# Conceptual models as a means of storytelling

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Homer Navigation Improvement Study
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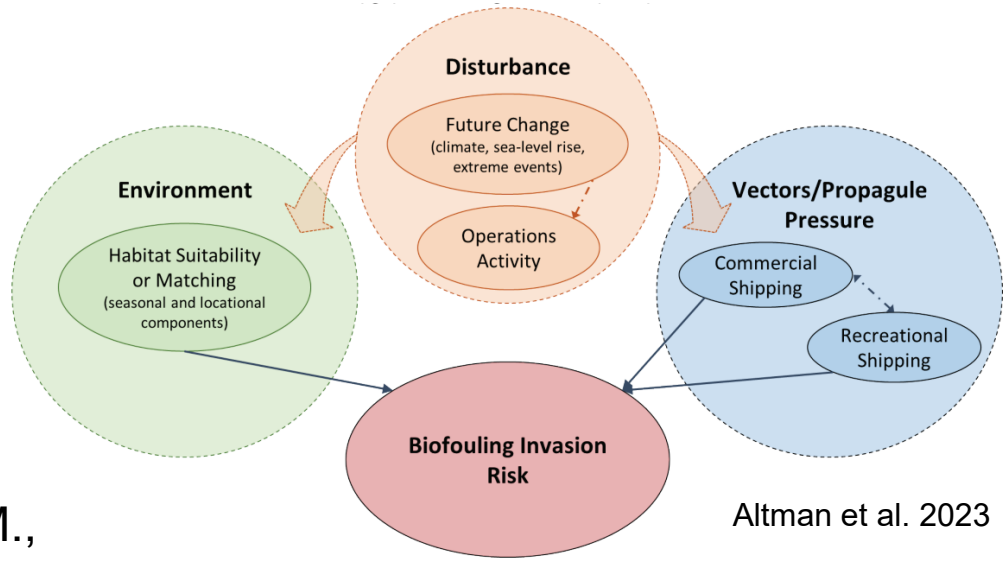
# Start at the beginning

**What we hope to cover today:**

- Describe what a conceptual model is
- Provide some examples
- Empower you to build a conceptual model
- Set goals for today's break-out sessions




Altman et al. 2023

**For those interested in more detail:**


- Herman, B.D., McKay, S.K., Altman, S., Richards, N.S., Reif, M., Piercy, C.D., and Swannack, T.M. 2019. Unpacking the black box: demystifying ecological models through interactive workshops and hands-on learning. *Frontiers in Environmental Science* 7. https://doi.org/10.3389/fenvs.2019.00122.
- Herman, B., Slack, T., and Swannack, T. 2021. Developing conceptual models for assessing benefits and impacts of USACE activities on freshwater mussel communities. ERDC/TN EMRRP-EBA-25.


