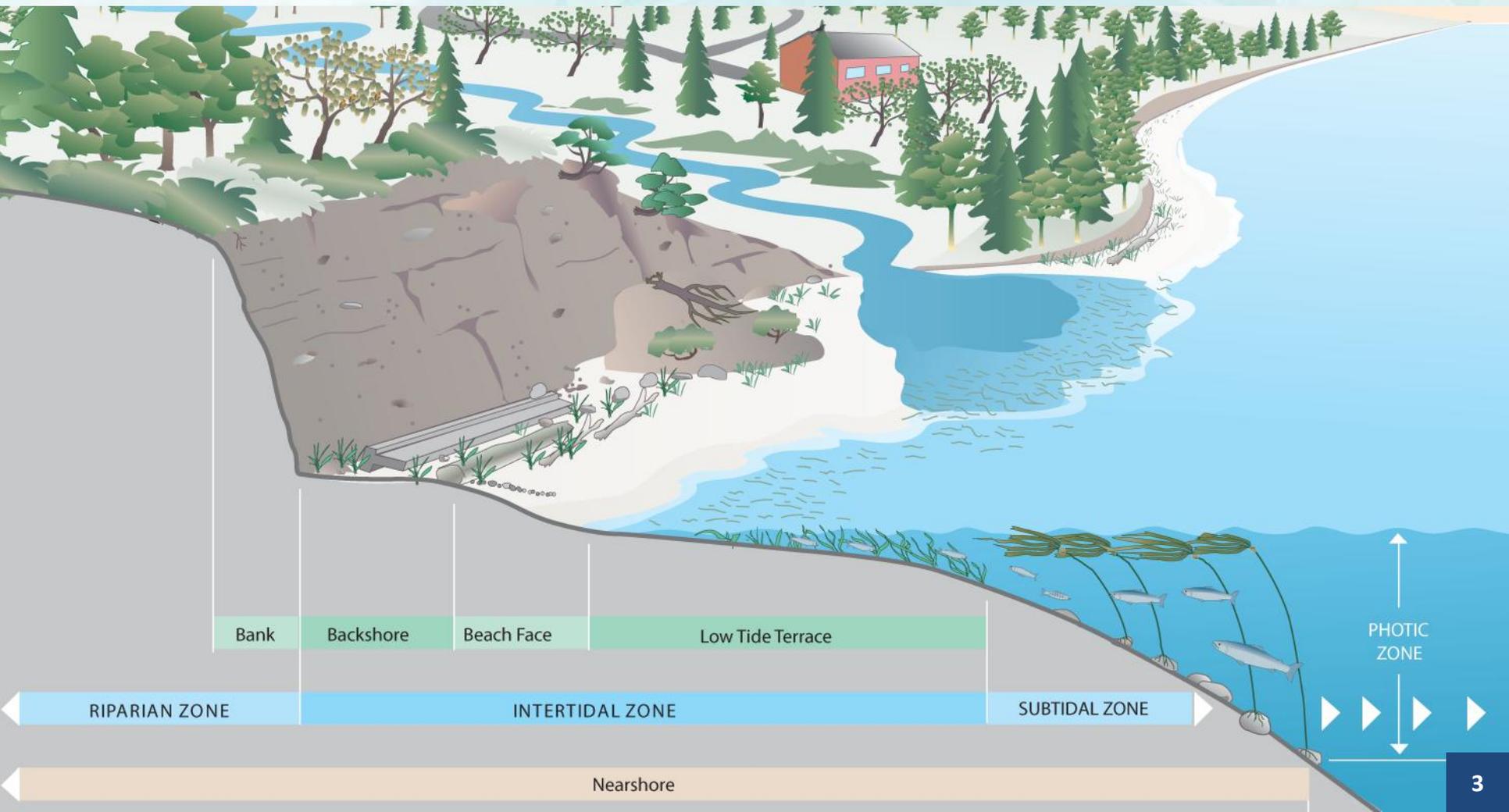# Strategic Protection and Restoration of Puget Sound Nearshore Ecosystems

Clallam County Planning Commission and Clallam Marine Resources Committee
March 17, 2010

The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP):

- is a large-scale initiative to protect and restore natural processes and functions in the nearshore

- is a General Investigation study, jointly sponsored by Corps of Engineers and WDFW

- began in 2001, completion in 2011

- can result in Corps construction authority and funding

- is the nearshore component of the Puget Sound Partnership's strategy to restore Puget Sound

The Nearshore: The shallow water of estuarine deltas & marine shorelines, from the top of the coastal bank to water depths where light supports plant growth and up rivers to the end of tidal influence


Bank | Backshore | Beach Face | Low Tide Terrace

RIPARIAN ZONE | INTERTIDAL ZONE | SUBTIDAL ZONE

PHOTIC ZONE

Nearshore

Ecosystem: Interrelated complex of diverse shoreforms and associated biota.

River deltas

Salt marshes

Beaches

Bluffs

KELP AND EELGRASS BEDS

BEACHES

CLIFFS AND BLUFFS

ROCKY SHORES

MUDFLATS

SAND SPITS

RIVER DELTAS

SALT MARSHES

BAYS

LAGOONS

PSNERP's process-based approach to restoration :
Natural **processes** create the **structure** of habitats, which support ecological **functions** for species and people.
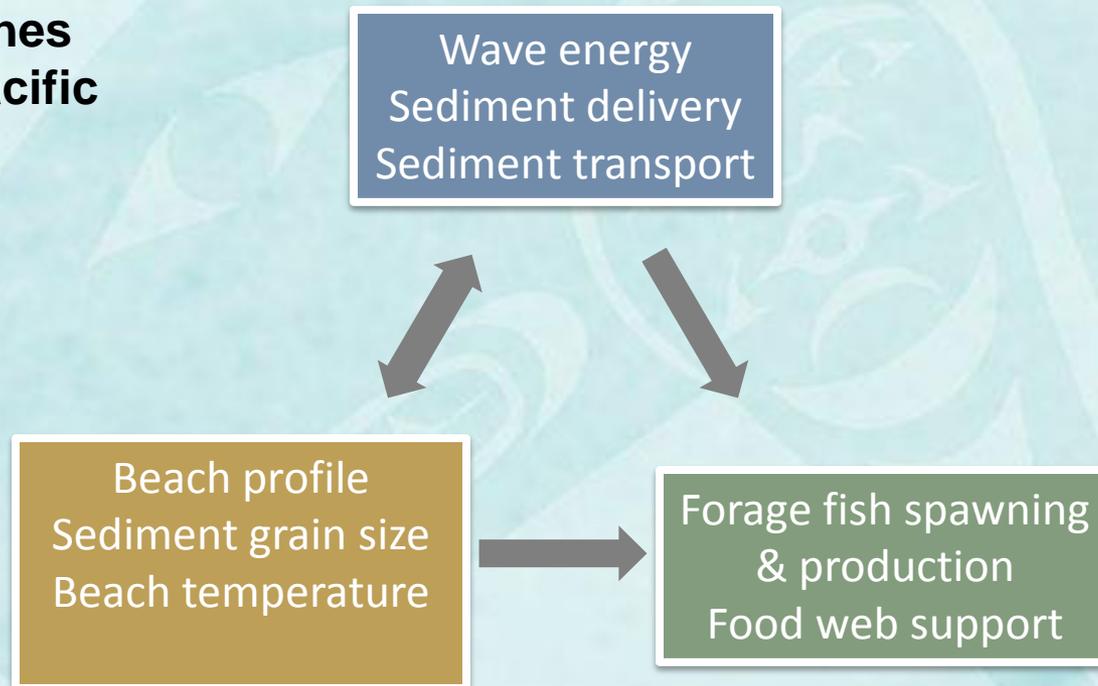
Conceptual Model

