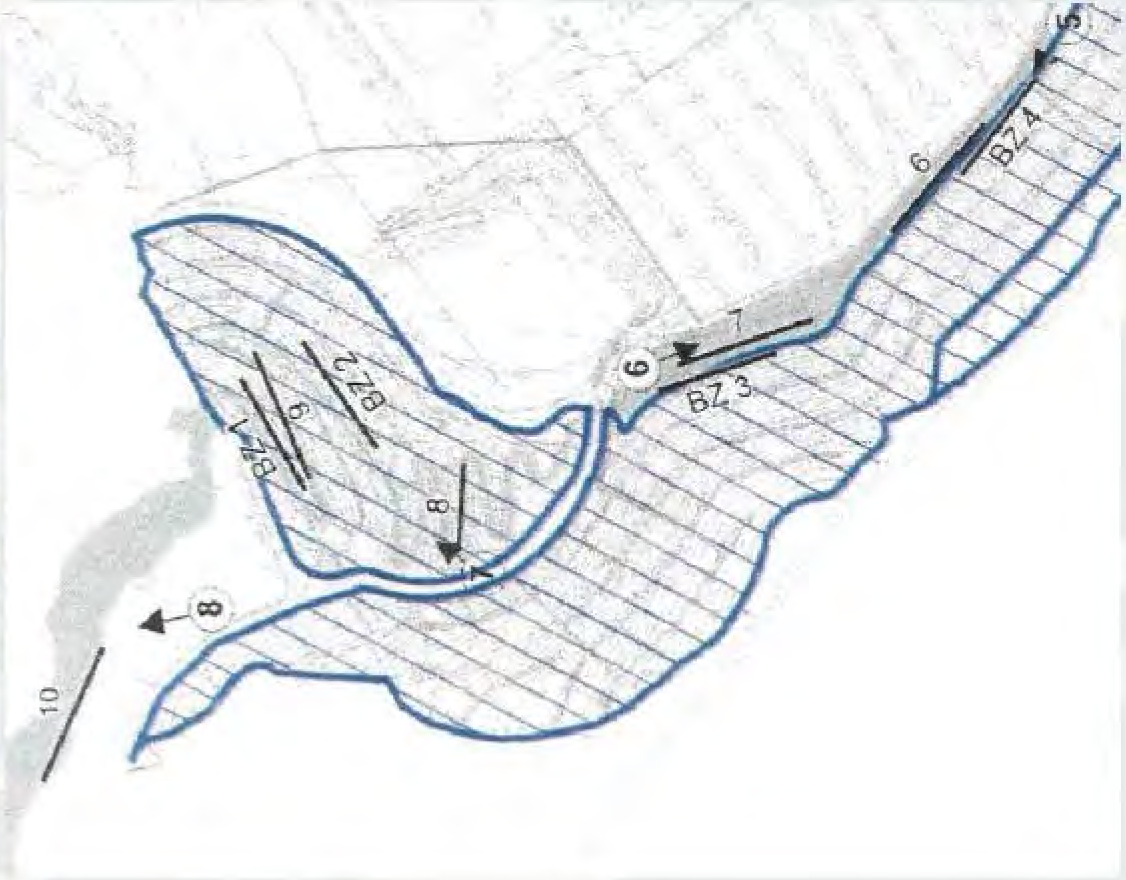


2-year inundation zone

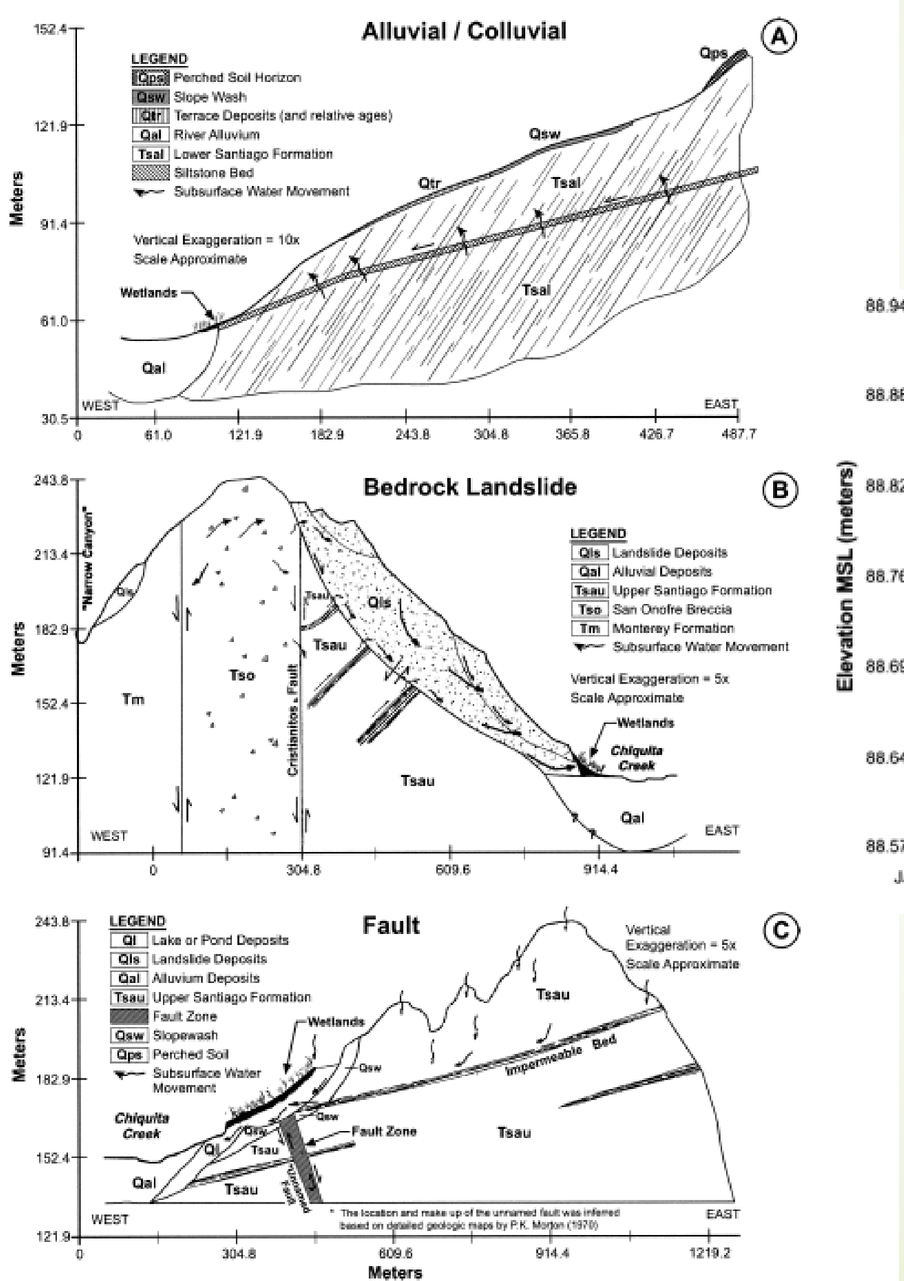


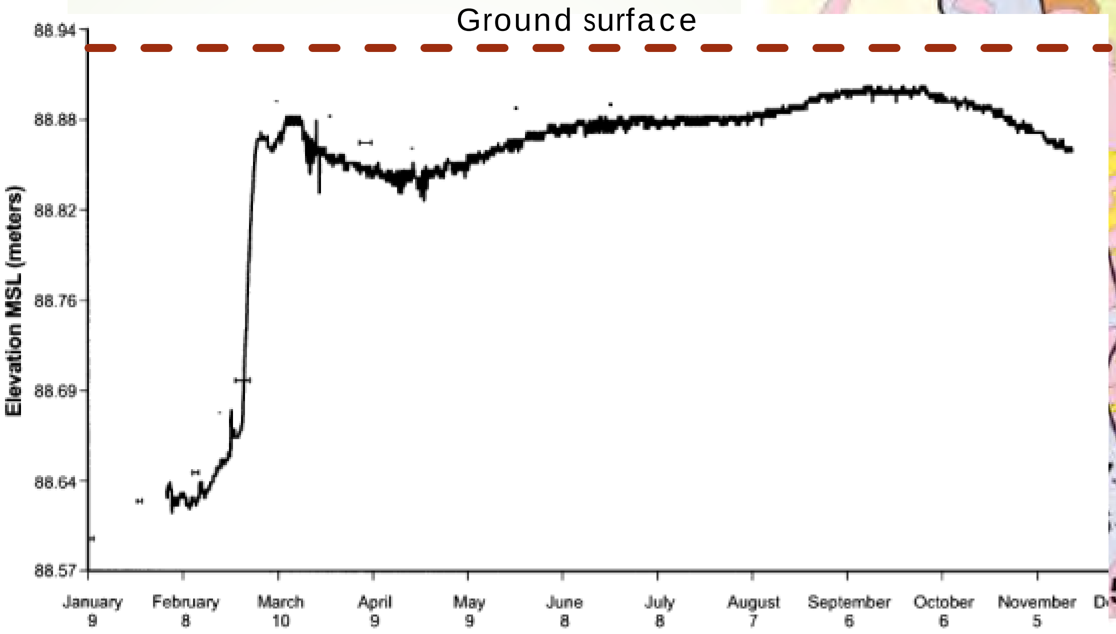
Simulation of restored floodplain wetlands