EMRRP

# What is a conceptual model?

**A description of a system or sub-system that serves as a basis for intellectual organization**

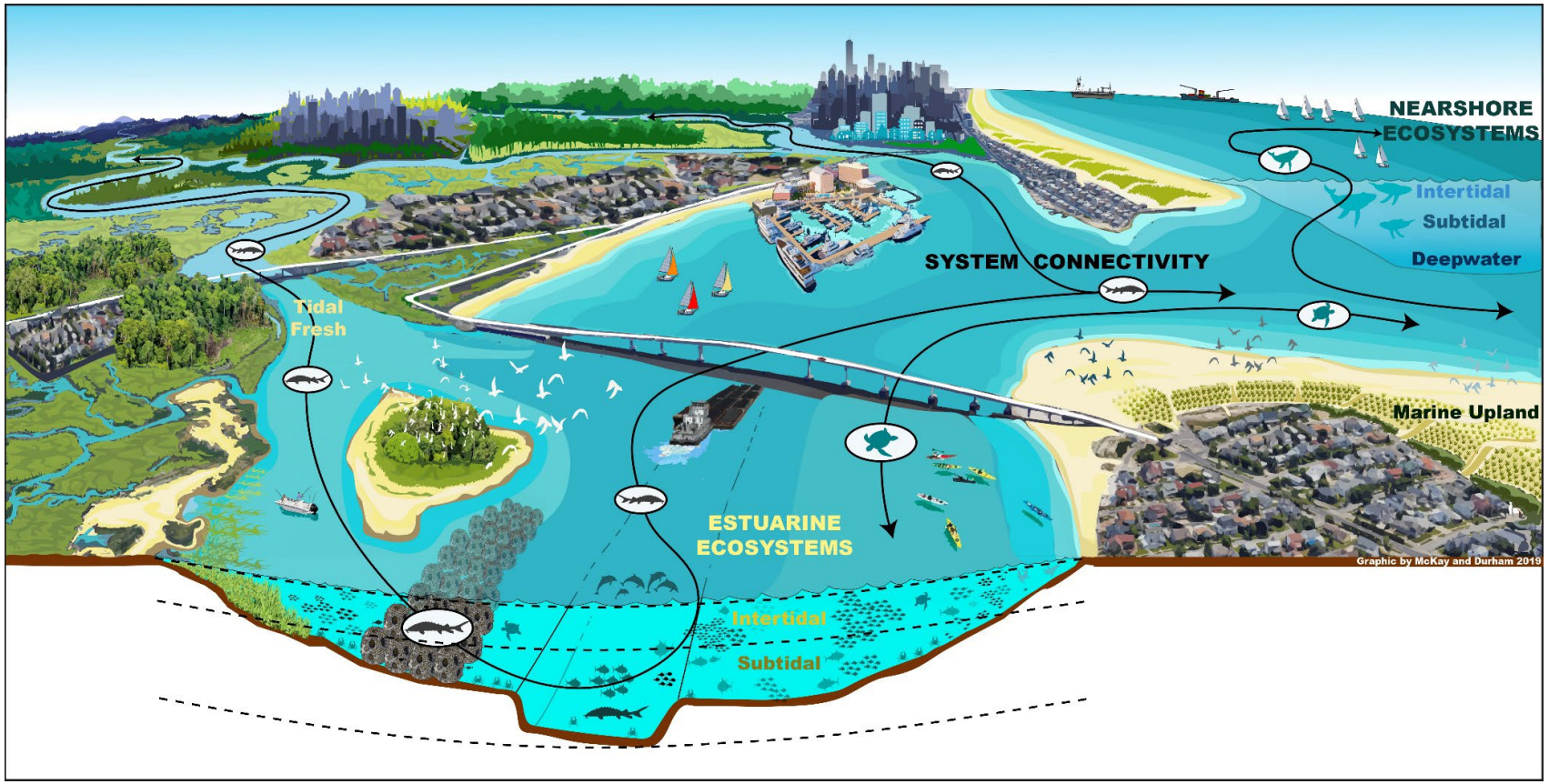
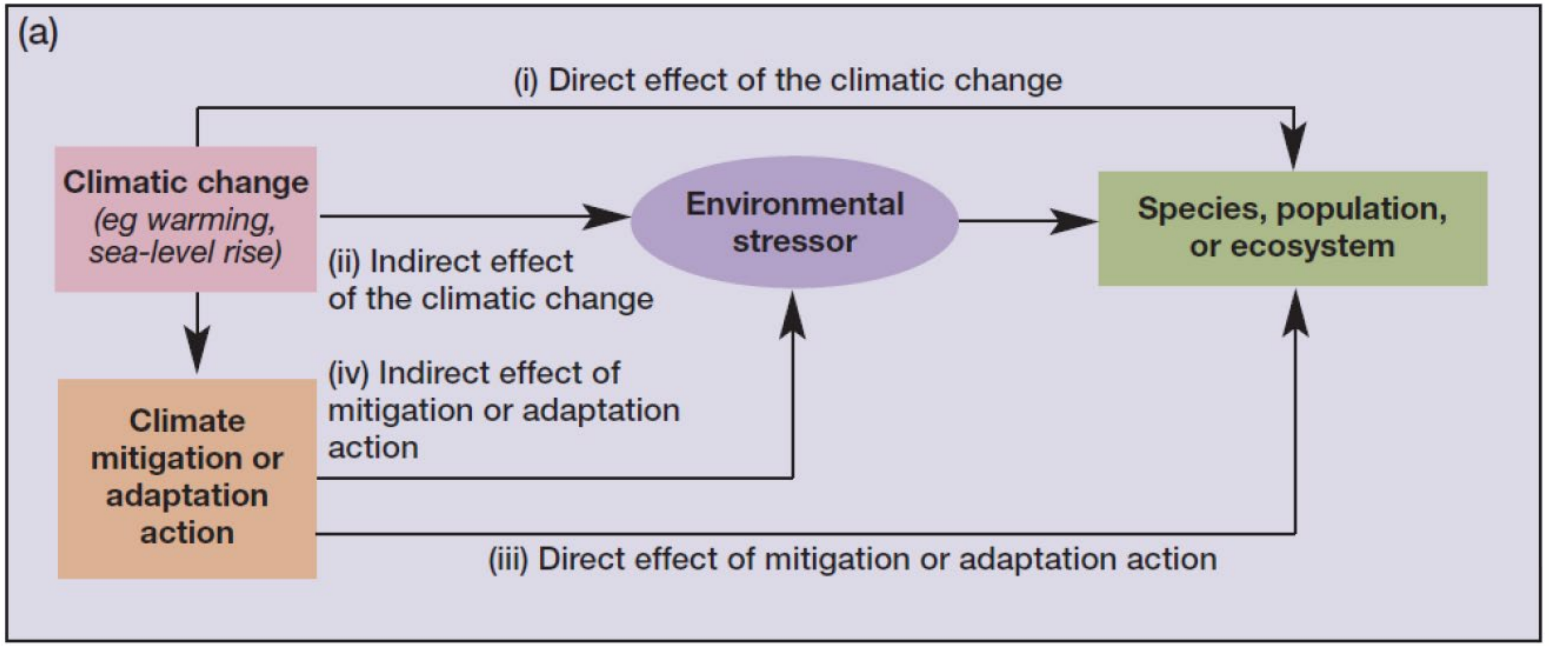



Figure: New York Bight Ecological Model (Durham and McKay)

# What does a conceptual model do?

**Conceptual models describe general functional relationships among essential ecosystem components and tell the story of "how the system works"**




Staudt et al. 2013

# How are conceptual models used in ecosystem restoration?

**Develop a shared, transparent understanding**:

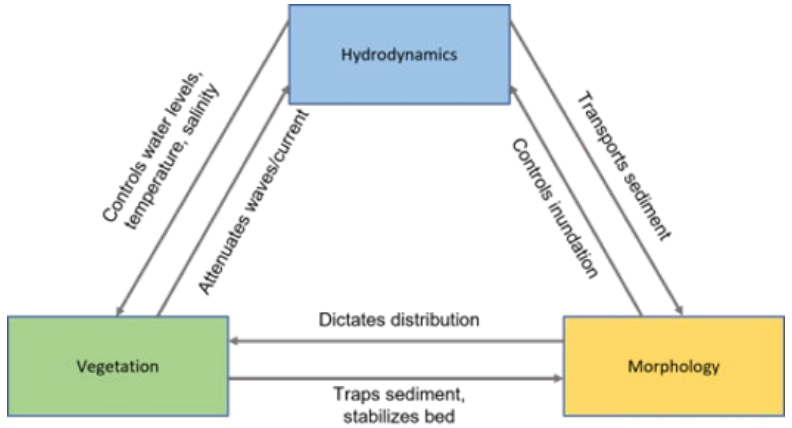
- Synthesis of different perspectives
- Team building
- Communication
- Compilation of collective knowledge

**Set the stage for quantitative models**:

- Identify important variables
- Describe critical processes
- Articulate flow of logic
- Define key data gaps


**Inform restoration decisions**:

- Diagnose problems
- Guide restoration actions
- Identify key decision metrics
- Inform monitoring plans