Source Conceptual Model: Simenstad et al. 2006, Penttila, 2007
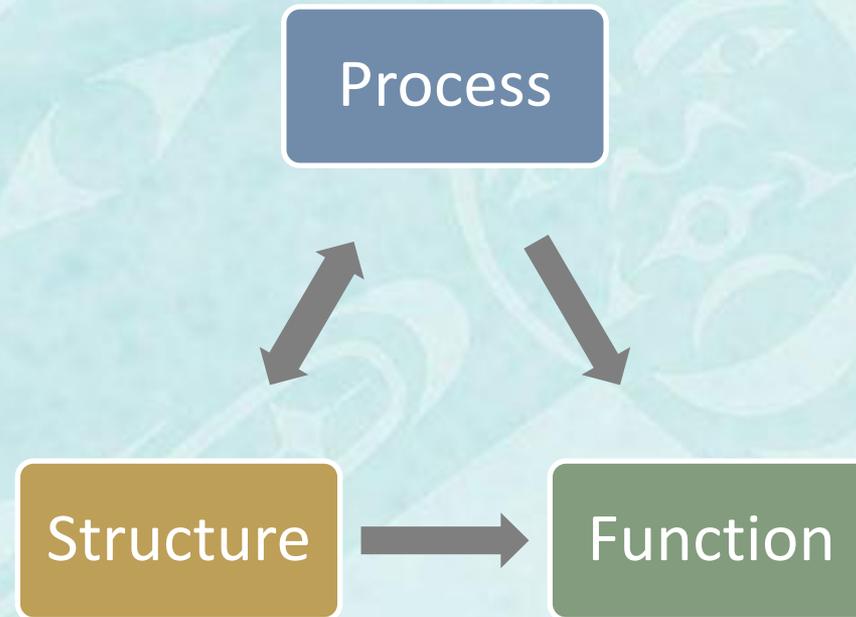
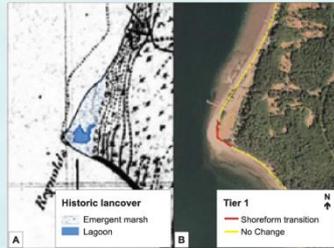**PSNERP's process-based approach to restoration :**
Natural **processes** create the **structure** of habitats, which support ecological **functions** for species and people.

Conceptual Model:
**the role of Puget Sound nearshore beaches in sustaining Pacific sand lance**

Wave energy
Sediment delivery
Sediment transport

Beach profile
Sediment grain size
Beach temperature

Forage fish spawning & production
Food web support

Source Conceptual Model: Simenstad et al. 2006, Penttila, 2007

PSNERP's plan:

How has the nearshore changed?

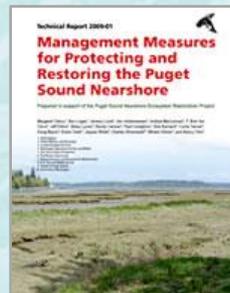**Where are the most problematic changes and why?**
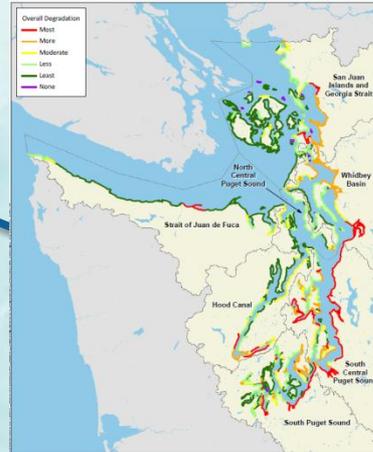
How might future growth and development affect the nearshore?

What are guiding restoration principles from literature and practice?

What can we do to protect and manage the nearshore?

**What actions should we take and where?**

Change Analysis of nearshore conditions

- Allowed PSNERP to detect and describe changes between the past and the present in Puget Sound's deltas, estuaries, and beaches

- Informs an assessment of nearshore restoration needs in Puget Sound that is:
  - process-based
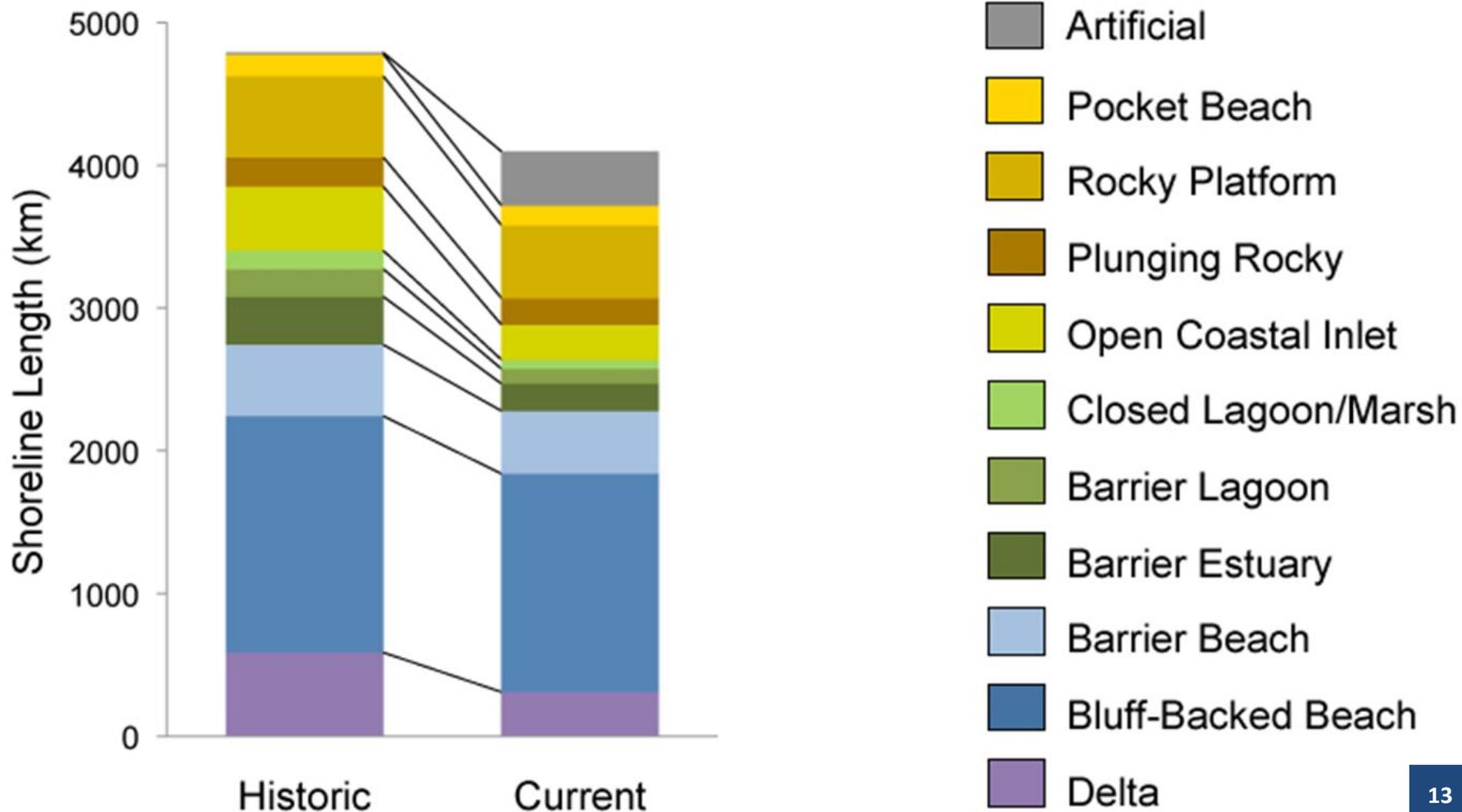 - comprehensive and
  - spatially-explicit