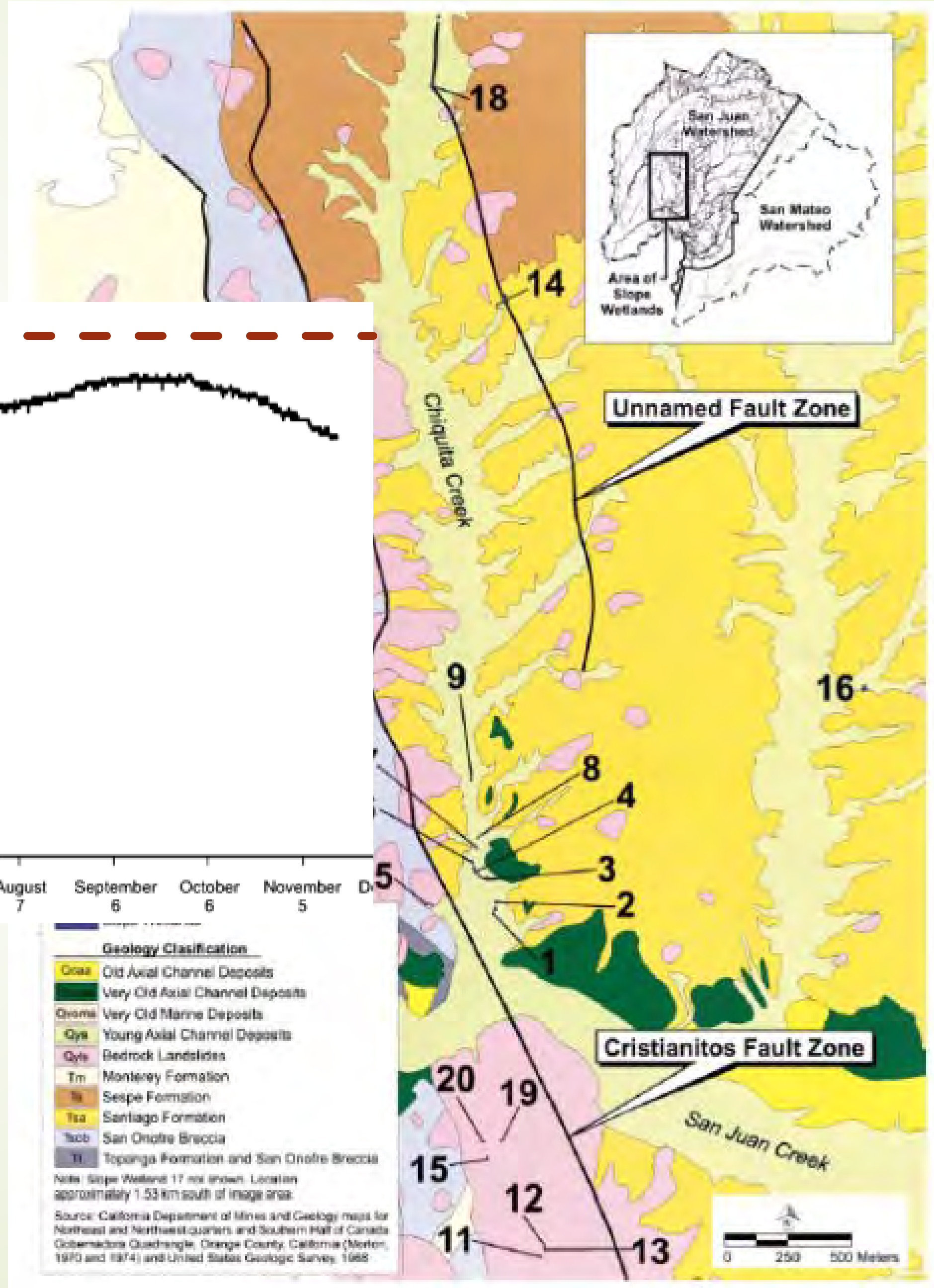
Inappropriate Landscape Position



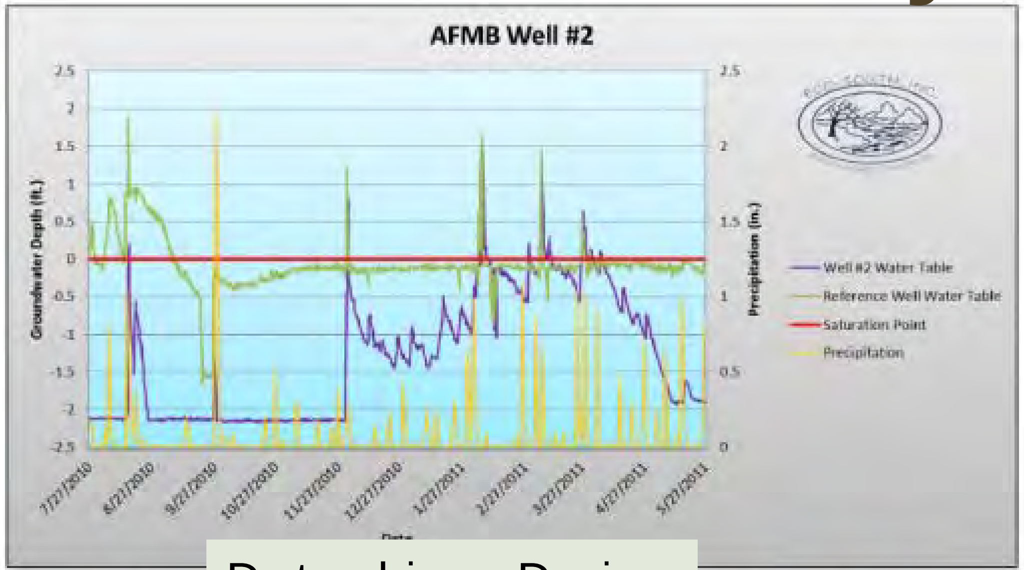
Sustainable Hydrologic Connections







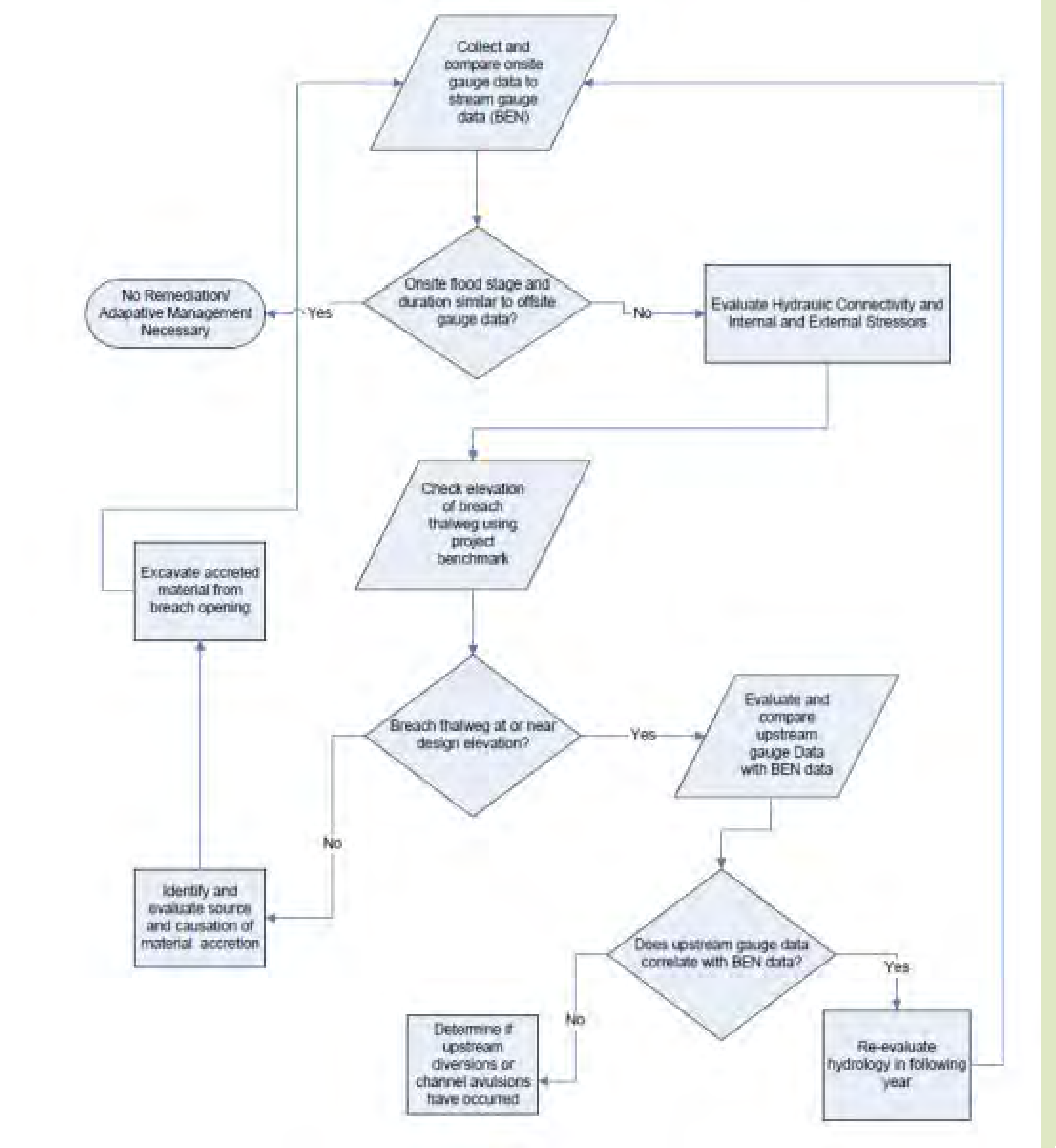
Sustainable Hydrologic Connections



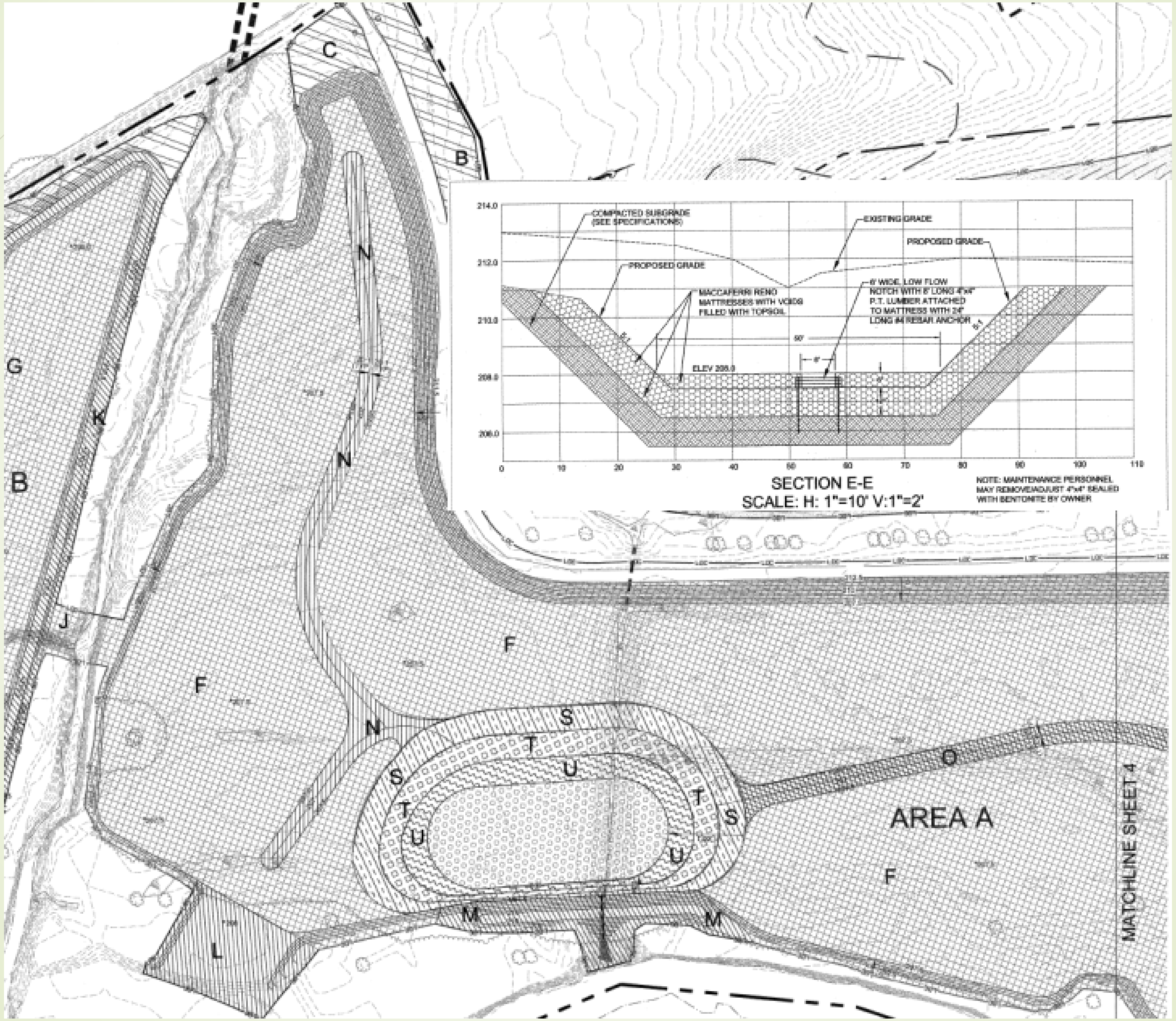
Data-driven Design

Groundwater Well #2 in Wetland Rehabilitation Area

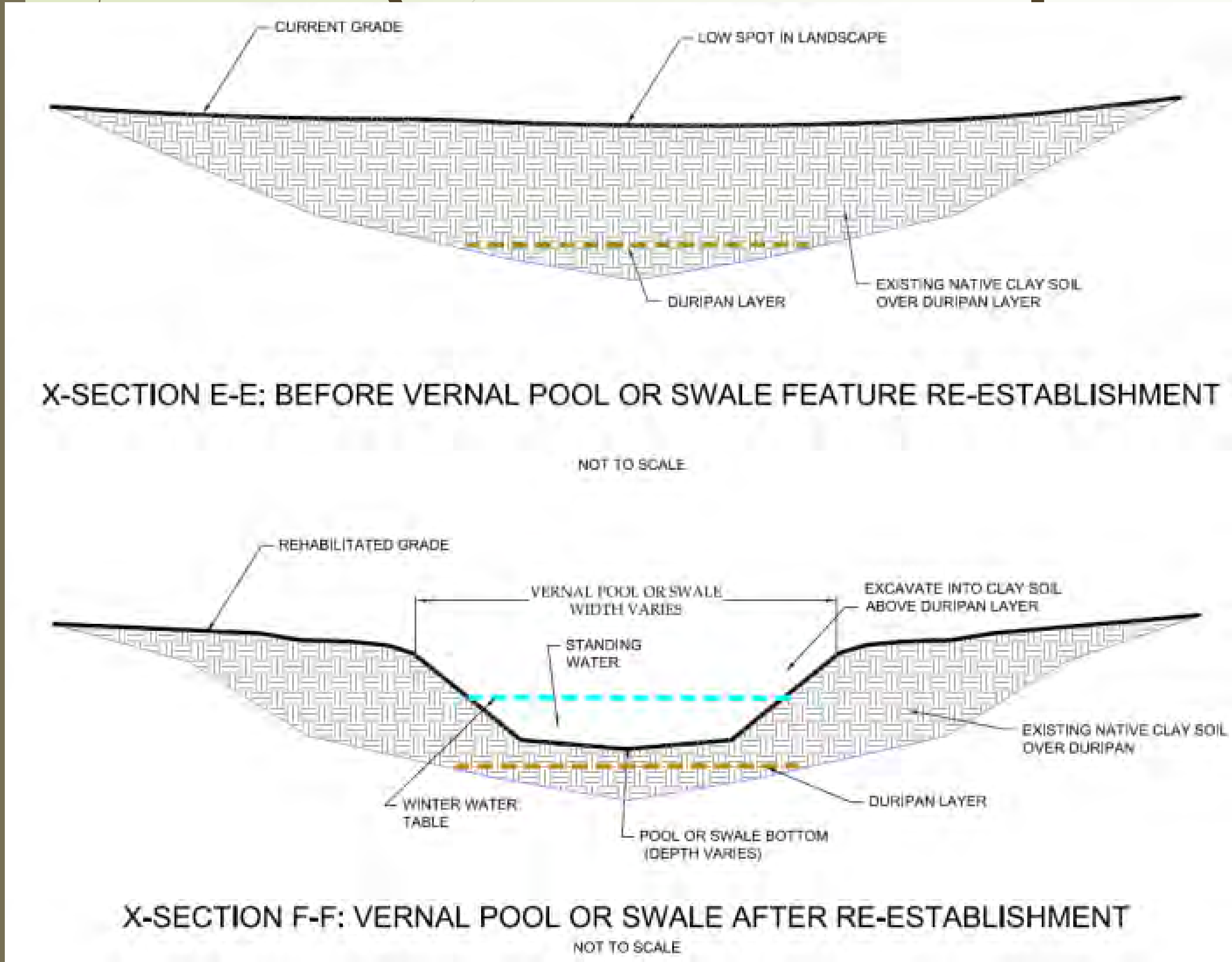
Adaptive Management Plan

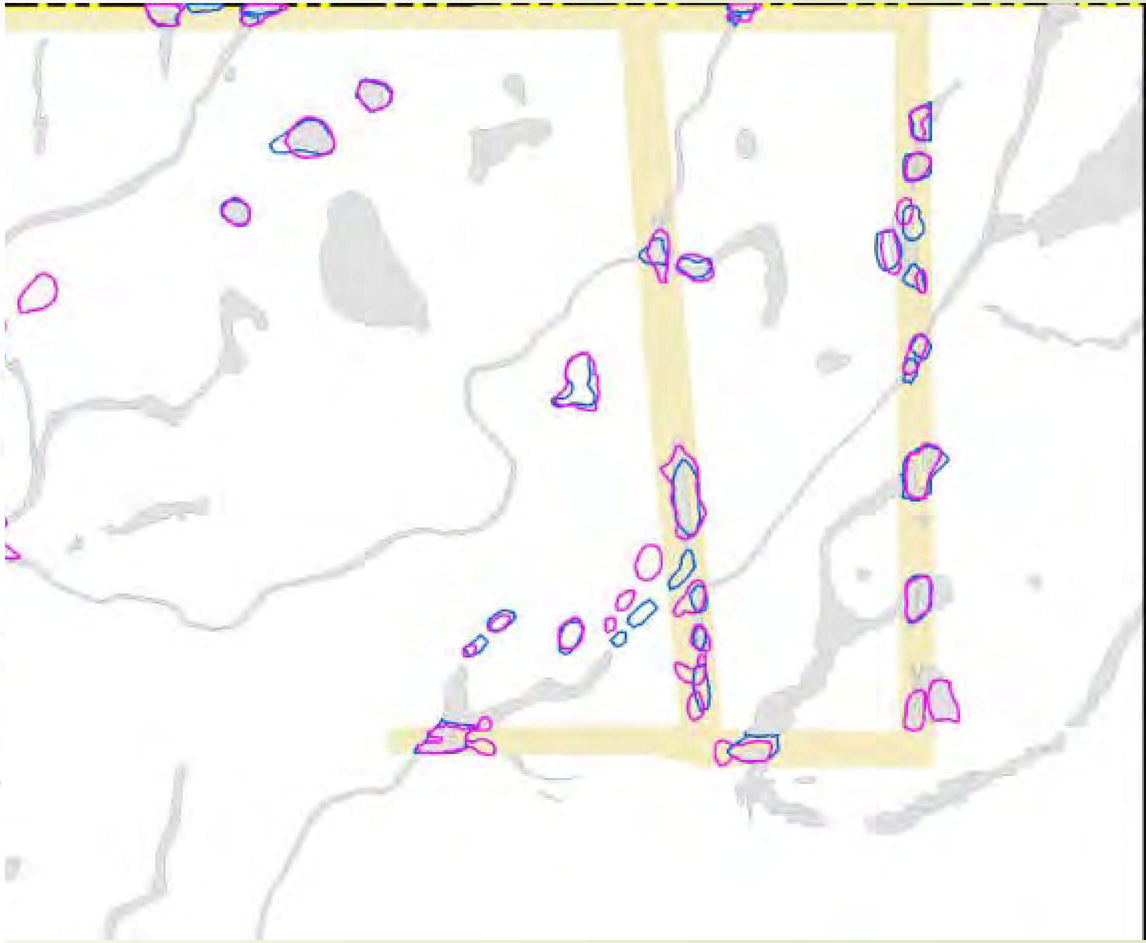


Avoid "Overengineered" Hydrology



Ensure Appropriate Soils and Subsurface Connections (western vernal pools)





Vernal pool complex mitigation bank

Promote Soil Development