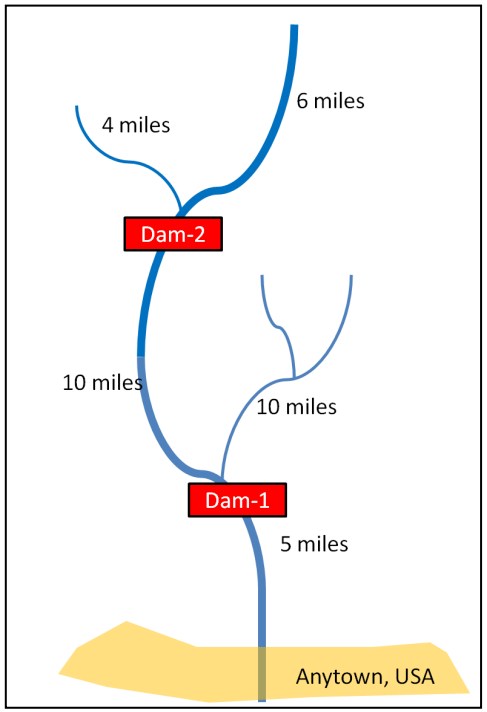



Russ et al. 2024

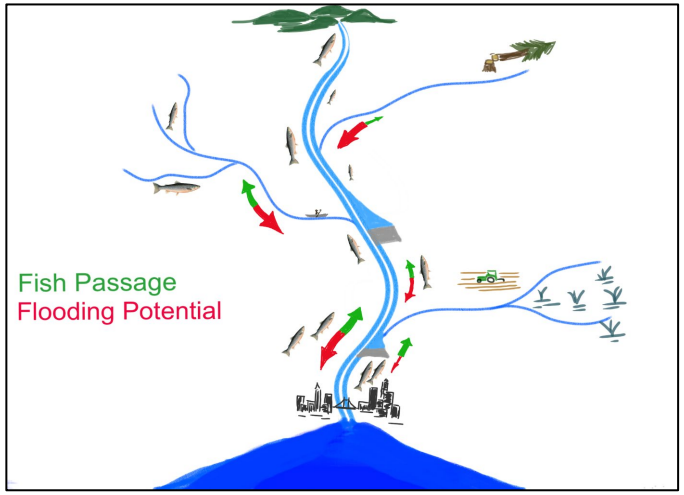
# Different types of conceptual models

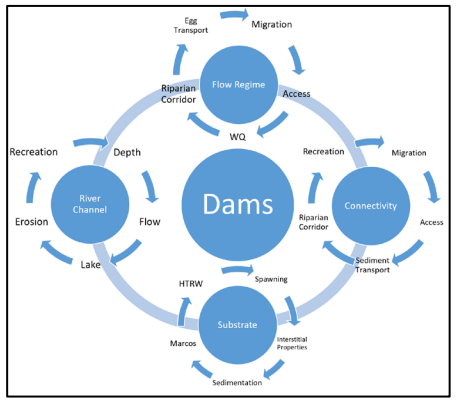
**Narrative**: A small Pacific coast watershed with two economically obsolete mining dams and an imperiled salmon run

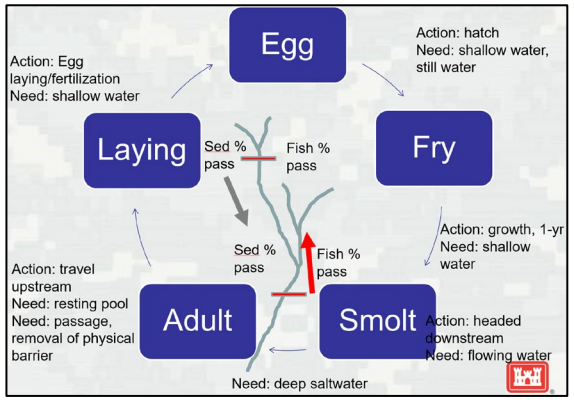
## Maps (not always georeferenced)



