

# *Conceiving and Managing Estuaries as Landscapes*

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The background of the slide is a solid blue color. In the lower half, there are several faint, concentric circles of varying sizes, resembling ripples in water, scattered across the bottom right and center.

## *Traditional Management*

- *Problem Focused*
- *Fragmented*
- *Uncoordinated*

Endangered  
Species

Urban  
Industrial  
Development

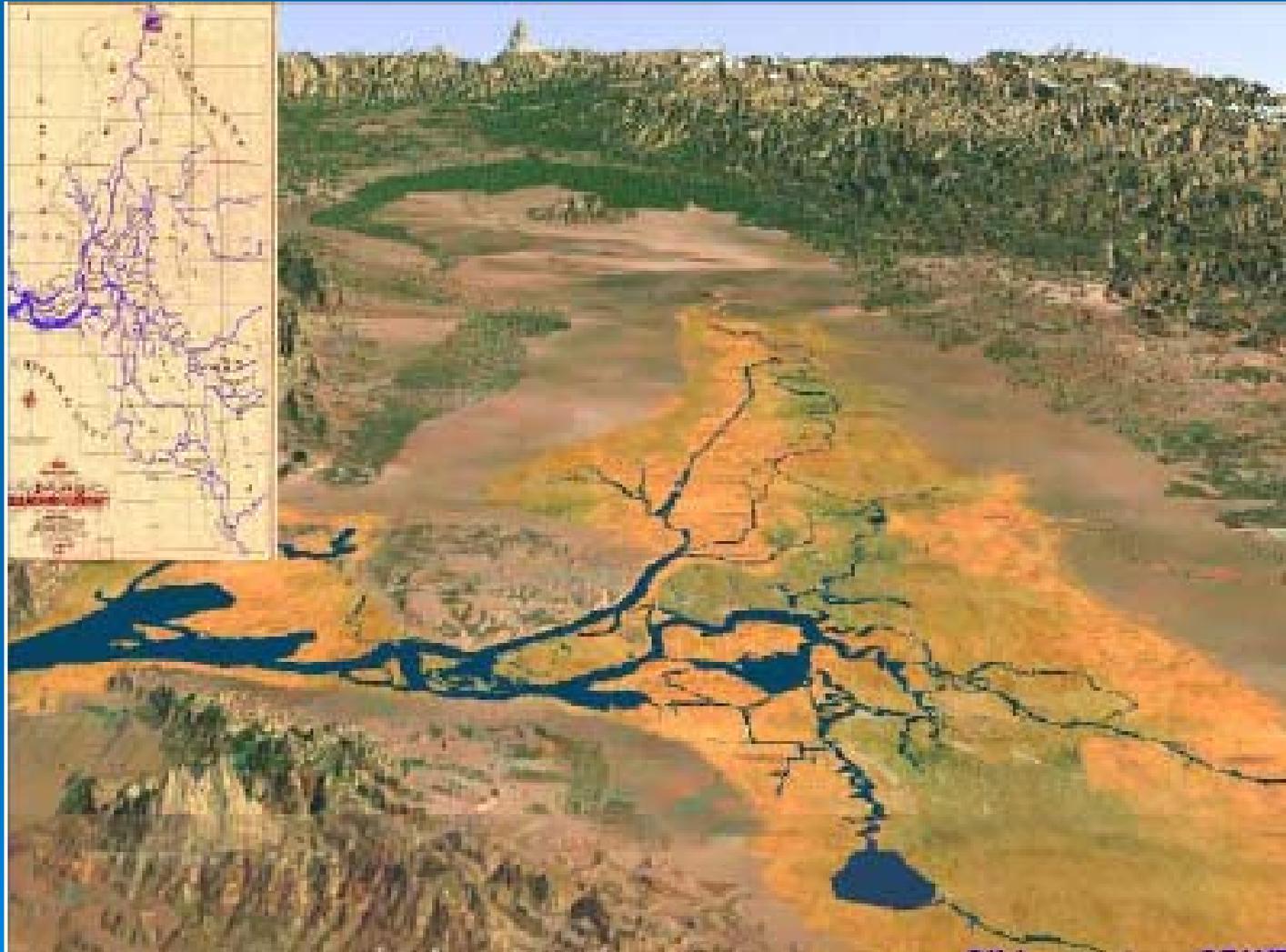
Hydrology  
Flood Risk

Transportation  
Corridors