- Consider original soil type and amend as necessary
- Soil development takes time – be patient

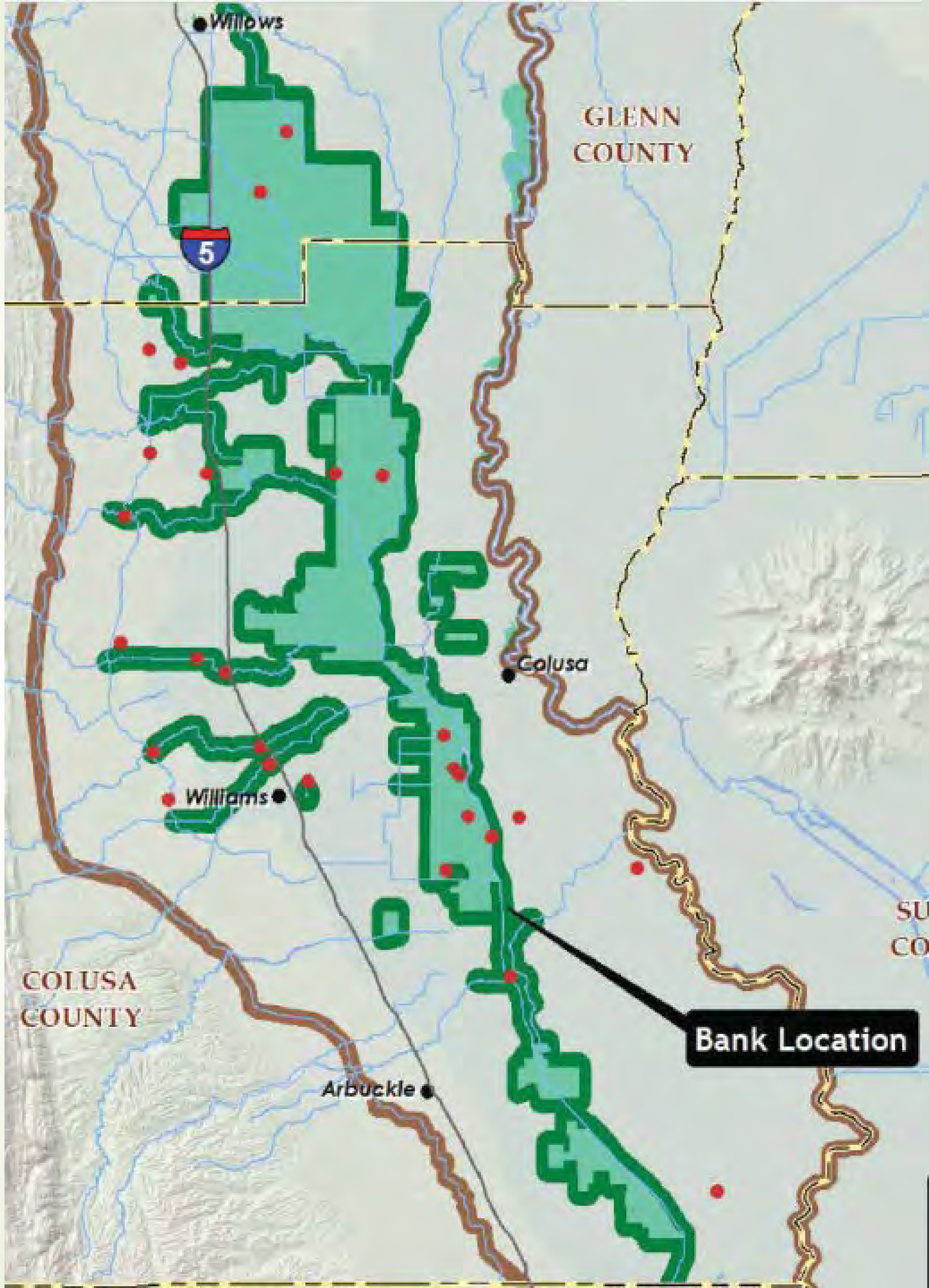
✓ Sandy soil with + amendments
✓ 11 years of organic matter accumulation

Photo courtesy of W. Lee Daniels

Ecological Connections

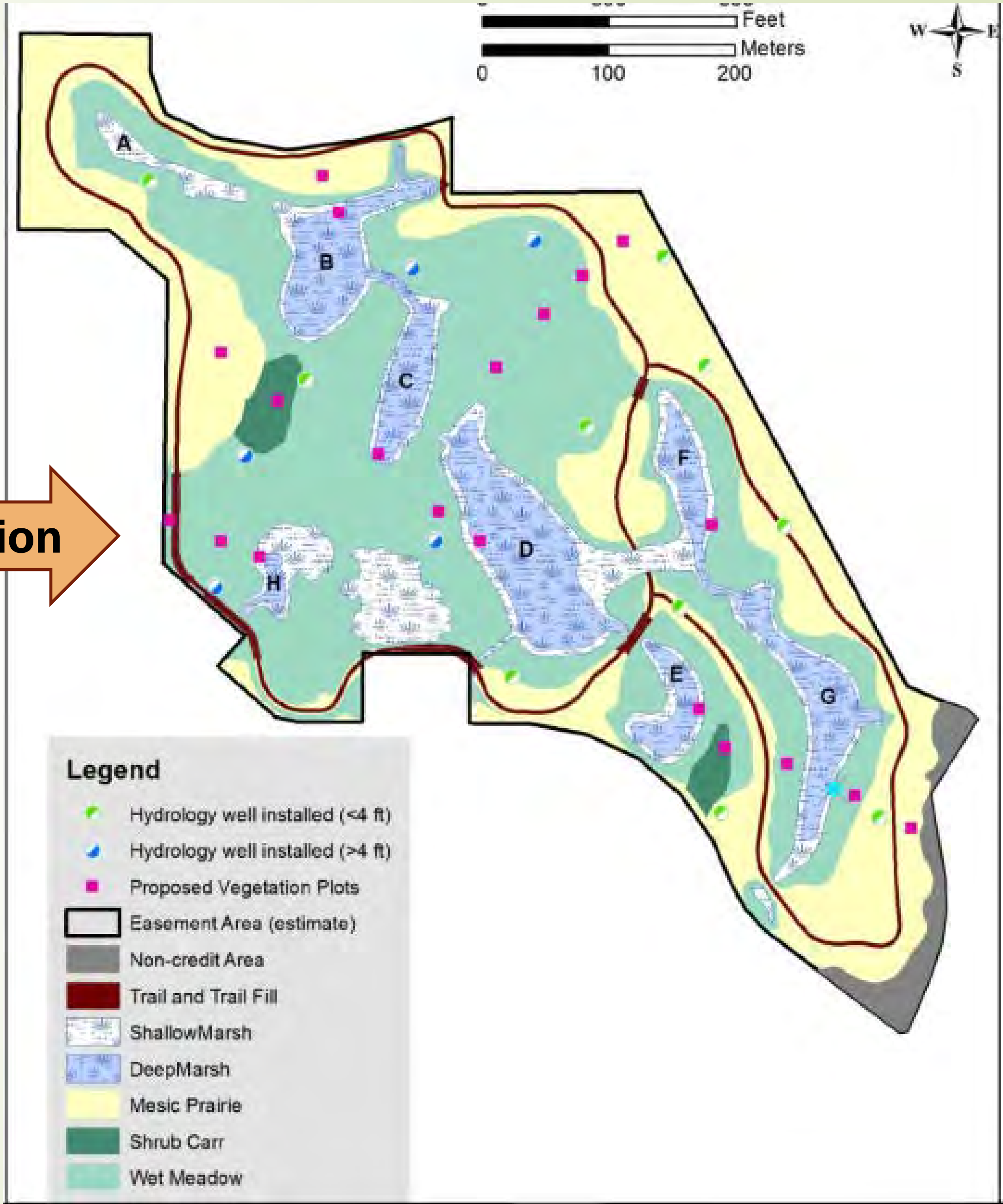
Ecological Connections: Role of Uplands

- Promote hydrologic connections
- Sediment and organic matters sources
  - Especially in upper watershed areas
- Reduce sources of invasion
- Habitat for important life history stages
  - aestivation, foraging
- Providing migration/dispersal opportunities



Landscape Connections??