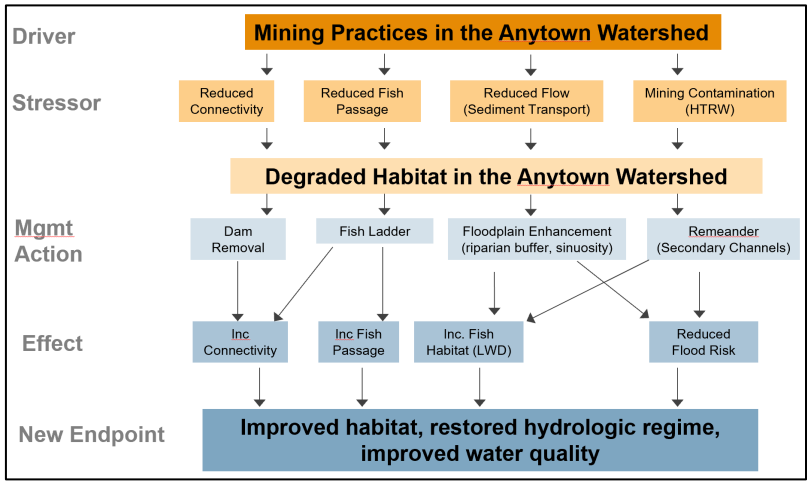

## Pictures & diagrams

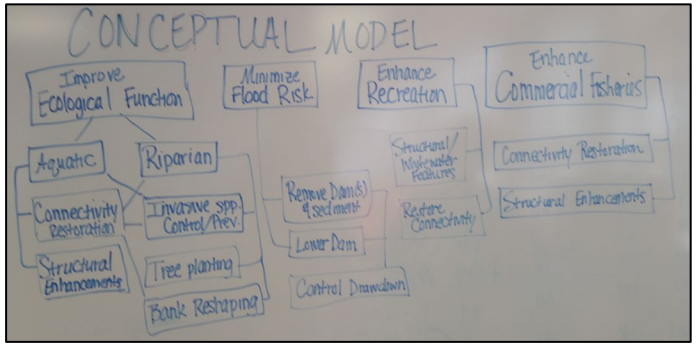


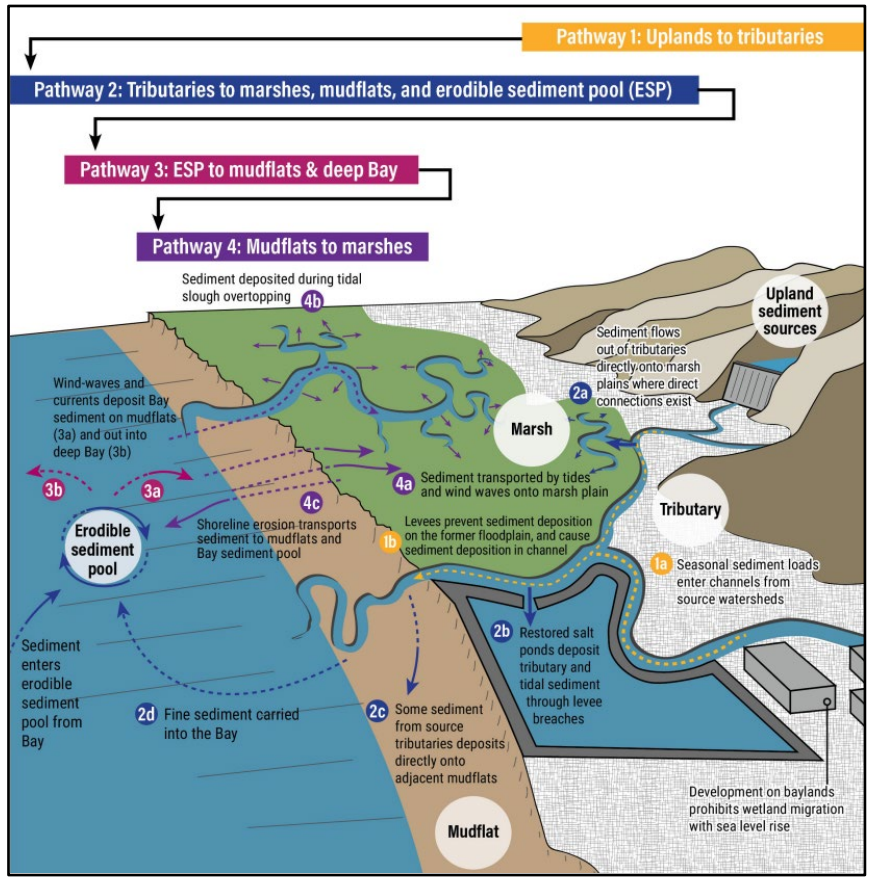




## Box-and-Arrow models

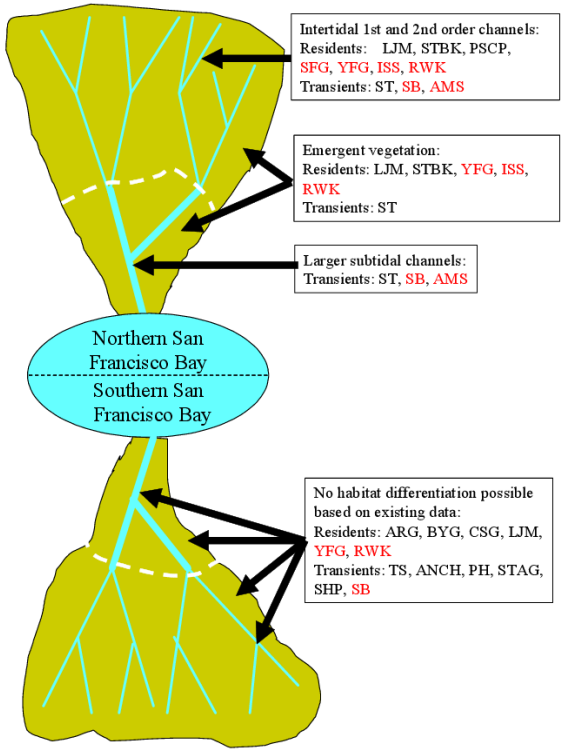


# The same system can have many conceptual models




San Francisco Estuary Institute 2023




Brown 2003

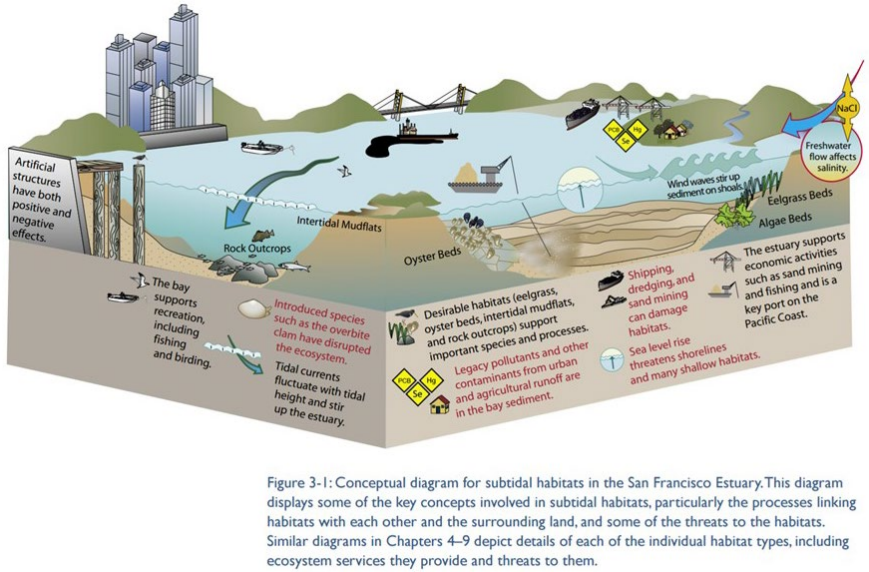
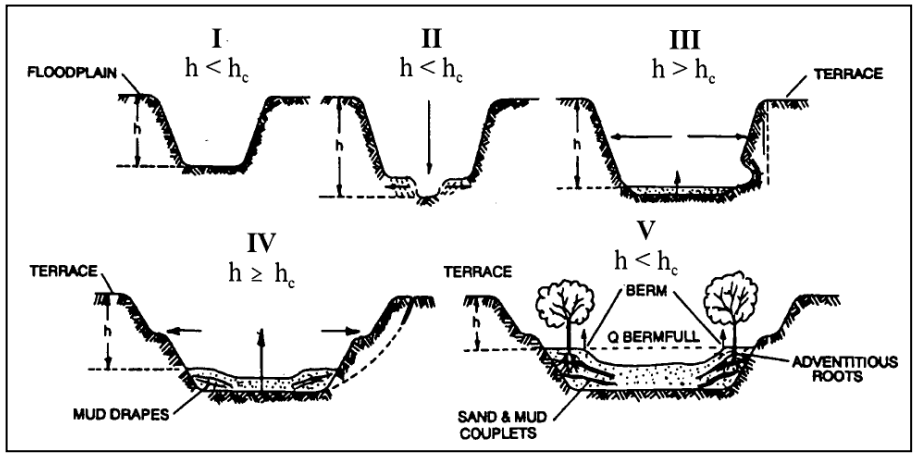



Figure 3-1: Conceptual diagram for subtidal habitats in the San Francisco Estuary. This diagram displays some of the key concepts involved in subtidal habitats, particularly the processes linking habitats with each other and the surrounding land, and some of the threats to the habitats. Similar diagrams in Chapters 4–9 depict details of each of the individual habitat types, including ecosystem services they provide and threats to them.