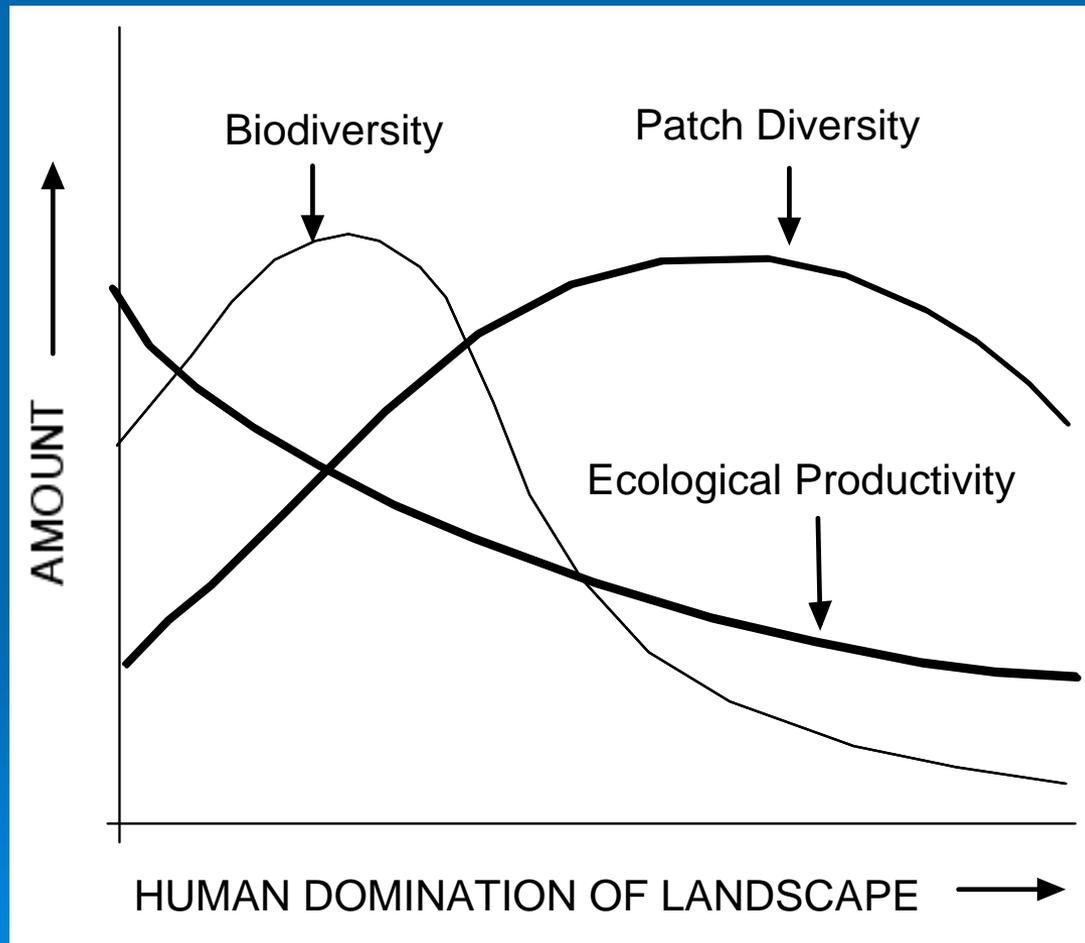
Recreation

Invasive  
Species

# *Estuaries Are Landscapes*



# *Human Development of Estuaries Has Important Ecosystem Level Consequences*



# *Critical Landscape Level Questions*

- How does the estuary interact with watershed and ocean?
- What ecosystem patches comprise the larger estuarine ecosystem?
- What are the important exchanges (materials, organisms, energy) among ecosystem patches?
- What are the appropriate sizes and arrangement of ecosystem patches to deliver desired ecosystem services?