Nearshore Geodatabase

- Assembled to support Change Analysis

- Consistent data across Puget Sound

- Organized for analysis at multiple scales

- Available on-line: http://www.pugetsoundnearshore.org/
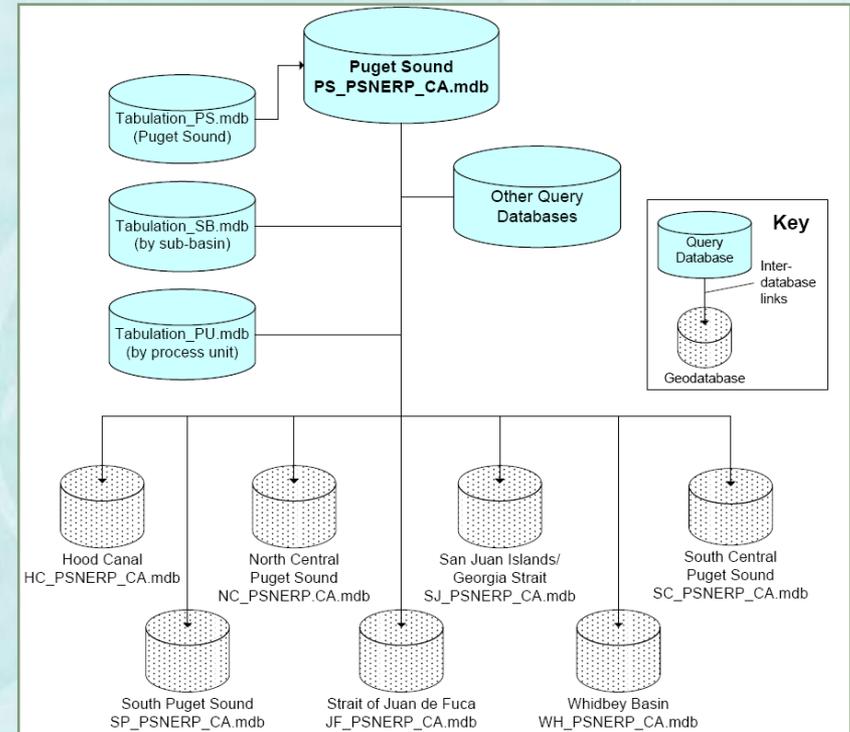
Example: Shoreform Transitions

Six science based problems

#1: Barriers in large river deltas restrict the movement of fresh water and tides.

Scientific evidence

- 63% of the area of large deltas classified as developed land

- Shoreline length has declined 25%

Significance

Shorebirds need large river deltas and nearshore wetlands to rest and "fuel up" as they migrate from the Puget Sound to their northerly breeding grounds.
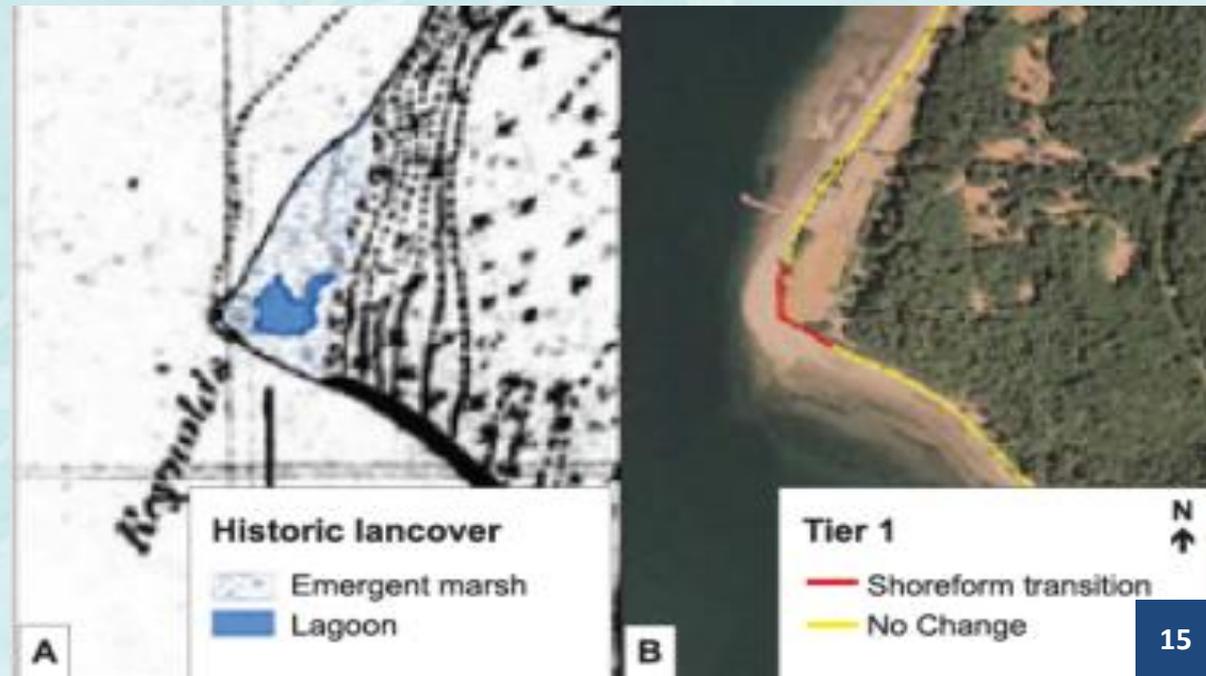
Six science based problems

#2: Small coastal inlets have been blocked off and filled in.

Scientific evidence

- 299 small embayments have been eliminated, especially closed marsh/lagoons

- Historically embayments accounted for 23% of the shoreline, currently they are 15%.

Significance

Salmon need large river deltas, small coastal inlets, and shallow water areas to rest, feed, and hide from predators.