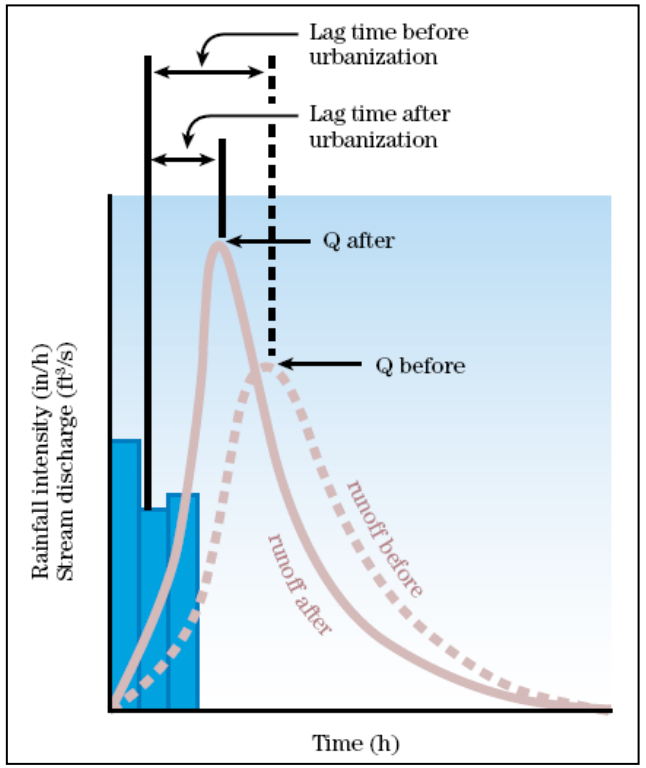
San Francisco Subtidal Habitat Goals Project