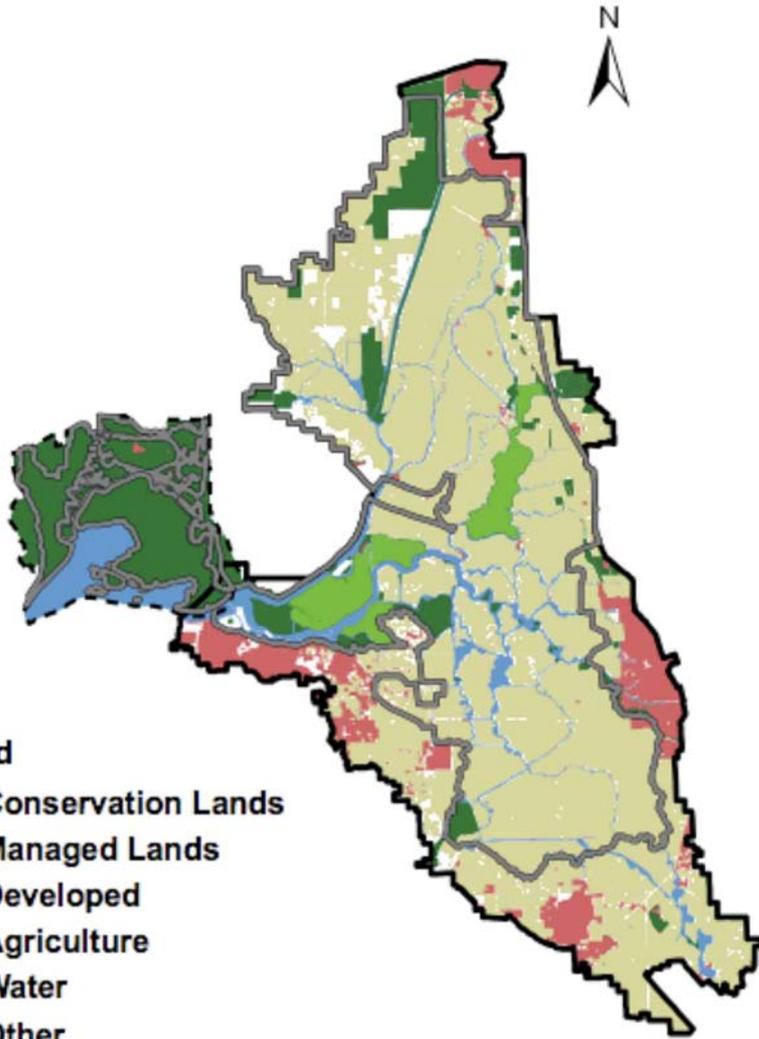
# *How does the estuary interact with watershed upstream and ocean downstream?*

- Most of the DOC in the Sacramento-San Joaquin estuary comes from upstream sources
- Mixing processes within the Sacramento-San Joaquin estuary are driven by tides