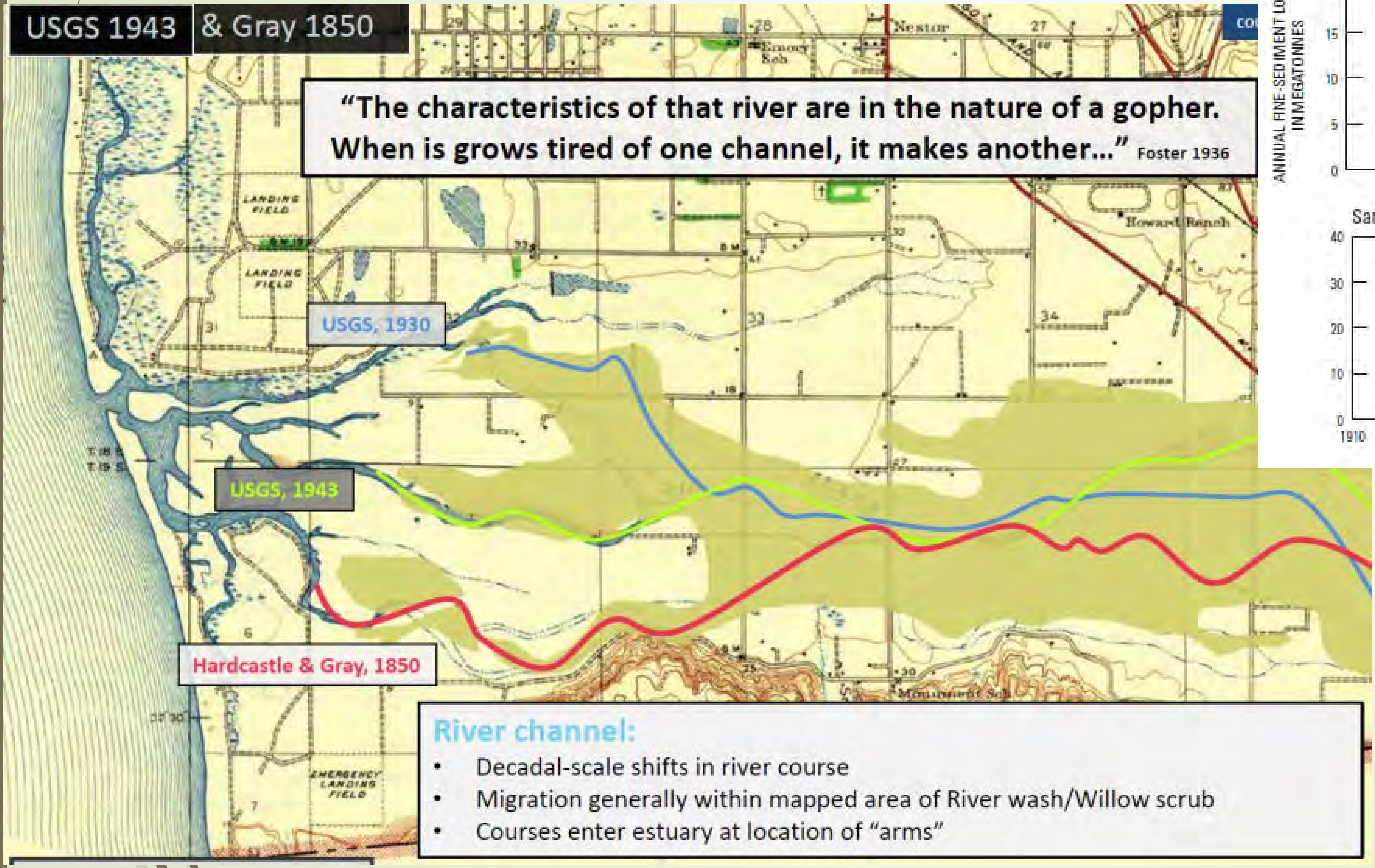
mitigation

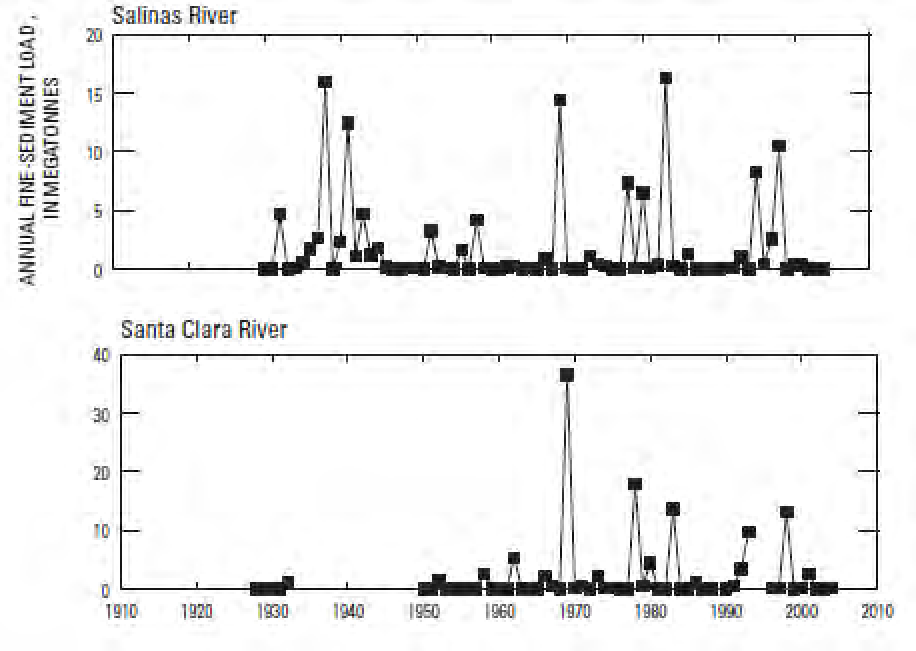


Considerations for Coastal Wetlands

- Need to maintain connections with ocean and watershed
- Frequency and magnitude of fluvial inputs provides critical sediment supply and flushing
- Mouth behavior (i.e. migration, closure) affects all functions
- Coastal wetlands often occur in interconnected complexes → these are great opportunities for restoration

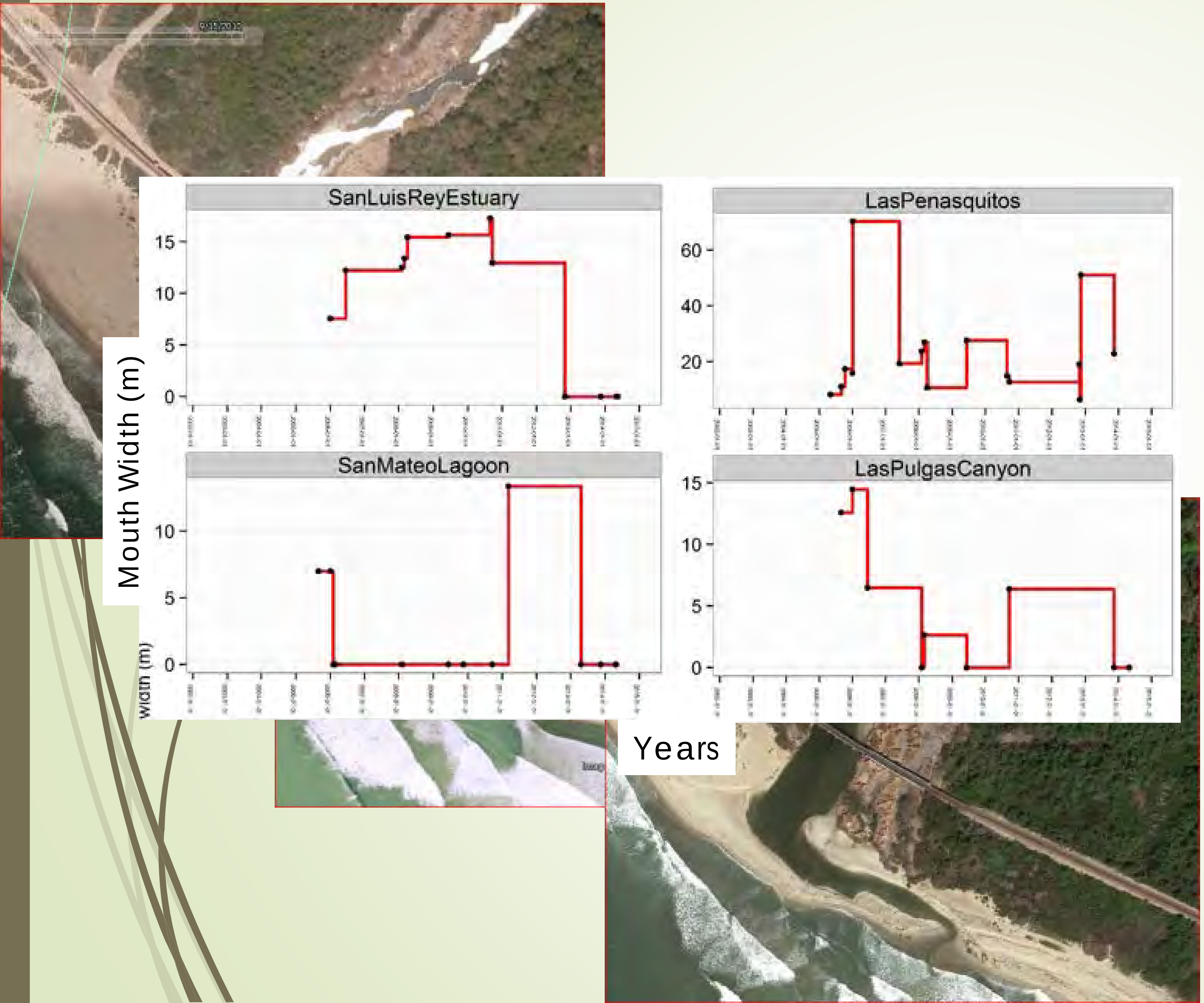
Understand Watershed Connections

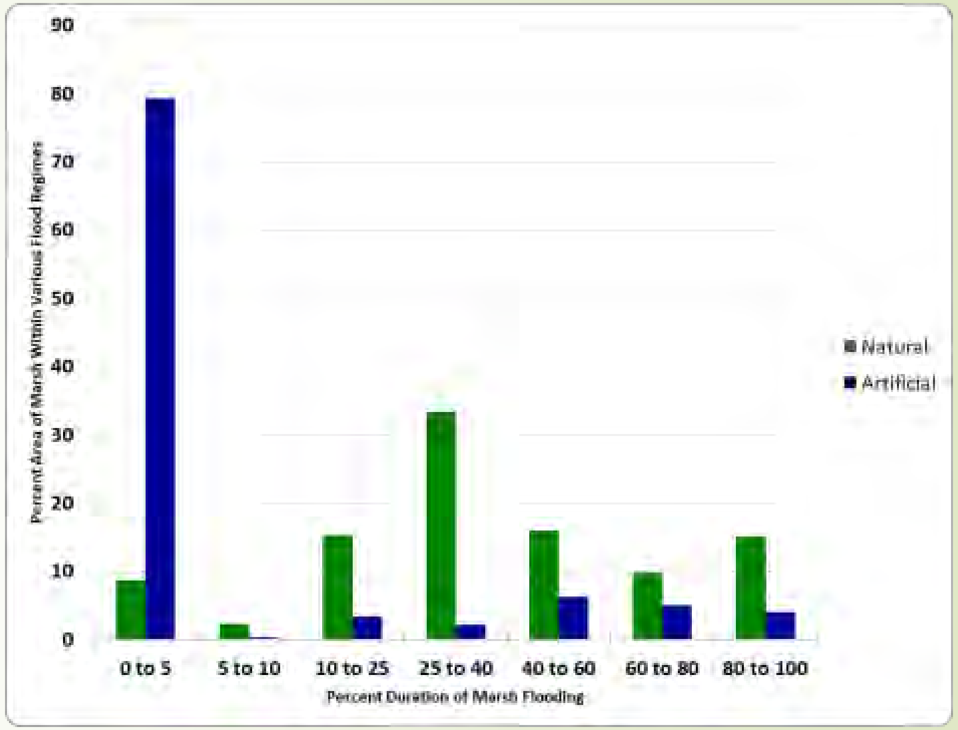




Farnsworth and Warrick, 2007

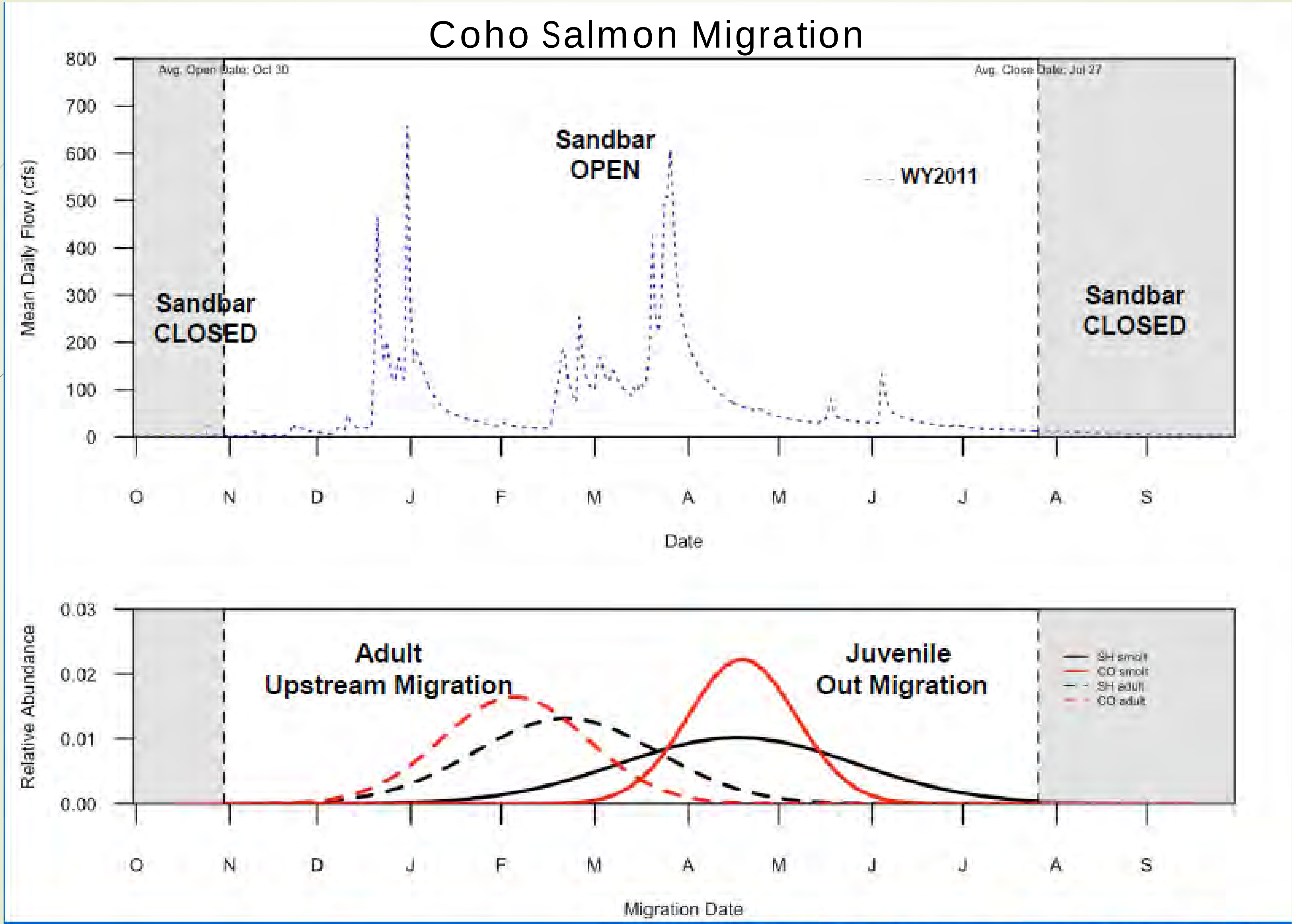
Mouth Dynamics Influence Habitat Distribution