Historic lancover
- Emergent marsh
- Lagoon

A

Tier 1
- Shoreform transition
- No Change

B

N ↑

Six science based problems

#3: Armoring along beaches and bluffs prevents sand and gravel from replenishing beaches and intertidal areas.

Scientific evidence

- 128 km (out of 1600km) of bluff backed beach has been lost. 33% of the remainder has been armored

- 60 km of barrier beach has been lost. 27% of the remainder has been armored

Significance

Bulkheads can prevent sediment from coastal bluffs from reaching the shoreline, resulting in fewer and smaller beaches.

Six science based problems

#4: Nearshore wetlands have been eliminated.

Scientific evidence

- Overall, 43% of nearshore wetlands have been lost.

- Over 90% of tidal freshwater and oligohaline wetlands have been lost.

Significance

Loss of nearshore wetlands makes our shorelines more vulnerable to the effects of sea level rise because wetlands help absorb energy from storms, waves, and high flows.

Six science based problems

#5: The shoreline has become shorter, simpler, and more artificial.

Scientific evidence

- The shoreline has been shortened by 15%

- 1062 km of natural shoreline lost and 368 km artificial shoreline was added

Significance

Nearshore habitat for shellfish, forage fish, and shorebirds has been eliminated. The loss of shellfish and forage fish reduces the ecological, economic, recreational, and cultural value of our shorelines.

Six science based problems

#6: Many places are affected by multiple types of changes.

Scientific evidence

- Only 7% of shoreline segments have not been altered

- 81% of shoreline segments have multiple stressors

Significance

While small scale alterations may be insignificant by themselves, cumulative impacts build over time, compounding the adverse effects.

Restoration objectives

1. Restore connectivity and size of large river deltas

2. Restore sediment input, transport and accretion processes

3. Restore shoreline complexity and length

4. Enhance landscape heterogeneity and connectivity

Protection objectives

5. Protect relatively undegraded processes in large river deltas

6. Protect relatively undegraded sources of sediment

7. Protect relatively undegraded embayments

Learning objective

8. Increase understanding of natural process restoration to improve effectiveness of project actions

Strategic Nearshore Restoration & Protection

|	
Problems	• Identify Problems
Objectives	• Define Objectives
Needs	• Determine Strategic Needs
Projects	• Select Projects
Results	• Implement and Assess Results

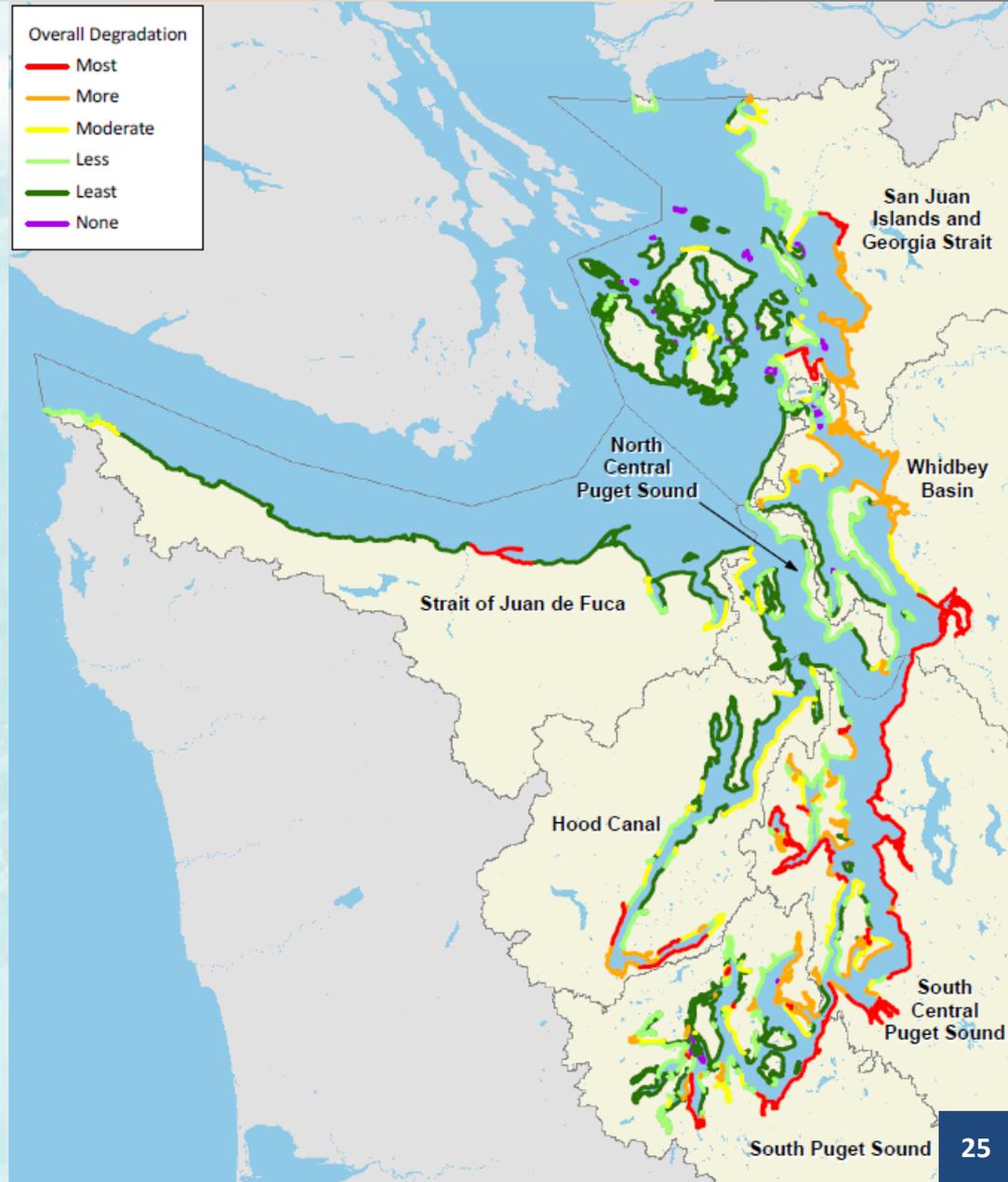# Evaluating Degradation of Nearshore Ecosystem Processes: Sediment Supply Example