*What ecosystem patches comprise the larger estuarine ecosystem?*

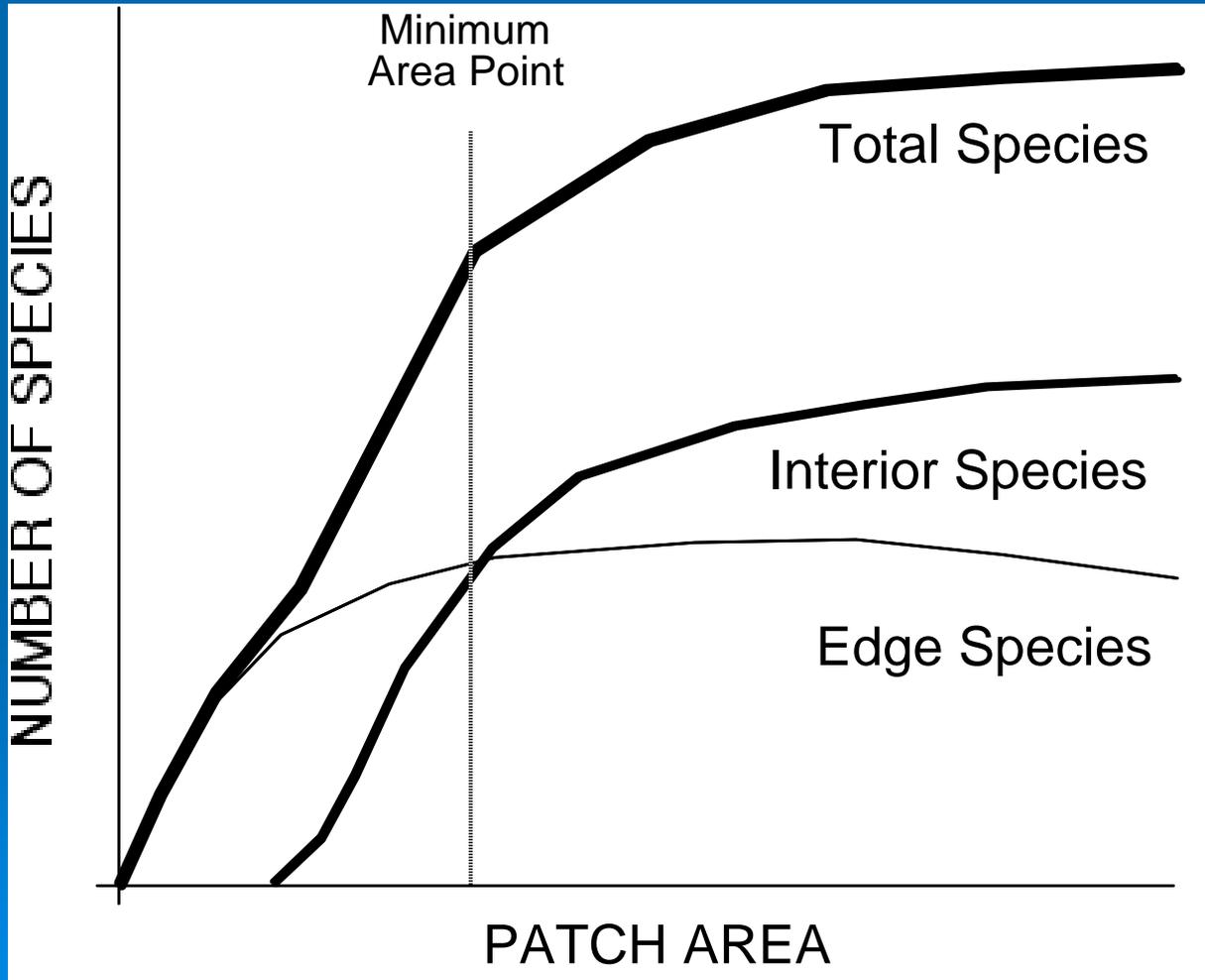
Legend

- Conservation Lands
- Managed Lands
- Developed
- Agriculture
- Water
- Other
- Delta Primary Zone
- Legal Delta
- Suisun Marsh



Delta-Suisun Land Uses Land use is predominantly agricultural in the Delta and conservation in the Suisun Marsh

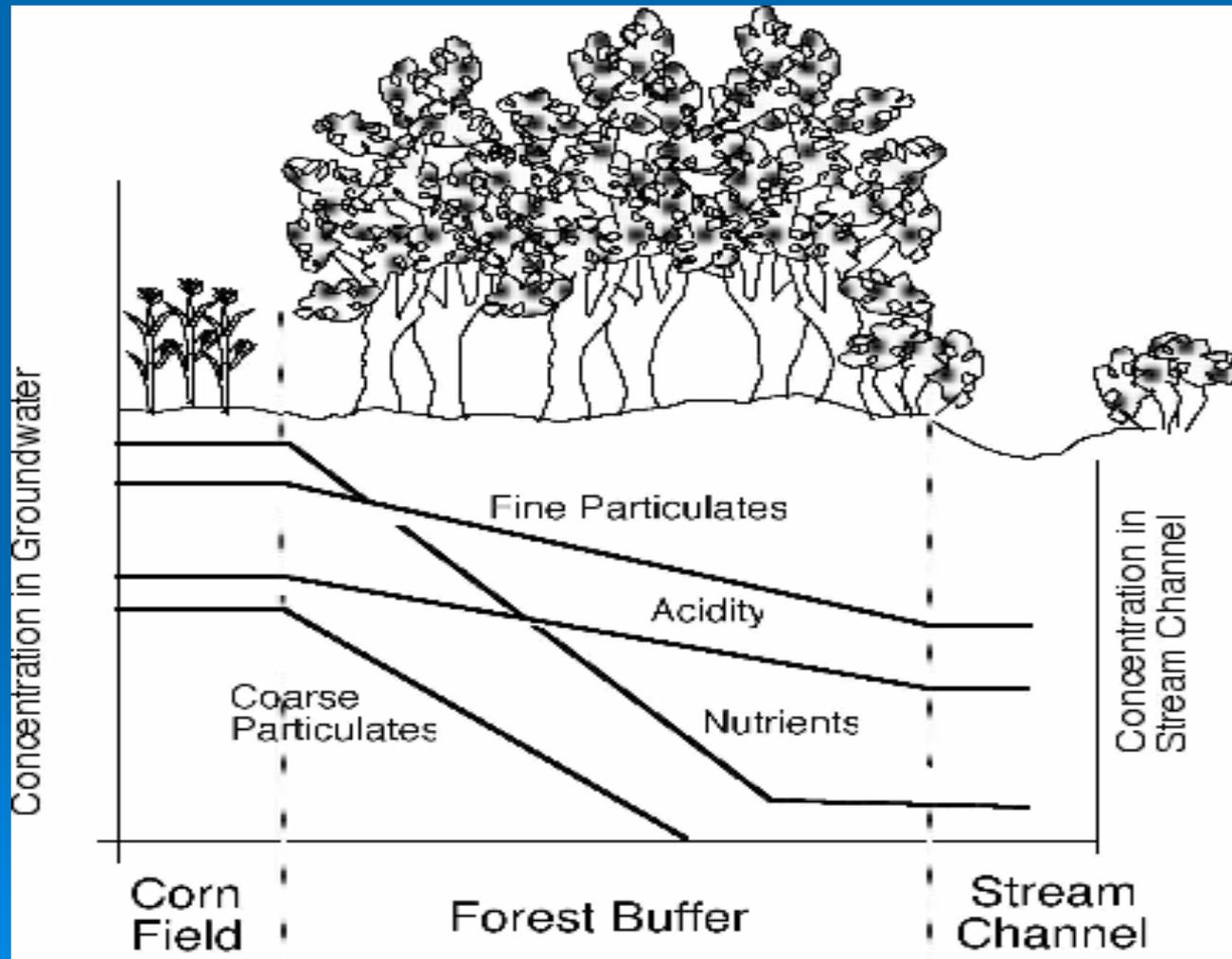
# *Ecosystem Patch Size and Species Richness*