Largier et al, 2018

Physical Dynamics Affect Biological Communities



Osterback, Kern & Kiernan – unpublished data

Altering Processes Can Lead to Type Conversion

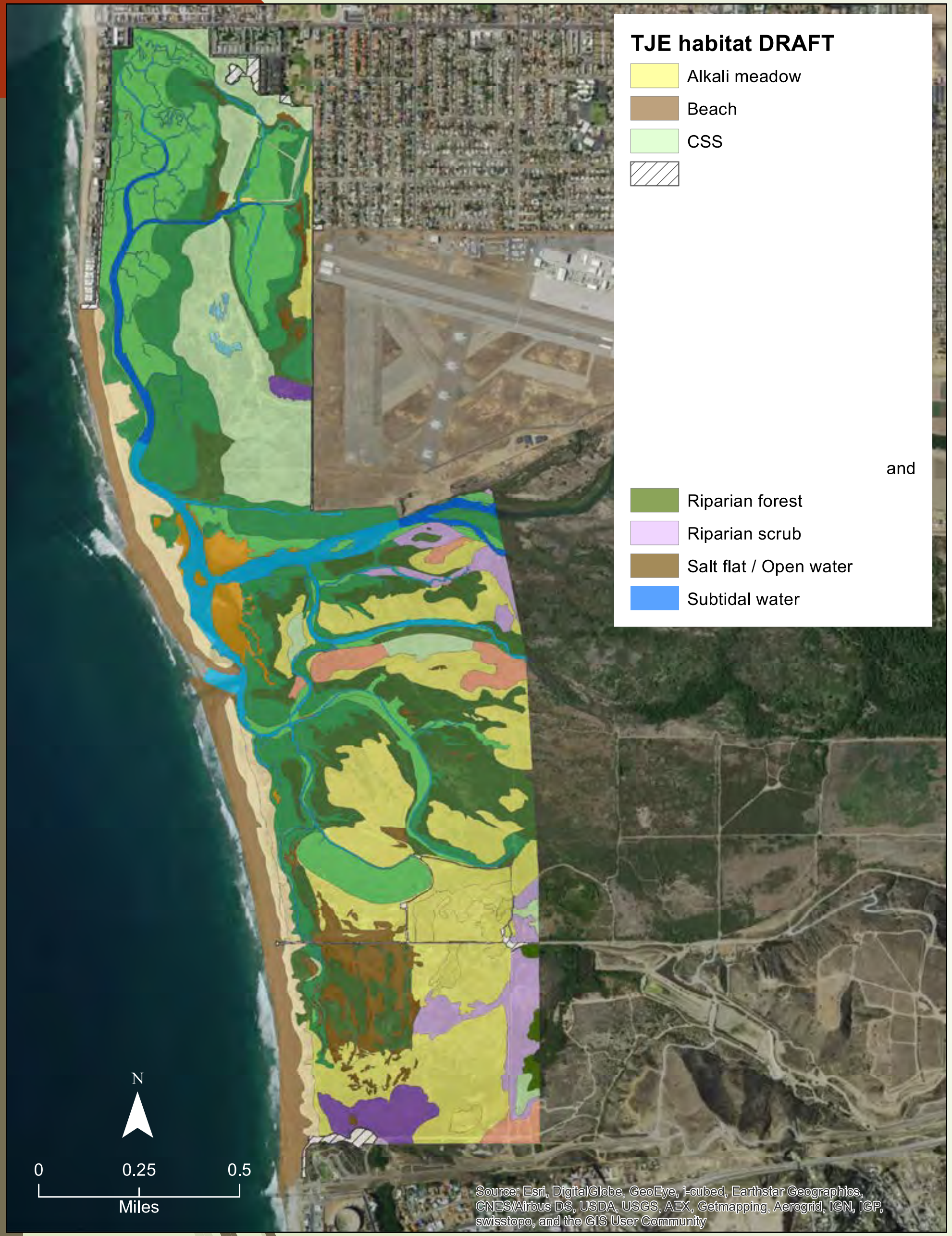
Lagoon "restored" as a mitigation bank for port expansion.

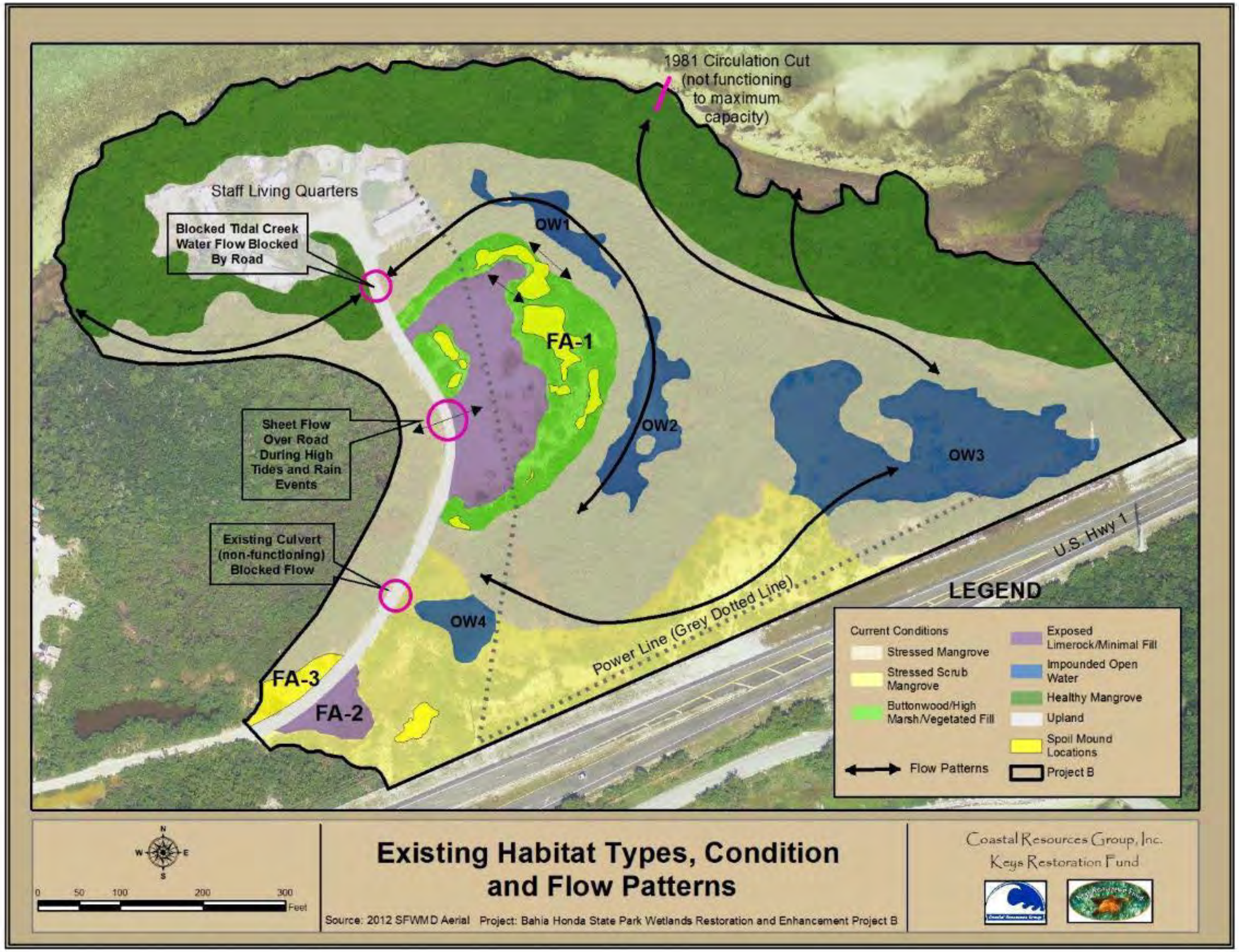
Mouth jettied open to improve tidal flushing, improve water quality, and reduce freshwater wetlands

"Restored" lagoon requires periodic dredging due to shoaling

Mitigation has resulted in "type conversion" – system supports different species and habitats as were historically present

Look for Opportunities to Restore Habitat Mosaics





Restore hydrological and ecological connectivity

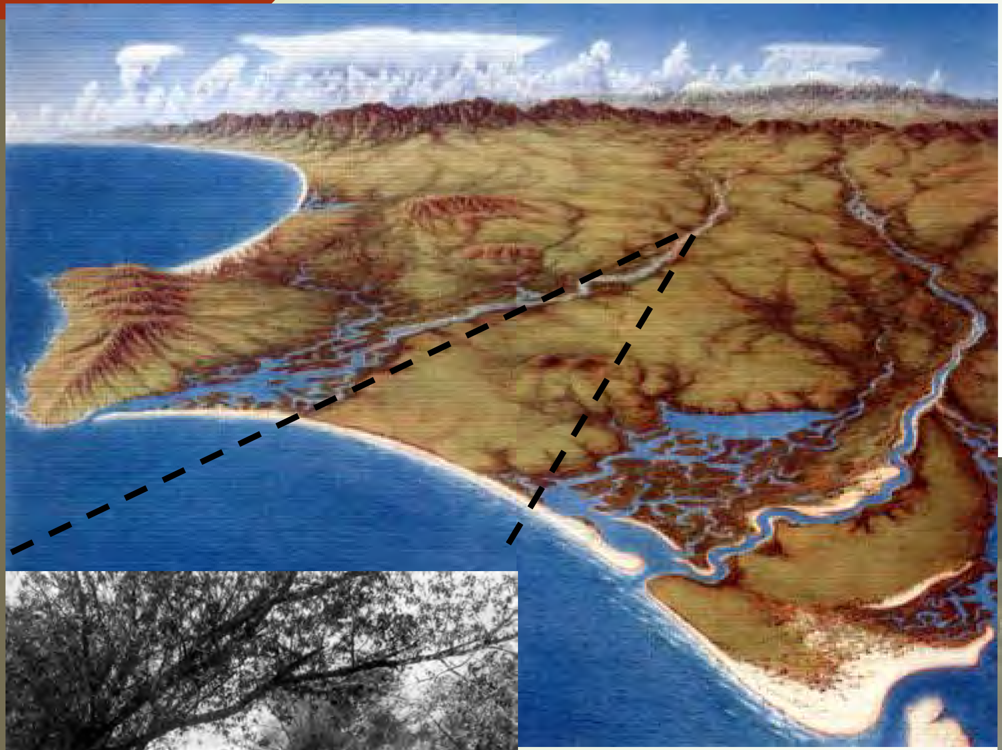
Roadmap for Today's Presentation

- Part 1 – Landscape Connections
- Part 2 – Classification
- **Part 3 – Providing Context Through Reference**
- **Part 4 – Challenges of Timing**

What is Reference, and Why Does it Matter?

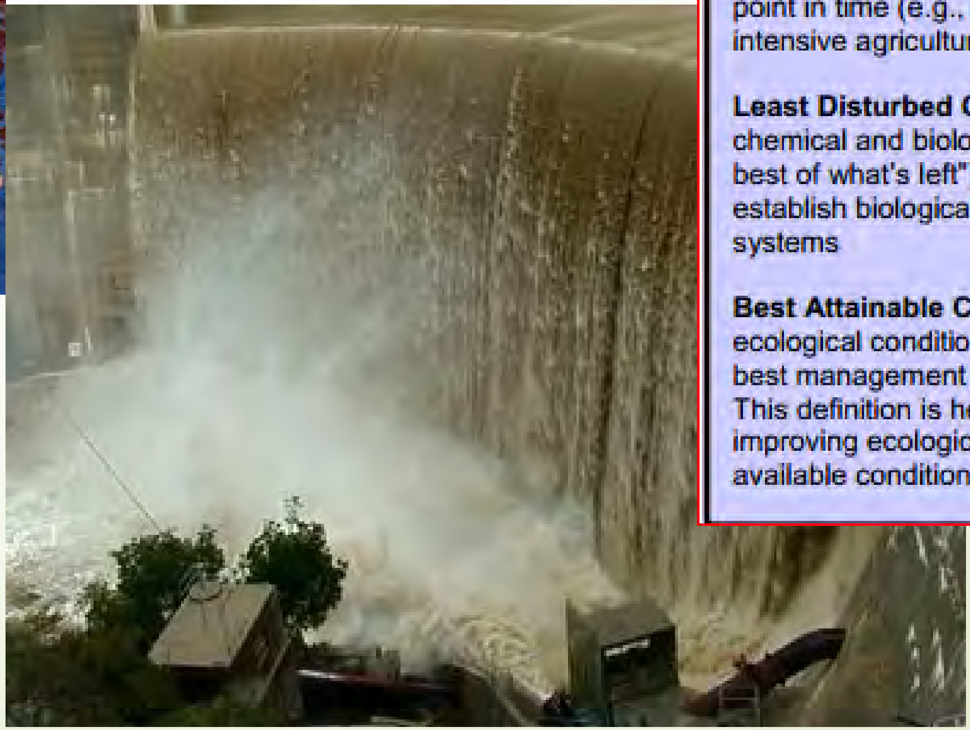
- Reference provides a template or anchor point to guide restoration
- Reference must reflect comparable landscape connections
  - Focus on hydrologic and physical process and connections
  - Don’t define reference based on biology
- “Pristine” (i.e. Reference Standard) may not be the most appropriate reference
  - Specific deviation from reference may be the most appropriate restoration target

What is an Appropriate Reference Condition?