- Determine potential
  - portion of process unit (i.e. drift cell) that support sediment delivery
- Identify area impacted by stressors
  - Armoring
  - Roads
  - Fill
  - Railroads
- Calculate % that where process has been degraded
  - ~75% of potential area impacted by stressors to sediment delivery process → degradation score (75%)
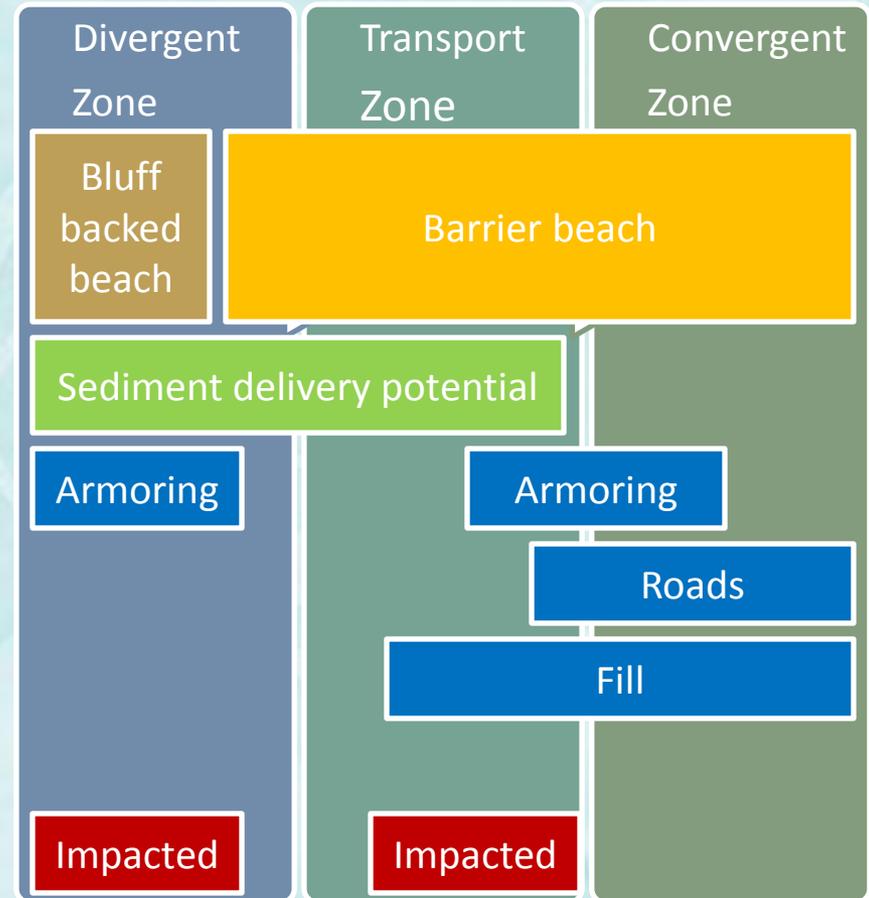
Nearshore Process Degradation

Composite category

- derived from 11 nearshore process degradation scores

- Can be scaled to Sound-wide or sub-basin specific scale

Overall Degradation
- Most
- More
- Moderate
- Less
- Least
- None

San Juan Islands and Georgia Strait

North Central Puget Sound

Whidbey Basin

Strait of Juan de Fuca

Hood Canal

South Central Puget Sound

South Puget Sound

PSNERP Strategies

Given all of the problems identified by the PSNERP Change Analysis,

strategies define the places where we can best meet our restoration and protection objectives.

- These places provide relative:
  - High ecological benefit
  - Low risk/cost

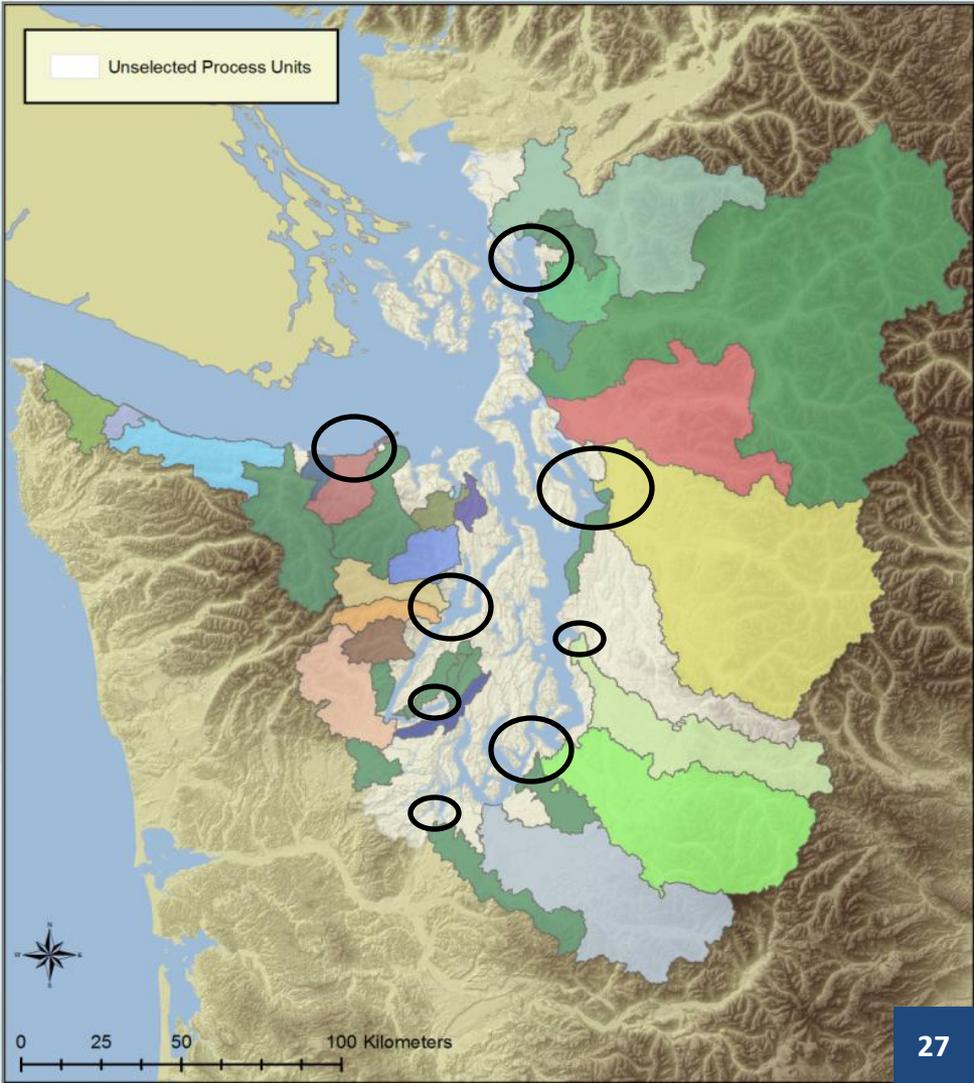# Identify Best Places to Address Objectives