# Conceptual models reflect our understanding and viewpoint



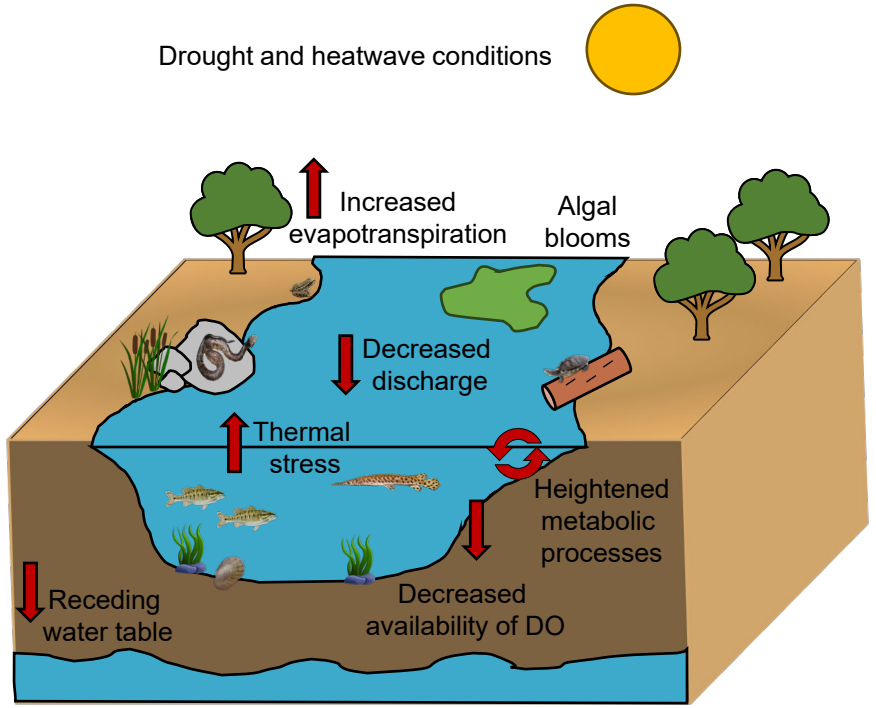

Schumm et al. 1984

**A geomorphic view of stream impacts**




USEPA

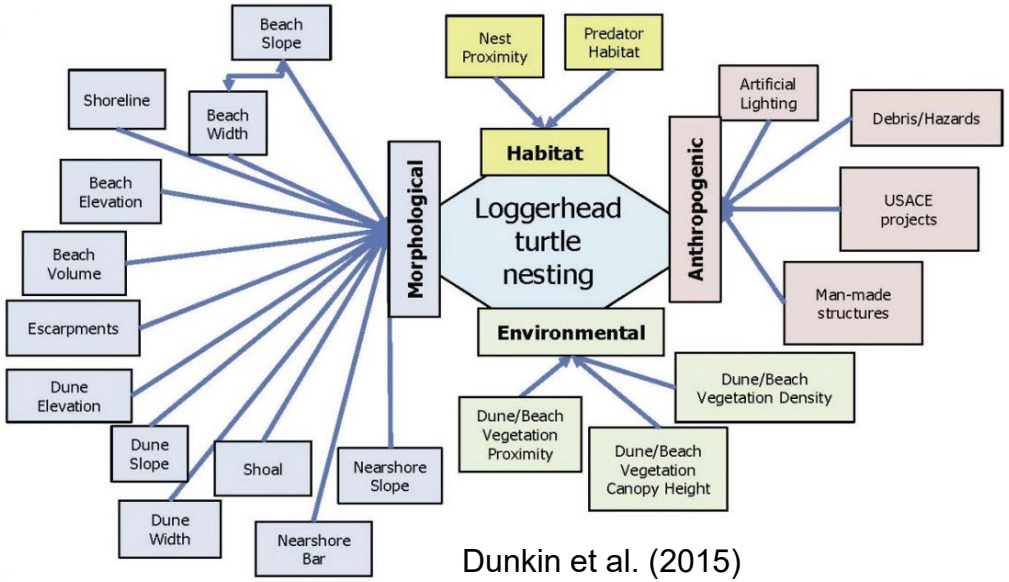
**A hydrologic view of stream impacts**



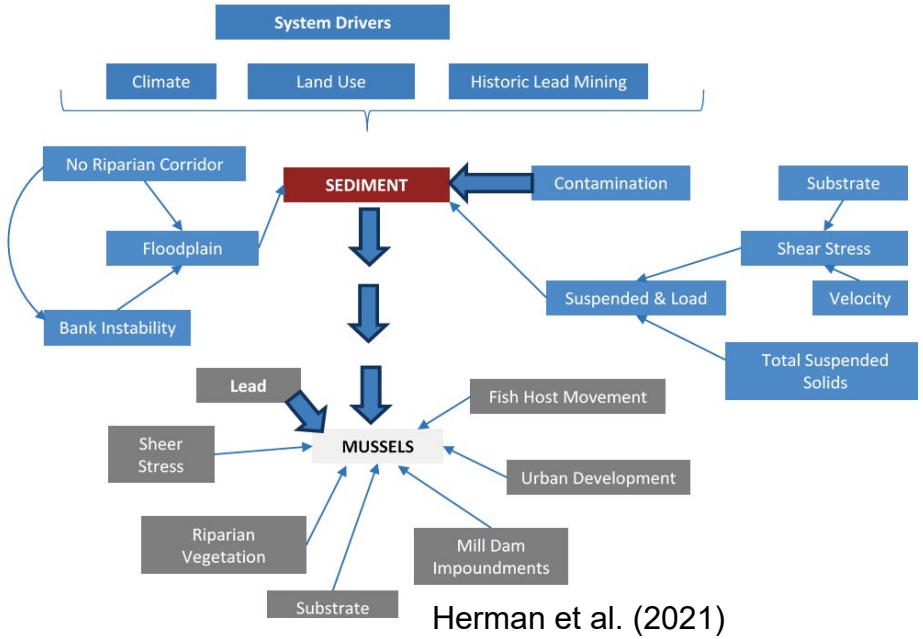

**An ecological view of stream impacts**

# Conceptual models are NOT…

- **The truth** – they are simplified depictions of reality
- **Comprehensive** – they focus only upon parts of an ecosystem deemed relevant while ignoring other important (but not immediately germane) elements
- **Final** – they provide a flexible framework that evolves as understanding of the ecosystem increases




Dunkin et al. (2015)

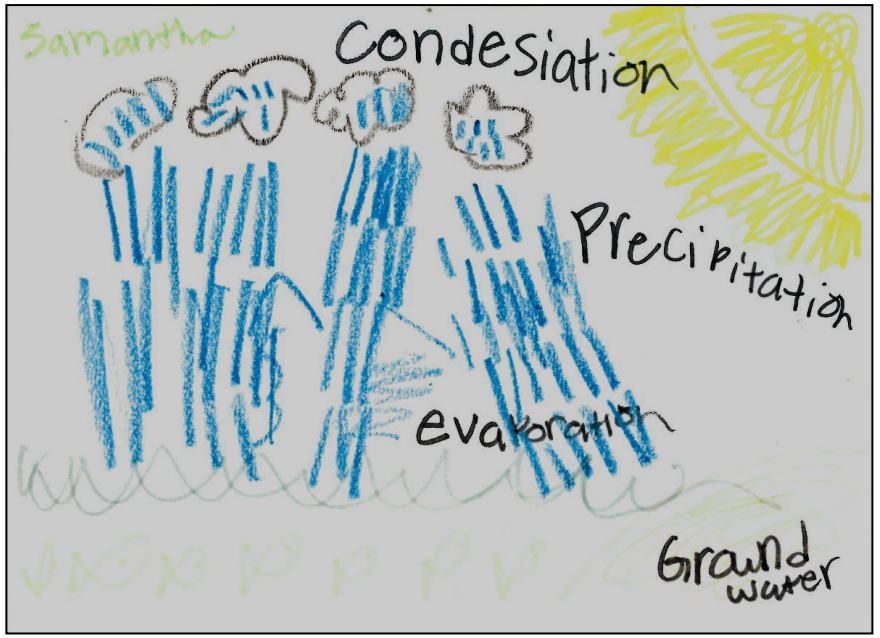


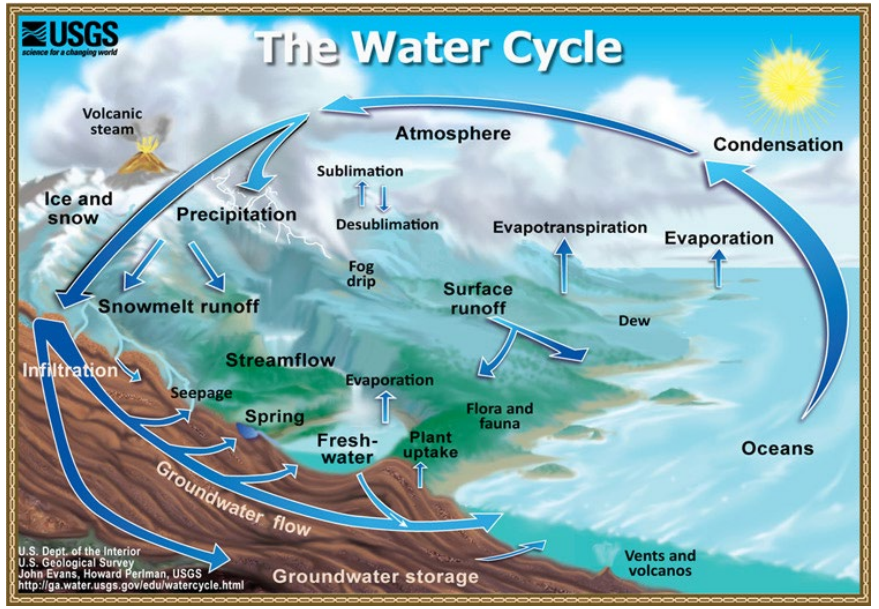

Herman et al. (2021)

# Common misconceptions

- **A model cannot be built with incomplete understanding**
  - **FALSE**: Incomplete information is the norm in environmental management!