The LA River near downtown ~circa 1900

"culturally unaltered"
vs
"best attainable"



A standardized lexicon of terms used to define biological expectations (adapted from Stoddard *et al.* 2006):

Reference Condition (RC(BI)) ~ Because this term has been used for a wide range of meanings, Stoddard *et al.* (2006) argue that the term should be restricted to meaning "reference condition for biological integrity … in the absence of significant human disturbance or alteration"

Minimally Disturbed Condition (MDC) ~ stream condition in the absence of "significant" human disturbance. Assumes all streams have some anthropogenic stresses, but in most cases will approach true RC(BI)

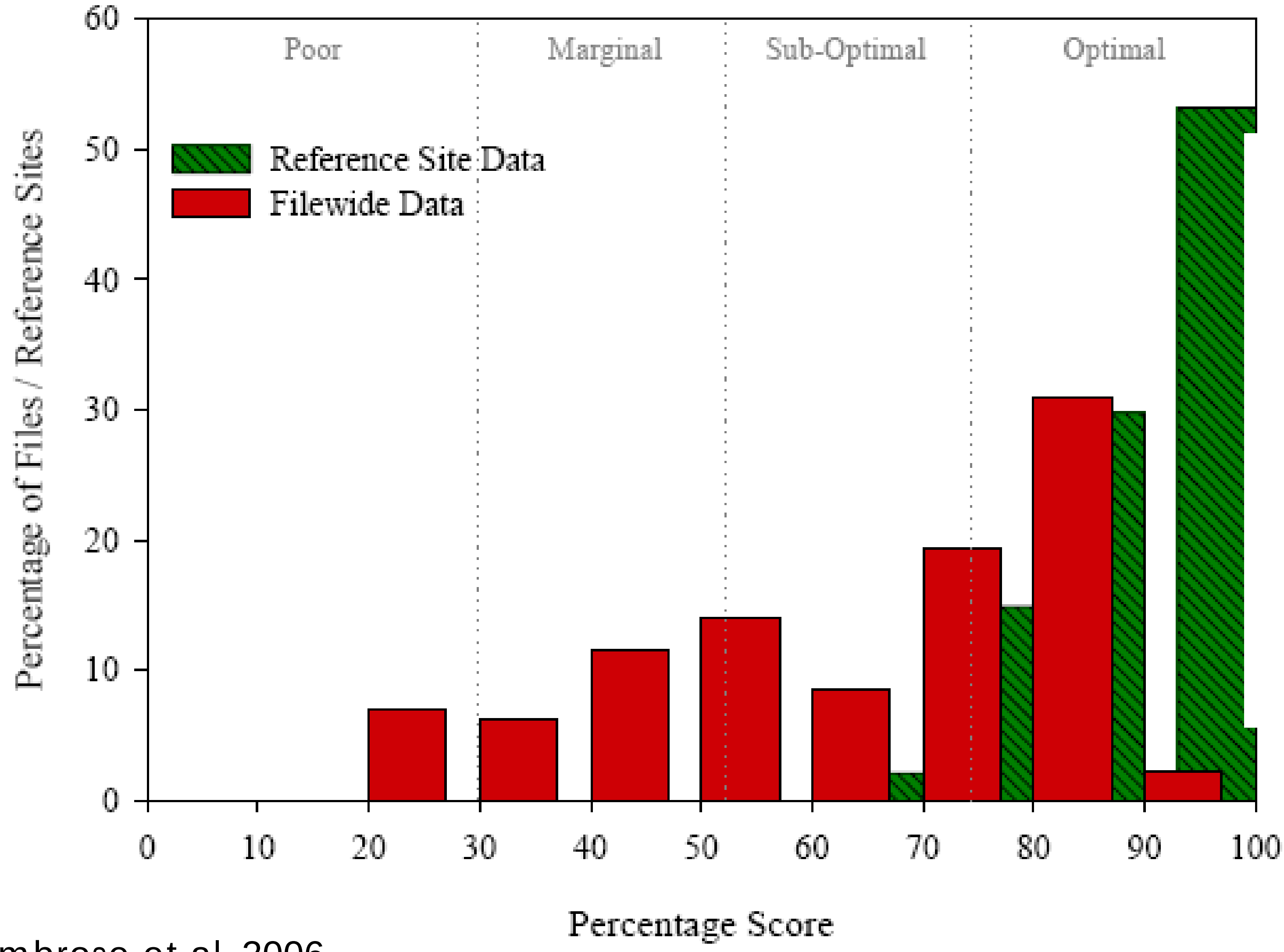
Historical Condition (HC) ~ stream condition at a specific point in time (e.g., pre-Columbian, pre-industrial, pre-intensive agriculture, etc.)

Least Disturbed Condition (LDC) ~ the best physical, chemical and biological conditions currently available ("the best of what's left"). This definition is sufficiently flexible to establish biological expectations even in highly altered systems

Best Attainable Condition (BAC) ~ the expected ecological condition of least disturbed sites given use of best management practices for an extended period of time. This definition is helpful for communicating the potential for improving ecological condition above the currently best available conditions

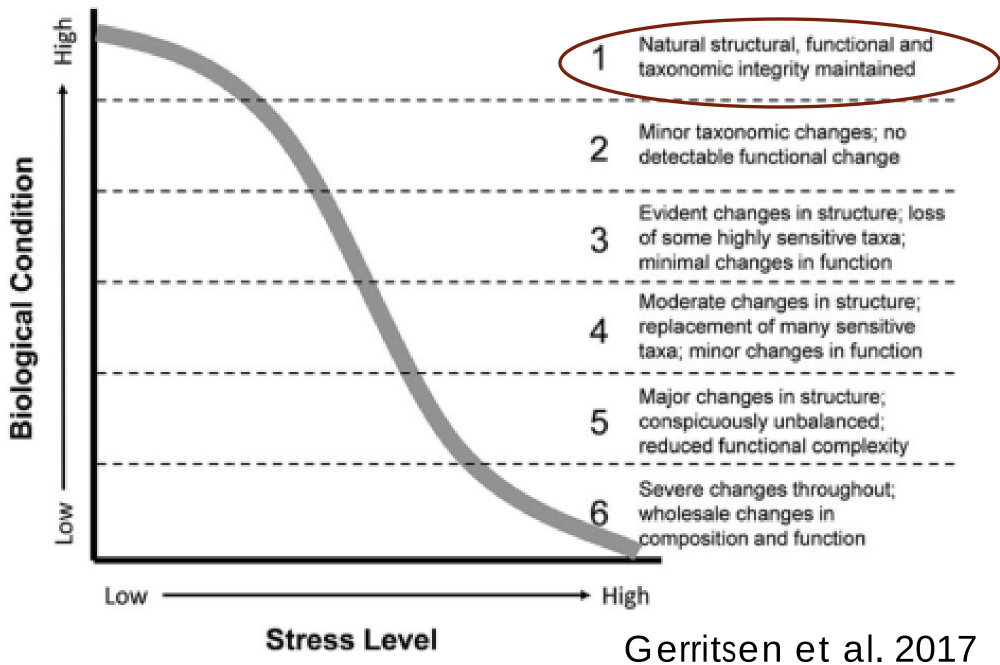
Stoddard et al, 2006

Comparison to Reference



Ambrose et al. 2006

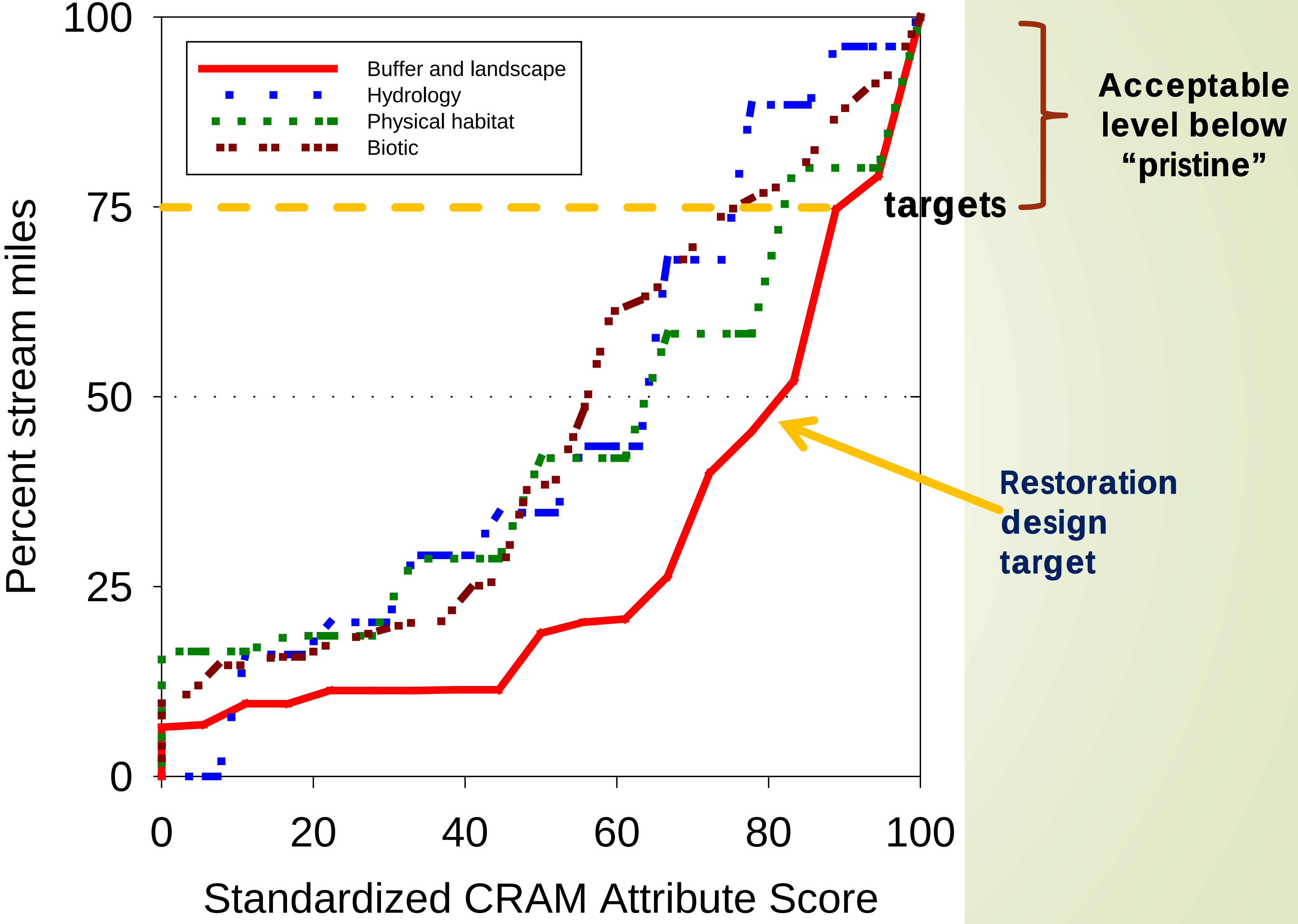
Often, pristine is not achievable



Gerritsen et al. 2017

... then what do you do??

Decisions Based on Ambient Data



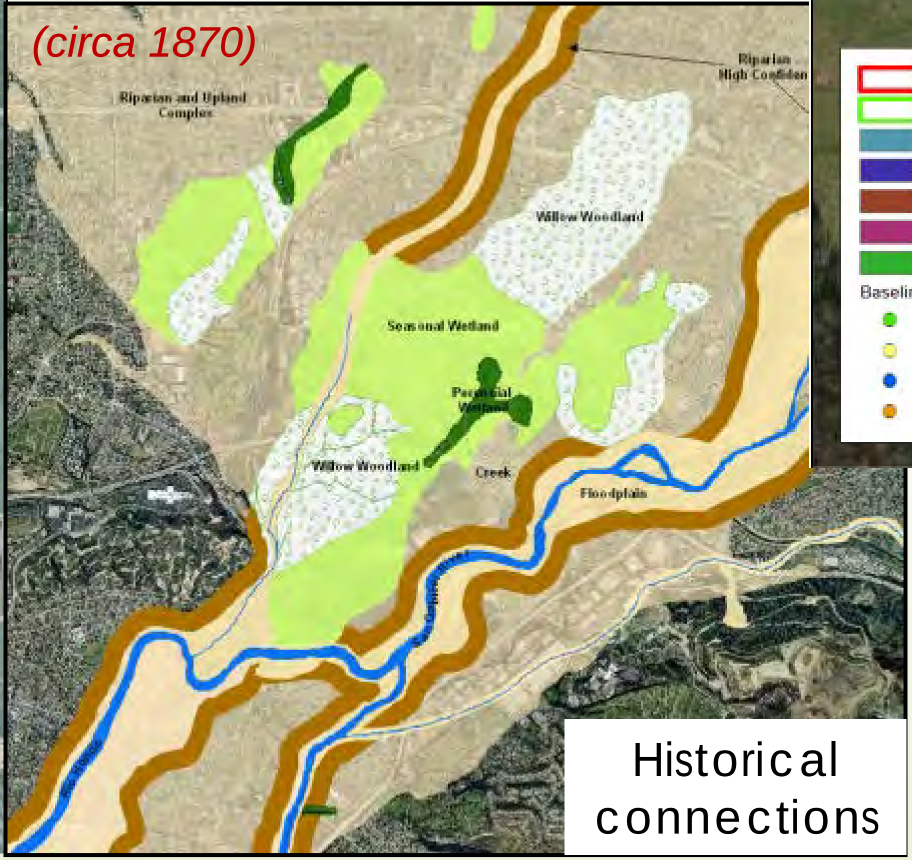
How to Determine the Appropriate Reference Condition