Strategy A:
River delta or barrier estuary
-AND-
sediment processes degraded
-AND-
freshwater tidal and/or oligohaline wetlands once present
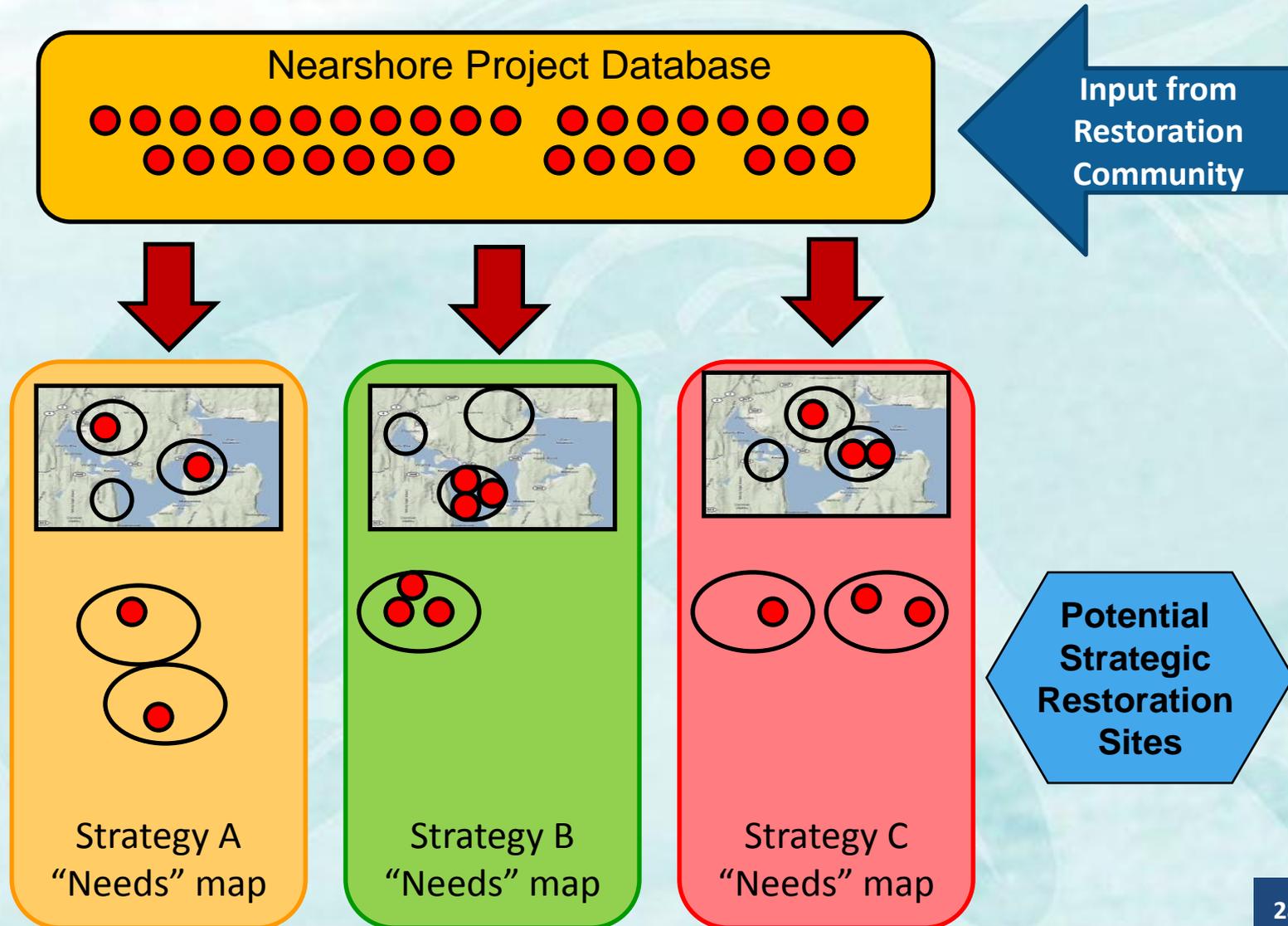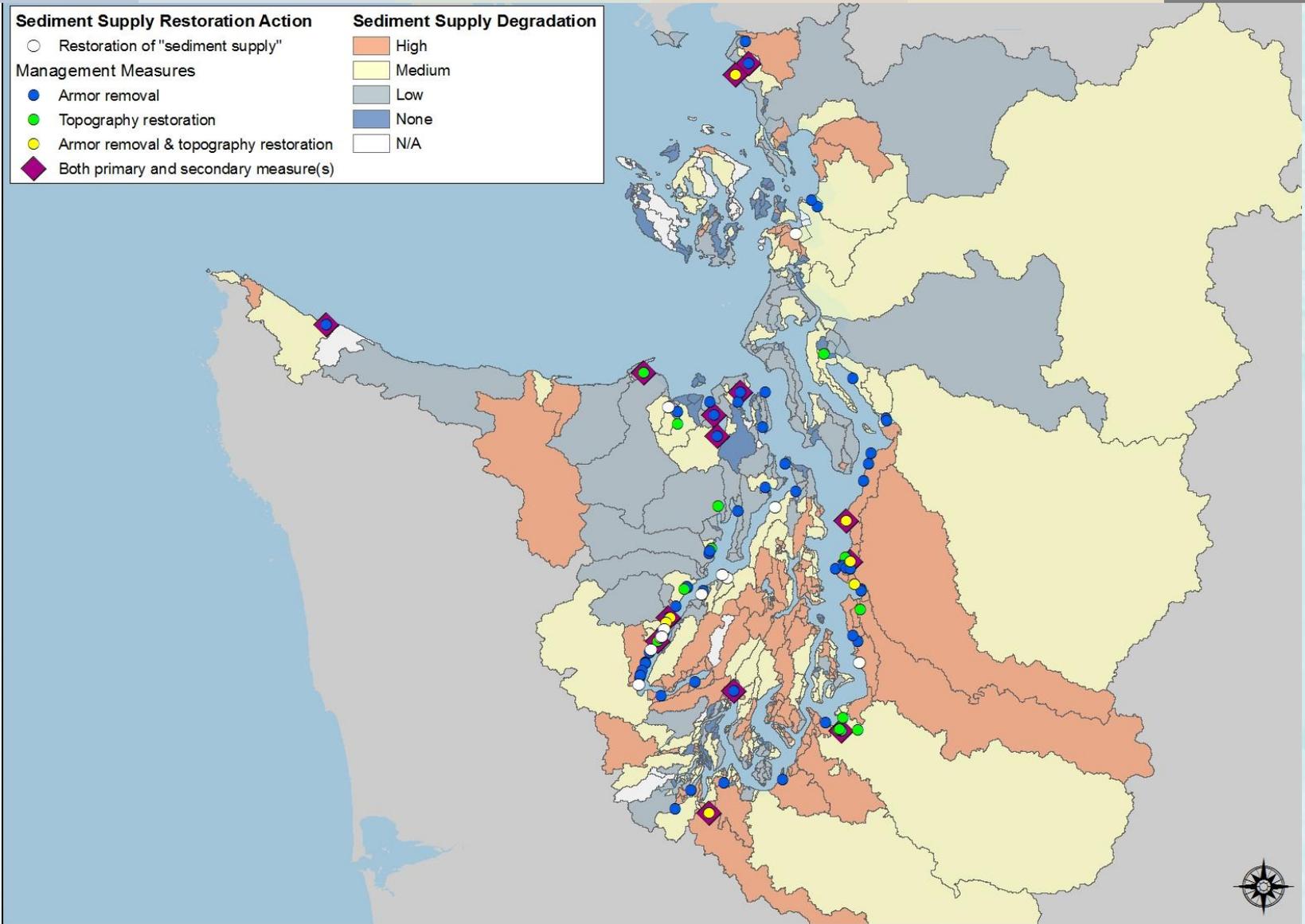**-AND-**
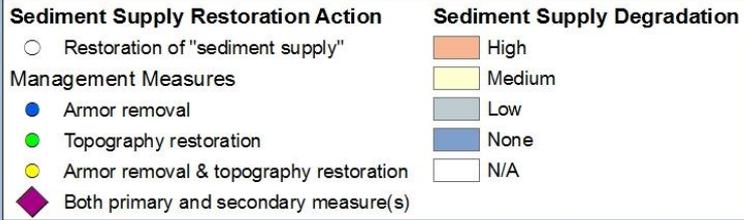>10% loss of historic wetland area