# *What are the important exchanges among ecosystem patches?*

- Large Scale: Pacific salmon returning from the ocean contribute significant nutrients to riverine and riparian ecosystems
- Local Scale: Seasonally and tidally flooded wetlands trap sediment and may be either sources or sinks for nutrients and organic carbon

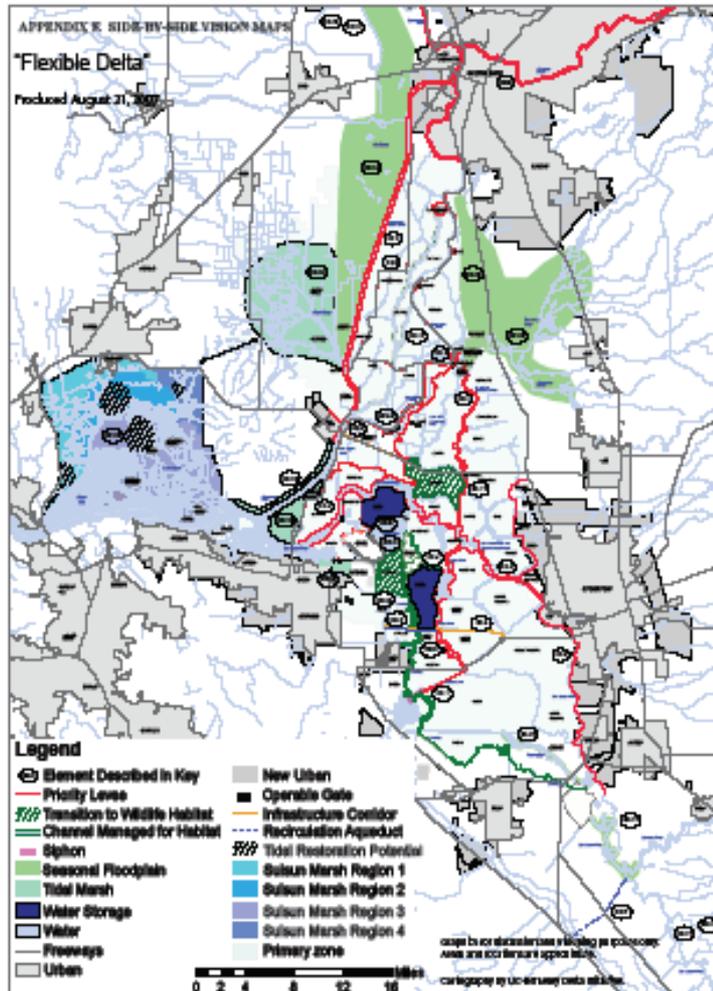
# *Filtering Effect of a Forest Buffer Along a Stream Channel*



# *What sizes and arrangements of ecosystem patches to deliver ecosystem services?*

- Consider estuaries as ecotones, patch mosaic, and/or sets of functions
- SLOSS dilemma for patch design
- Aggregate plus outliers model of patch design

# Conclusions



Landscape attributes of estuarine ecosystems are critical to their functioning

Restoration design needs to be based on landscape ecology principles