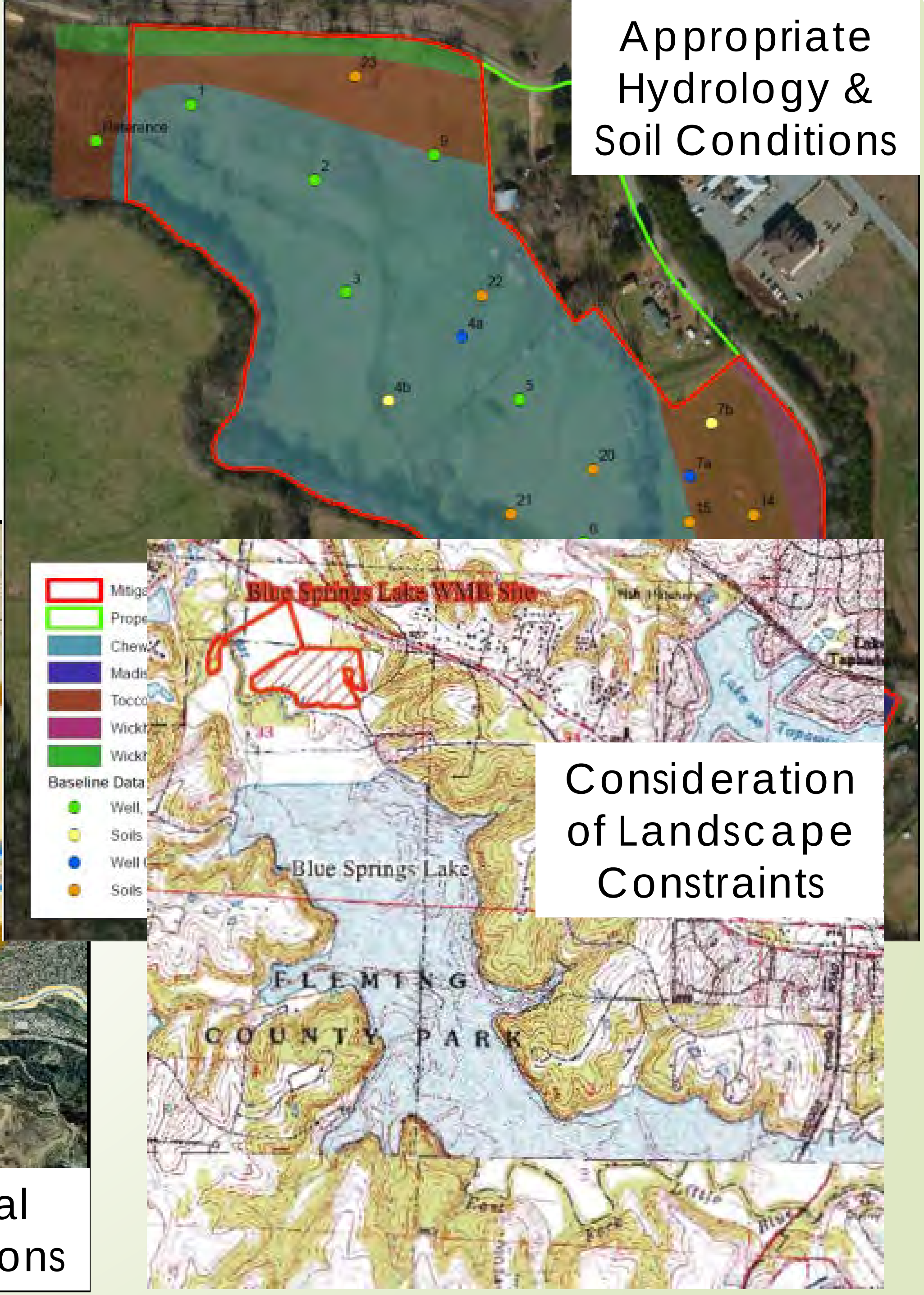
- Consider historical setting and associated hydrological and ecological connections
  - Groundwater connection due to geologic contact points, fissures, springs, etc.
  - Sumps and sags where organic reach (or peat) soils develop
  - Hydrologic connections in coastal wetlands – fluvial inputs and barrier berms, bars etc.

- Consider changes in the landscape that may have altered these connections
  - ***Best restoration opportunities may be to restore these connections; however, if connections are permanently altered must accommodate new landscape, i.e. sometimes type conversion may be appropriate***

- Determine most appropriate reference given objectives of the mitigation site

Considerations for Selecting Reference



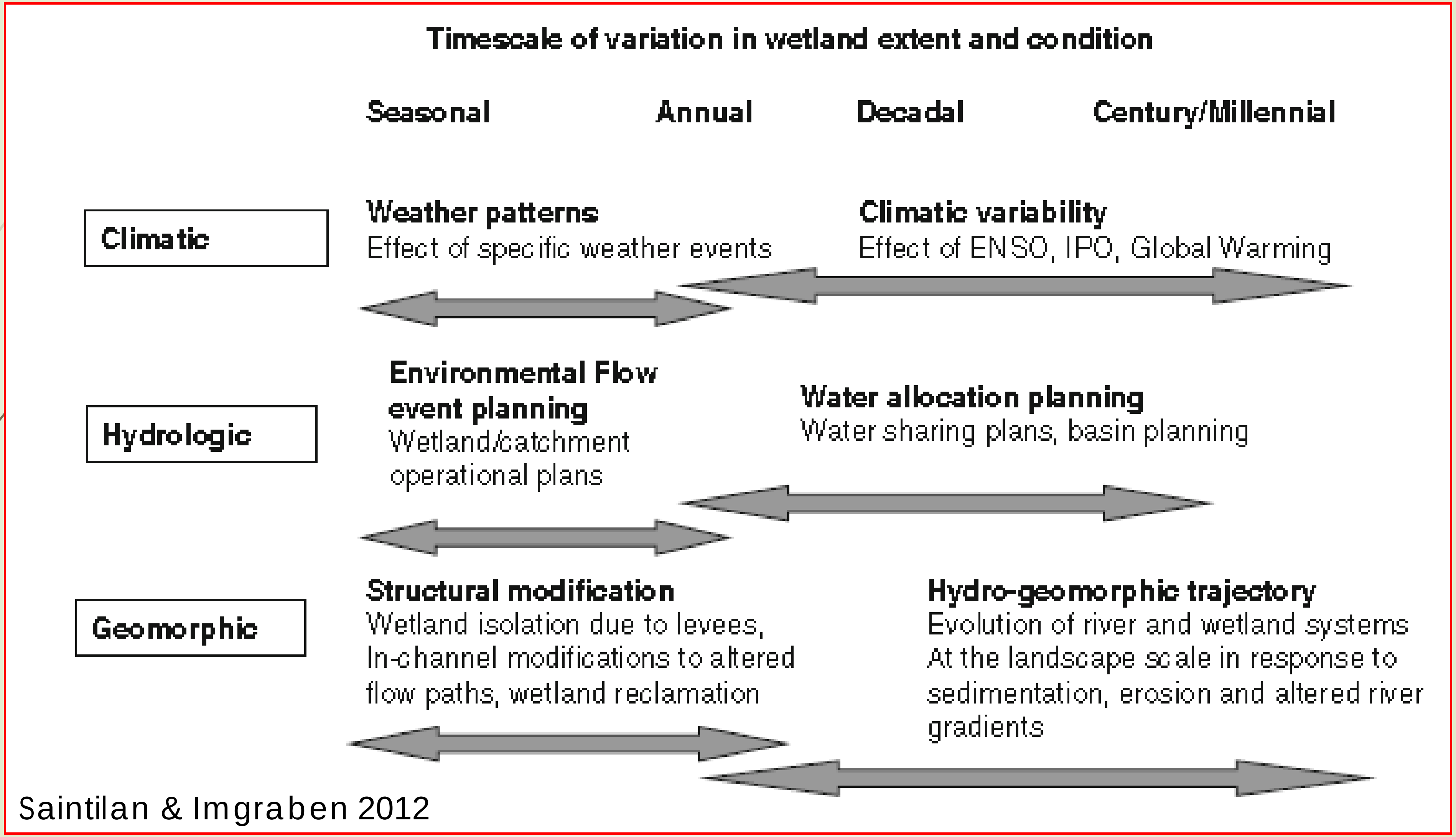


Timing is Everything

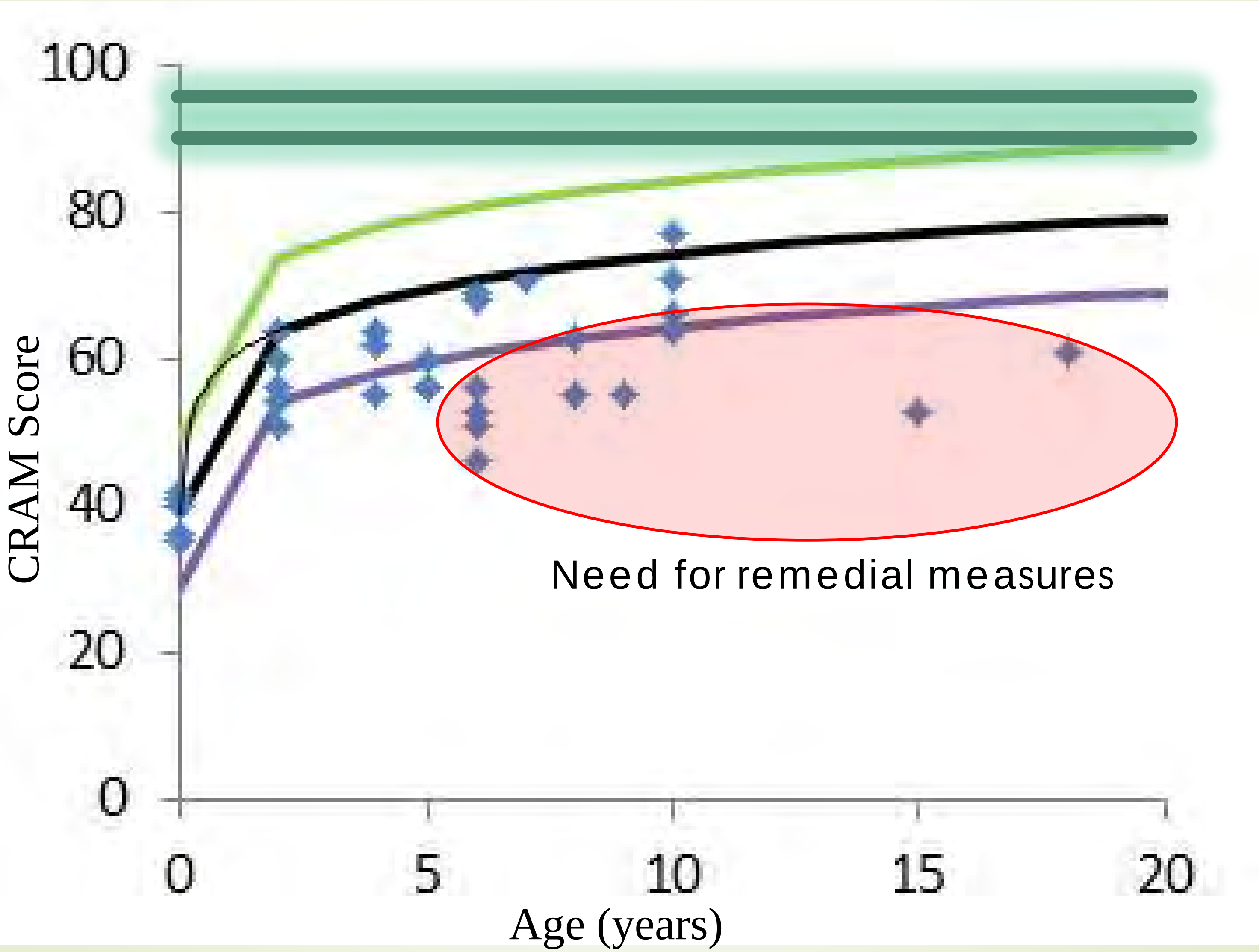
- Most mitigation sites will take longer than the typical 5-10 year monitoring period to mature
- Conditions will naturally fluctuate over time and in response to episodic events
  - Need to focus on long-term trajectory of site condition
- Need to couple **long-term monitoring** at mitigation sites with regional reference/comparator sites in order to assess trajectories of response relative to expectations.
- Focusing on landscape connections will maximize chances of long-term resiliency
  - Make sure you **monitor process not just structure** (e.g. piezometers, soil probes)

Subsequent speakers will discuss time scales for considering development of wetland function in more detail