Obj-1

Obj-2

Obj-4

Obj-5

Determine Which Potential Projects Meet Identified Needs

Nearshore Project Database

Input from Restoration Community

Strategy A "Needs" map

Strategy B "Needs" map

Strategy C "Needs" map

Potential Strategic Restoration Sites
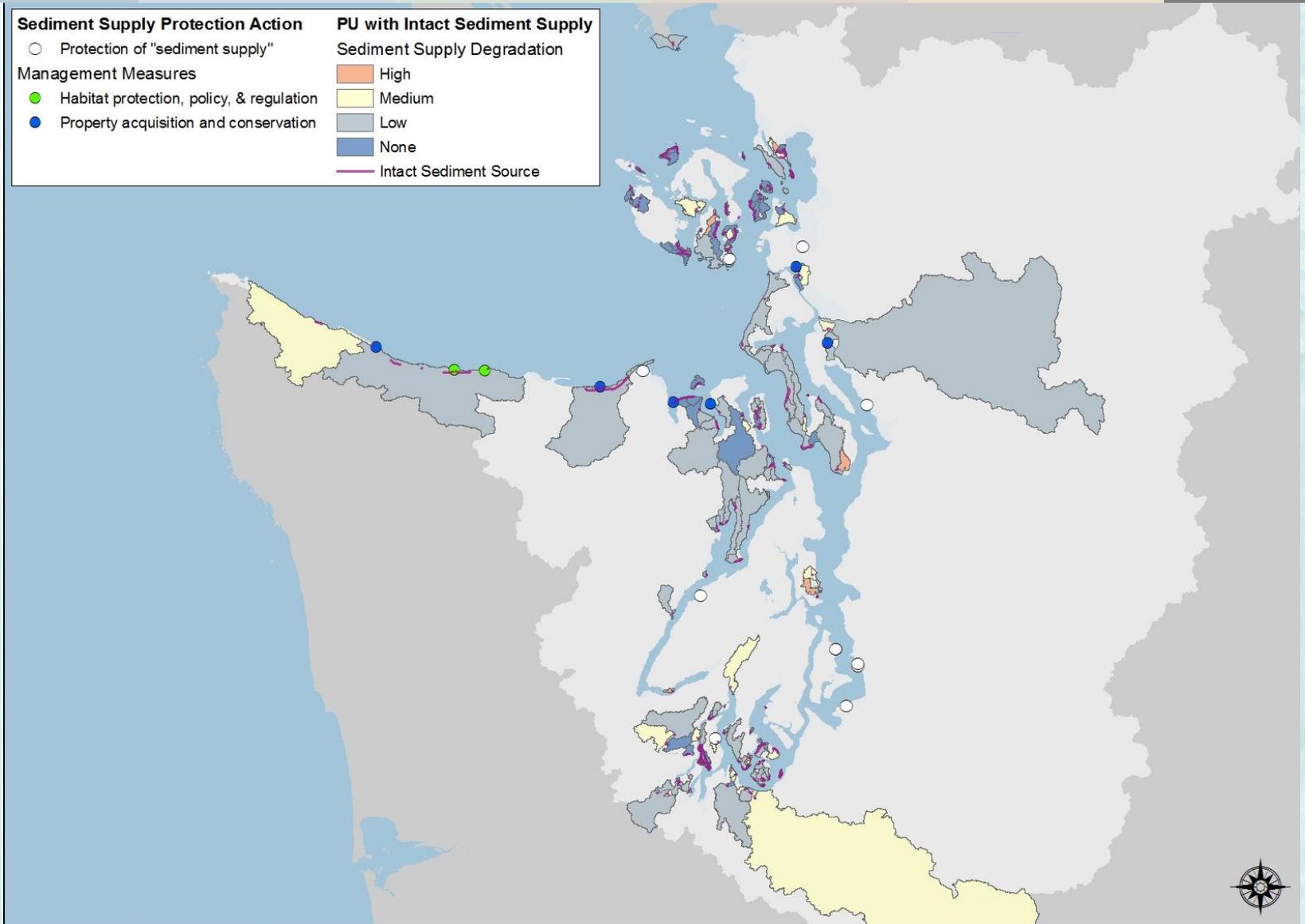
SEDIMENT SUPPLY RESTORATION
Primary Management Measure
- Armor removal
- Topography restoration

Secondary Management Measure
- Beach nourishment
- Berm or dike removal

Sediment Supply Protection Action
○ Protection of "sediment supply"
Management Measures
● Habitat protection, policy, & regulation
● Property acquisition and conservation

PU with Intact Sediment Supply
Sediment Supply Degradation
High
Medium
Low
None
—— Intact Sediment Source

SEDIMENT SUPPLY PROTECTION
Primary Management Measure
- Habitat protection, policy, and regulation
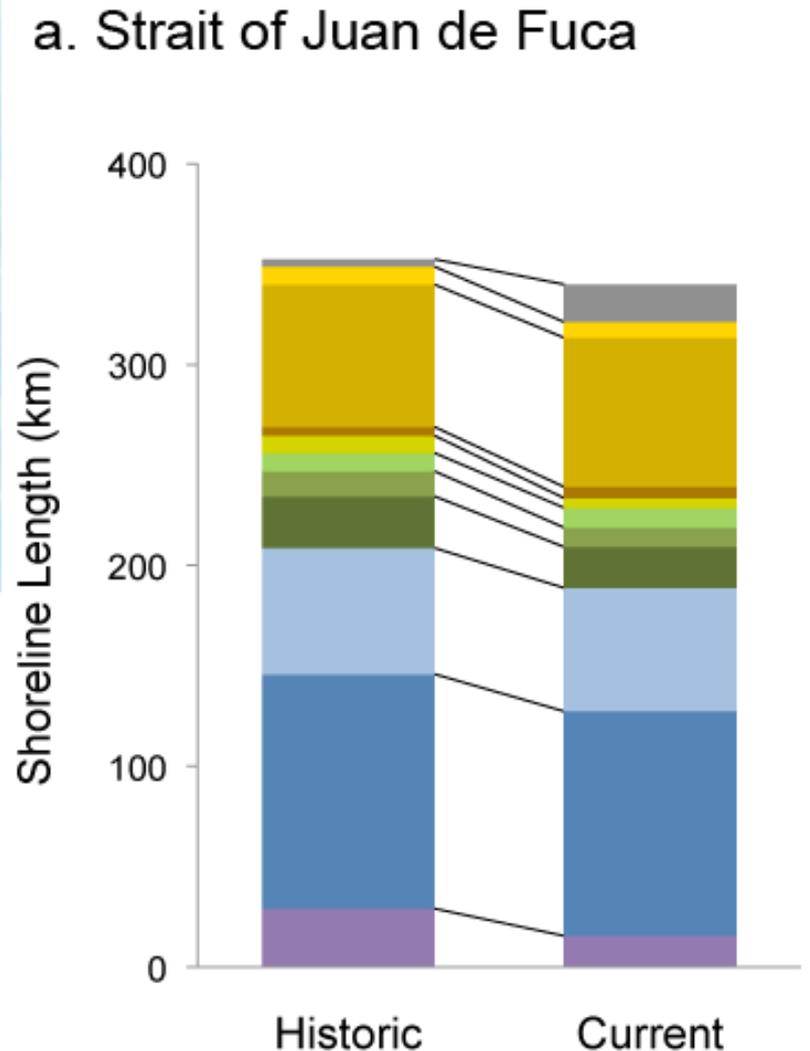- Property acquisition and conservation