- **A model must be as detailed and realistic as possible**
  - **FALSE**: “Lean” models are often the most elegant. Remember Einstein’s aphorism…As simple as possible, but no simpler!



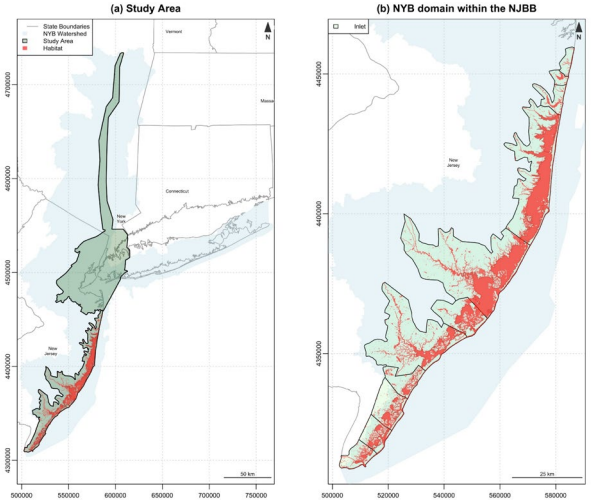




Figures: Sarah Miller’s niece, USGS

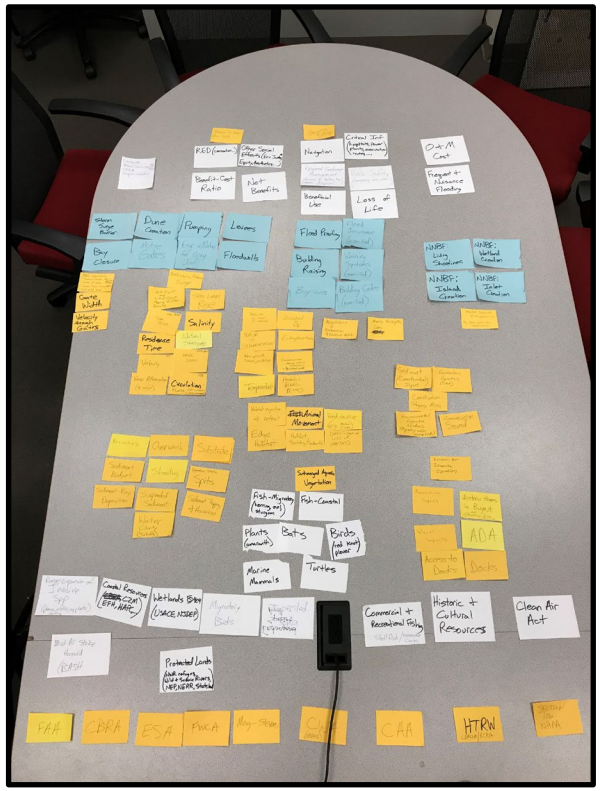
# Think of conceptual modeling as storytelling

## What audience are you reaching?

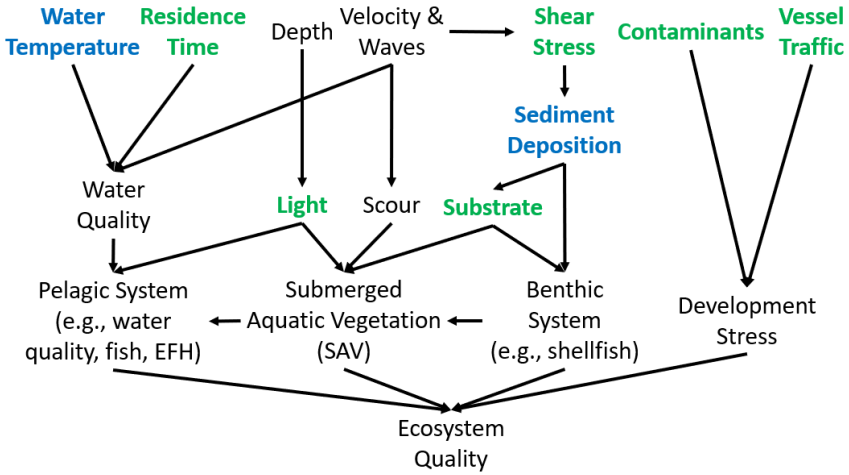
## What is the setting of your story?