Restoration Takes Time

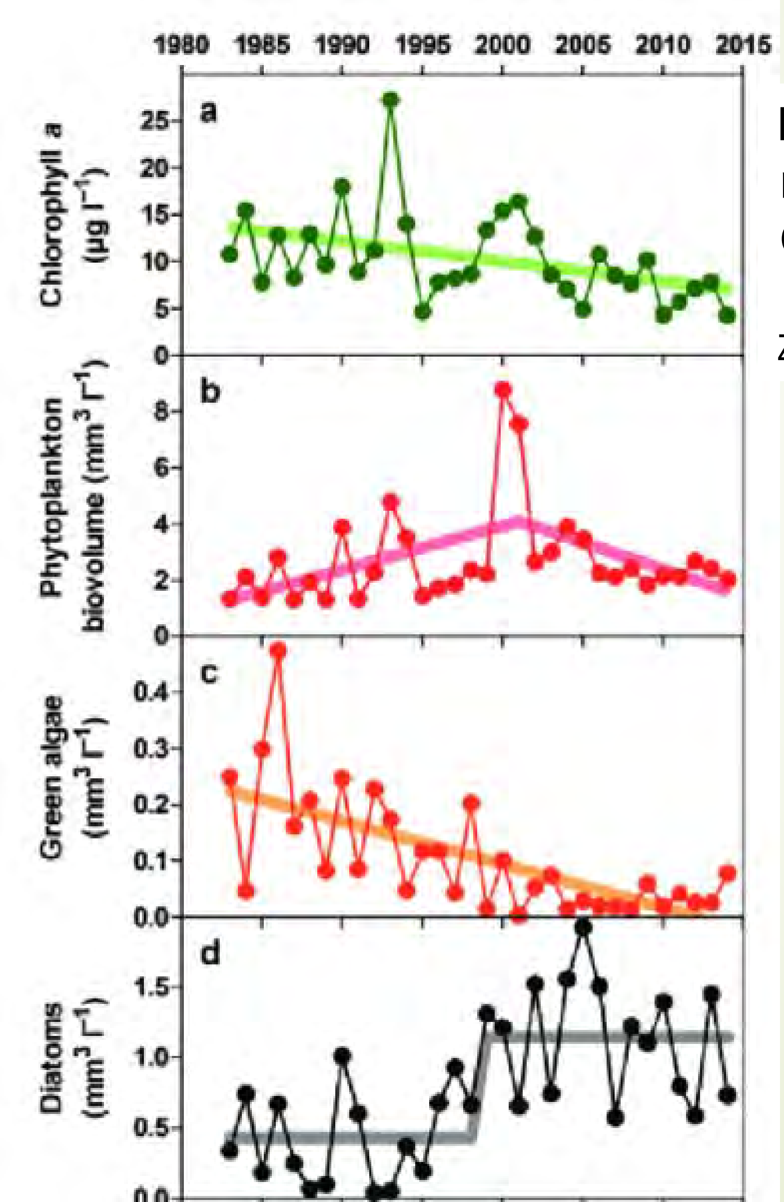


Restoration Performance Curves



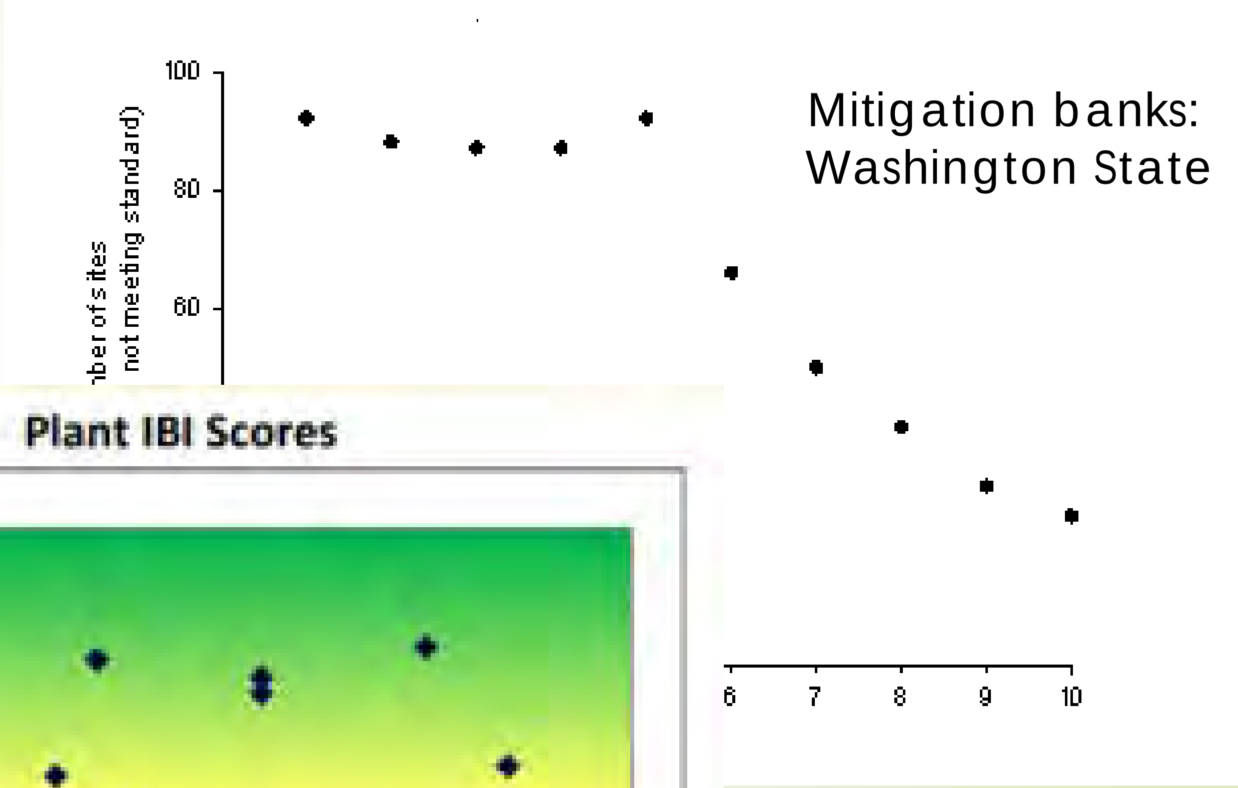
Fong et al. 2017

Typical Permit Monitoring Periods May be Insufficient → *Need Long-term Monitoring*

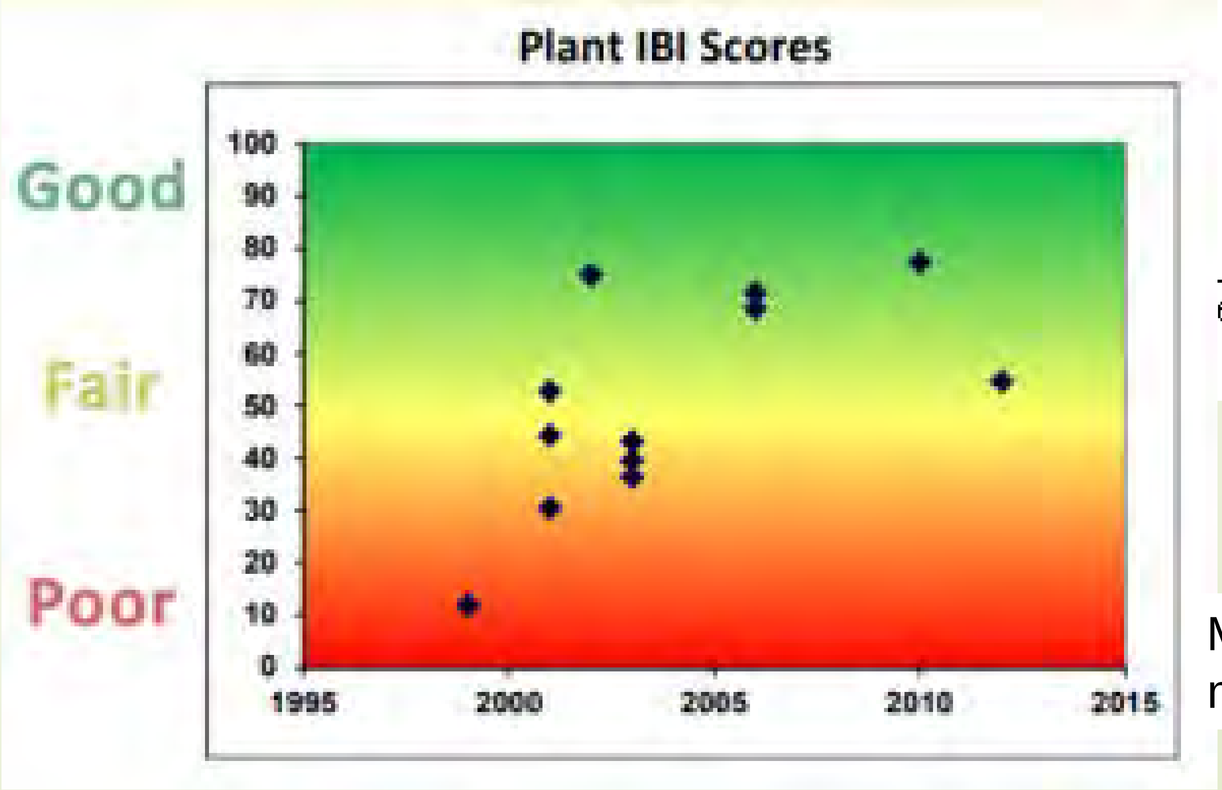


Long-term lake monitoring Czech Republic

Znachor et al. 2016



Mitigation banks: Washington State



Minnesota mitigation sites

So… What Should I Ask For?

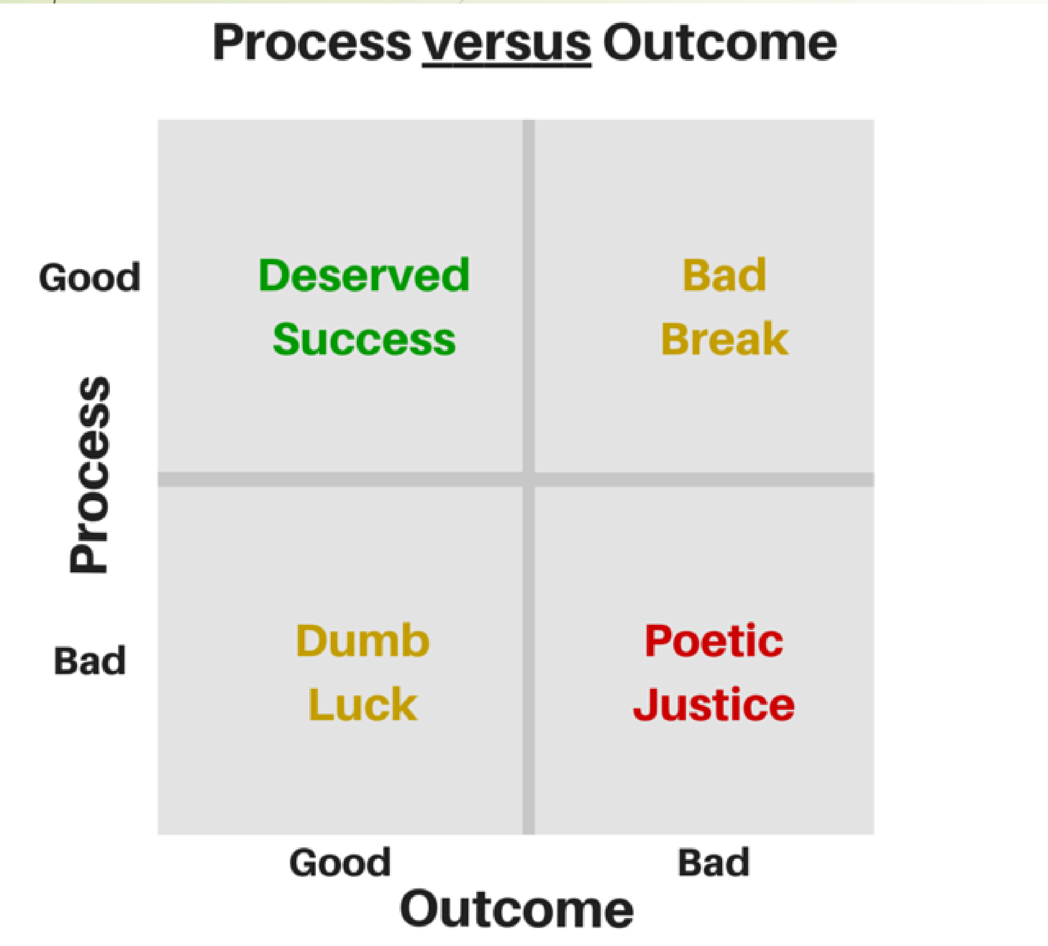
- Historical natural condition prior to major disturbance (if possible) IN ADDITION to historical degraded condition

- Diagrams of key hydrologic processes (e.g. directions of water flow, distance to groundwater)
  - Hydrologic impacts, e.g. tile drains, diversions, discharges, physical barriers
  - Mouth dynamics (for coastal systems)
  - History/frequency and magnitude of large “reset” events
  - Expected future hydrologic changes and climate change induced alterations of flood-drought cycles

- Current soil conditions (and historic if possible)
  - Compaction, salinity, organic matter, duration of saturation

- Biological connections
  - Adjacent land uses + expected changes to these in the future (also important for hydrology)
  - Proximity to wetlands that operate in a complex (e.g. vernal pools, prairie potholes)
  - Sources of invasion (plants and animals)
  - Other stressor inputs both current and expected future stressors

Closing Thoughts



- Focus on ecological processes
- Choose appropriate targets/goals
- Commit for the long-term
- Monitor...Adapt...Repeat

Coming up Next

- Jeremy Sueltenfuss – Hydrology
- W. Lee Daniels – Soils
- Matt Schweisberg – Plants (mostly)

THANK YOU!!

Eric Stein – SCCWRP

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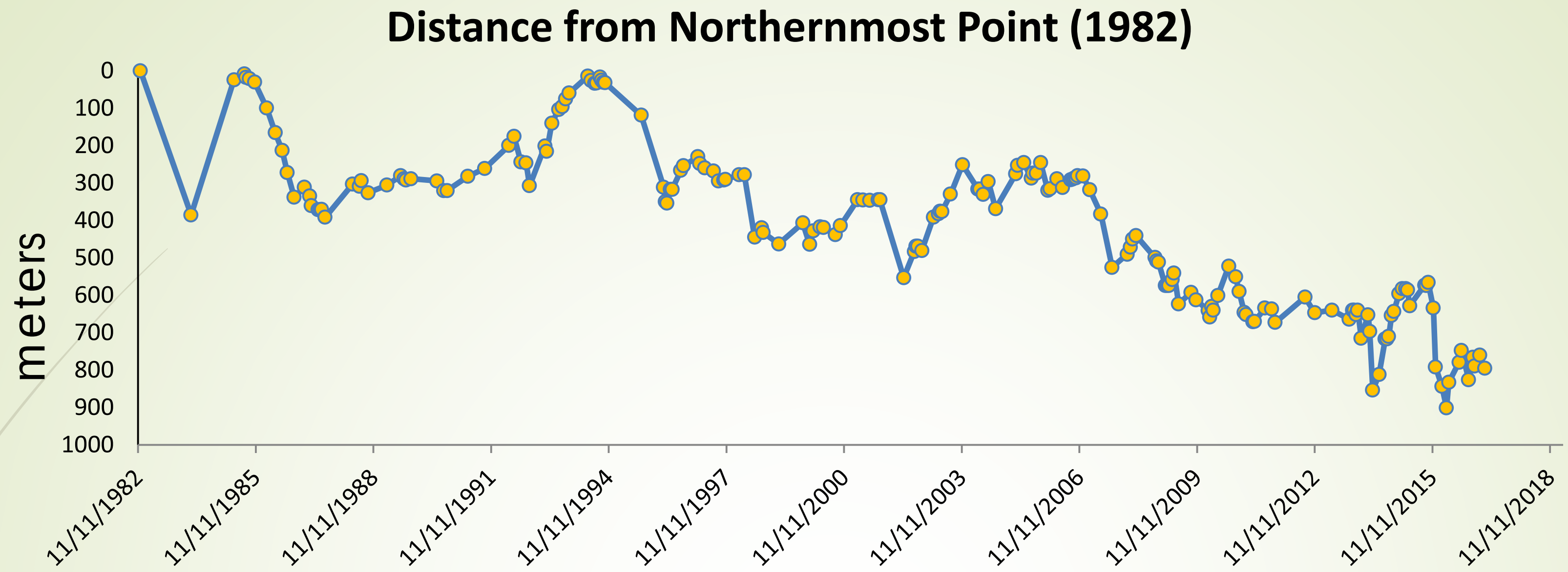
www.sccwrp.org

"Facts do not cease to exist because they are ignored."

Aldous Huxley

EXTRA SLIDES

Mouth Position from Satellite & Aerial Imagery



1977
840,000 m^3

1995
208,500 m^3

2001
92,000 m^3

2012
450,000 m^3

Beach Nourishments