Stakeholder Involvement

- Engage the restoration community to
  - Correct and add to the records in the nearshore project database
  - Refine project descriptions to address PSNERP-identified nearshore needs
- Engage the public so that
  - PSNERP projects have support from the surrounding communities
  - Potential implementation issues are understood and incorporated

Change Analysis Results

- Change in composition of shoreline
  - Loss of open coastal inlet (- 45%)
  - Loss of barrier lagoon (- 23%)
  - Loss of barrier estuary (-21%)
  - Loss of river delta (-47%)
  - Increase in rocky platform (+ 5%)

a. Strait of Juan de Fuca

Legend:
- Artificial
- Pocket Beach
- Rocky Platform
- Plunging Rocky
- Open Coastal Inlet
- Closed Lagoon/Marsh
- Barrier Lagoon
- Barrier Estuary
- Barrier Beach
- Bluff-Backed Beach
- Delta

# Change Analysis Results

- Observed Changes Concentrated
  - Elwha and Dungeness estuaries
  - South end of Discovery Bay
  - Ediz Hook
  - Protection Island

- Most changes due to anthropogenic factors
  - Only two of 52 observed changes involved potentially natural change
    - one barrier beach to a barrier lagoon
    - one open coastal inlet to a barrier estuary
  - All other changes resulted in loss of natural shoreform types
    - Conversion to "artificial" (fill) or "shoreform absent"

Change Analysis Results

- Shoreline Alterations
  - Shoreline armoring and tidal barriers in Elwha and Dungeness deltas
  - Shoreline armoring east of Elwha (75% armored)
  - Armoring, abandoned RR's and tidal barriers in Discovery Bay

- Adjacent Uplands and Watershed Area
  - Predominantly natural, evergreen forest
  - Relatively intact compared to other Puget Sound sub-basins

- Unique Sub-basin Characteristics
  - Historic composition of barrier beaches and rocky platforms
  - Relative to other Puget Sound basins, little shoreline alteration

Nearshore Process Degradation

- The Strait of Juan de Fuca sub-basin has the highest percentages of the sub-basin shoreline in the "least degraded" category (71%)
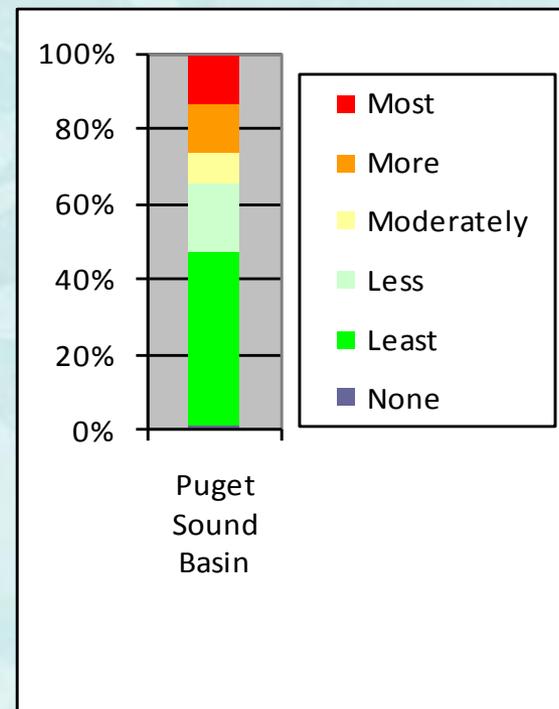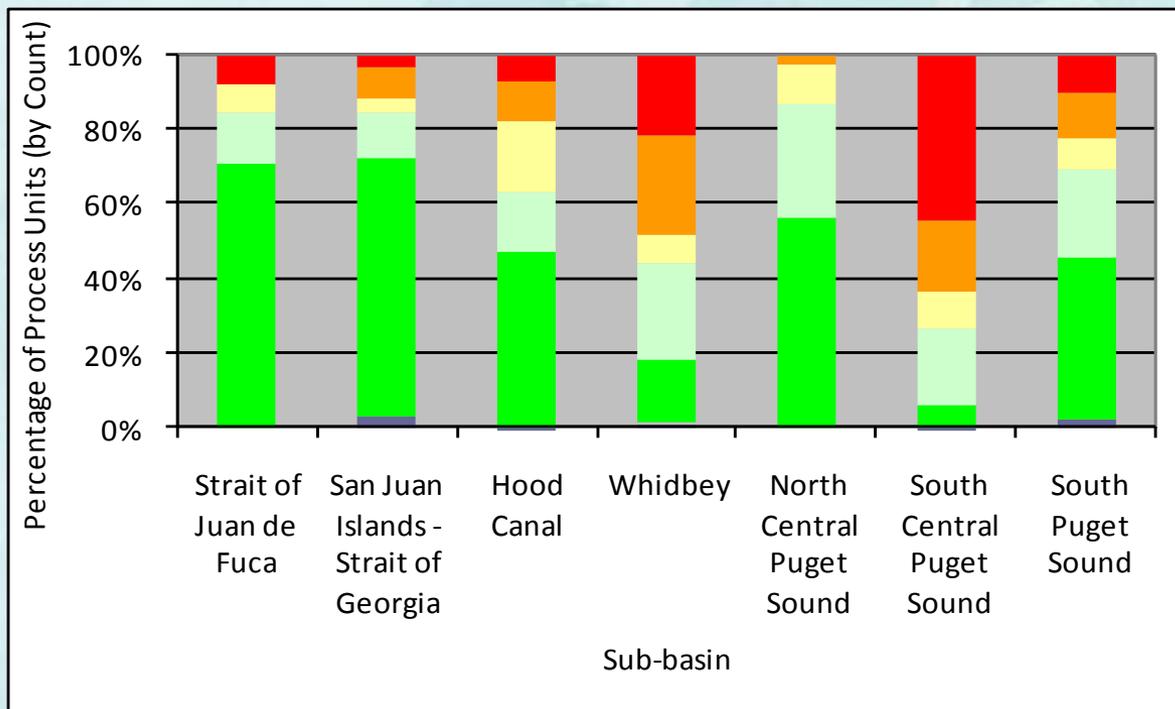
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