## Who are the characters?

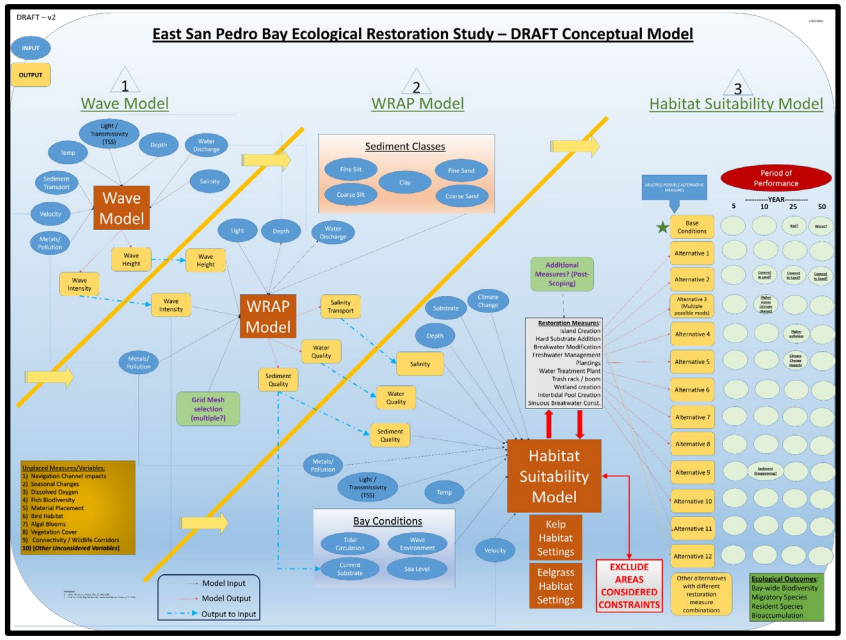


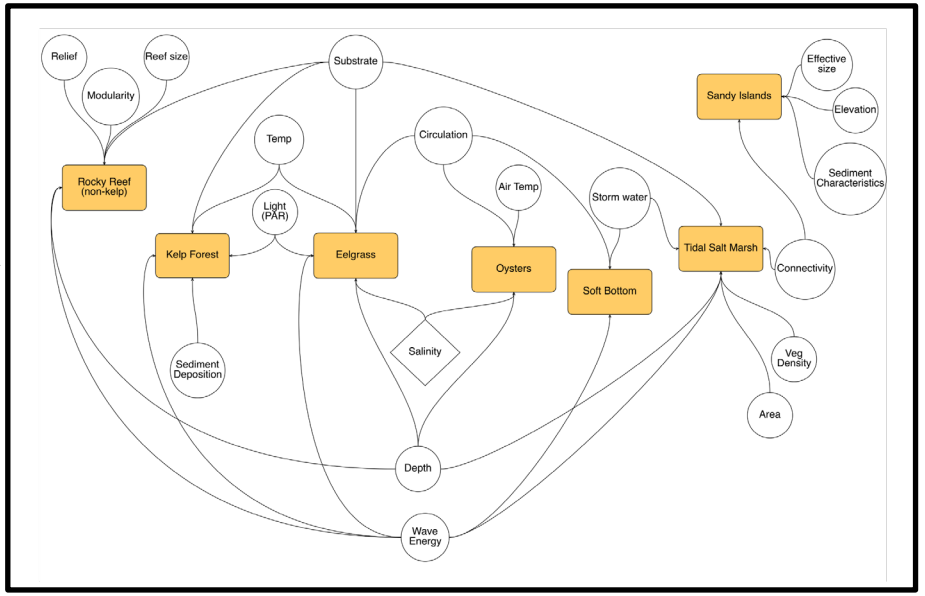
## What is the plot?




Figures: New York Bight Ecological Model (McKay)

# The “art” of conceptual modeling is in iterating




Herman et al. 2019

# Creating a conceptual model

Step 1: Setting: the Nature Conservancy would like to create a conceptual model outlining important aspects of marsh management

Step 2: What story did they want to tell about marsh management?

What aspects of restoration are you focusing on?

- Restoration that supports migration
- Restoration after marsh subsidence
- Persistence after storms
- Coastal resiliency

# Creating a conceptual model

## Step 2: What story do you want to tell about marsh management?

What should the conceptual model seek to do?

- Capture important indicators for selecting management strategies
- Relate goals of restoration with outcomes
- Set the stage for appropriate adaptive measurement

# Creating a conceptual model

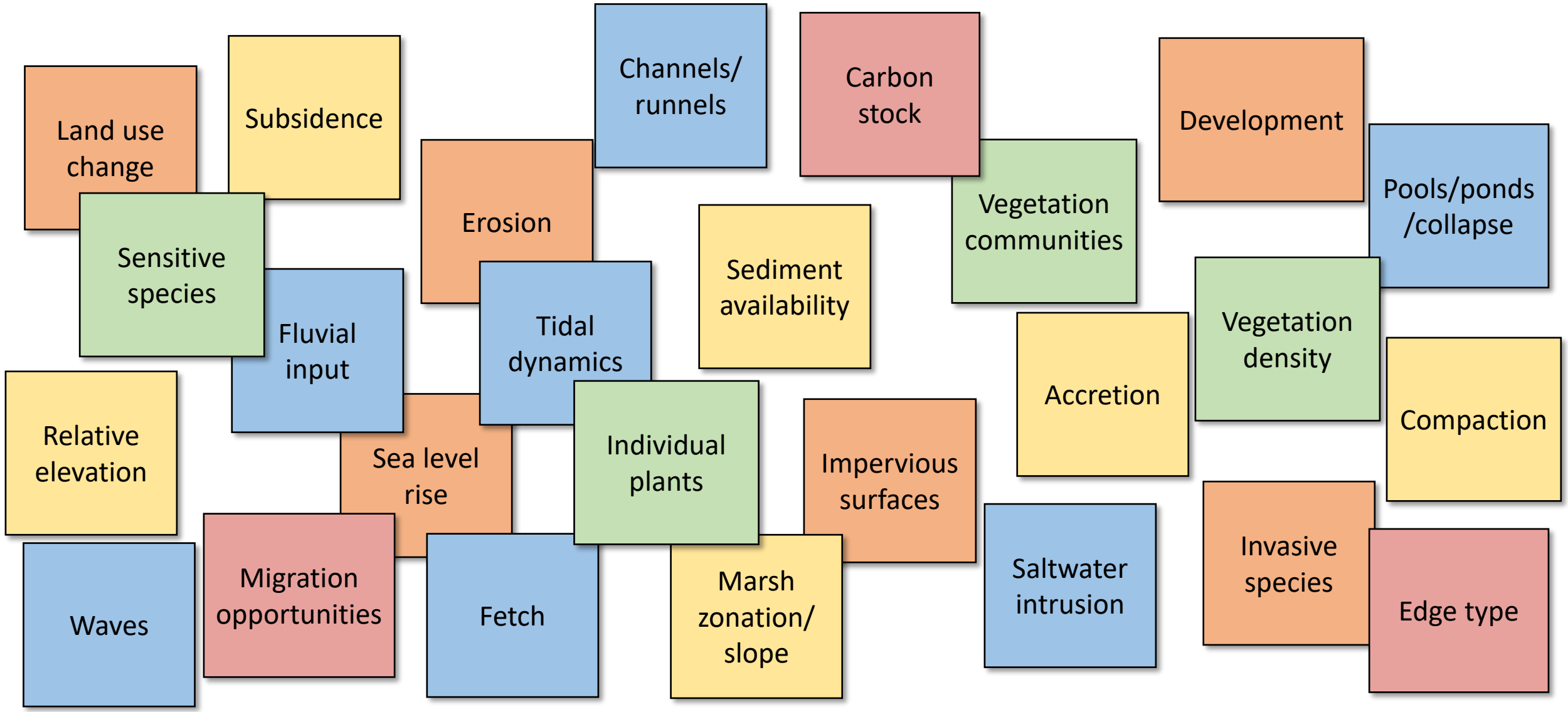
## Step 2: What story do you want to tell about marsh management?

Who is the target audience for the conceptual model?

- U.S. Army Corps of Engineers
- Practitioners
- Managers of large-scale marsh complexes

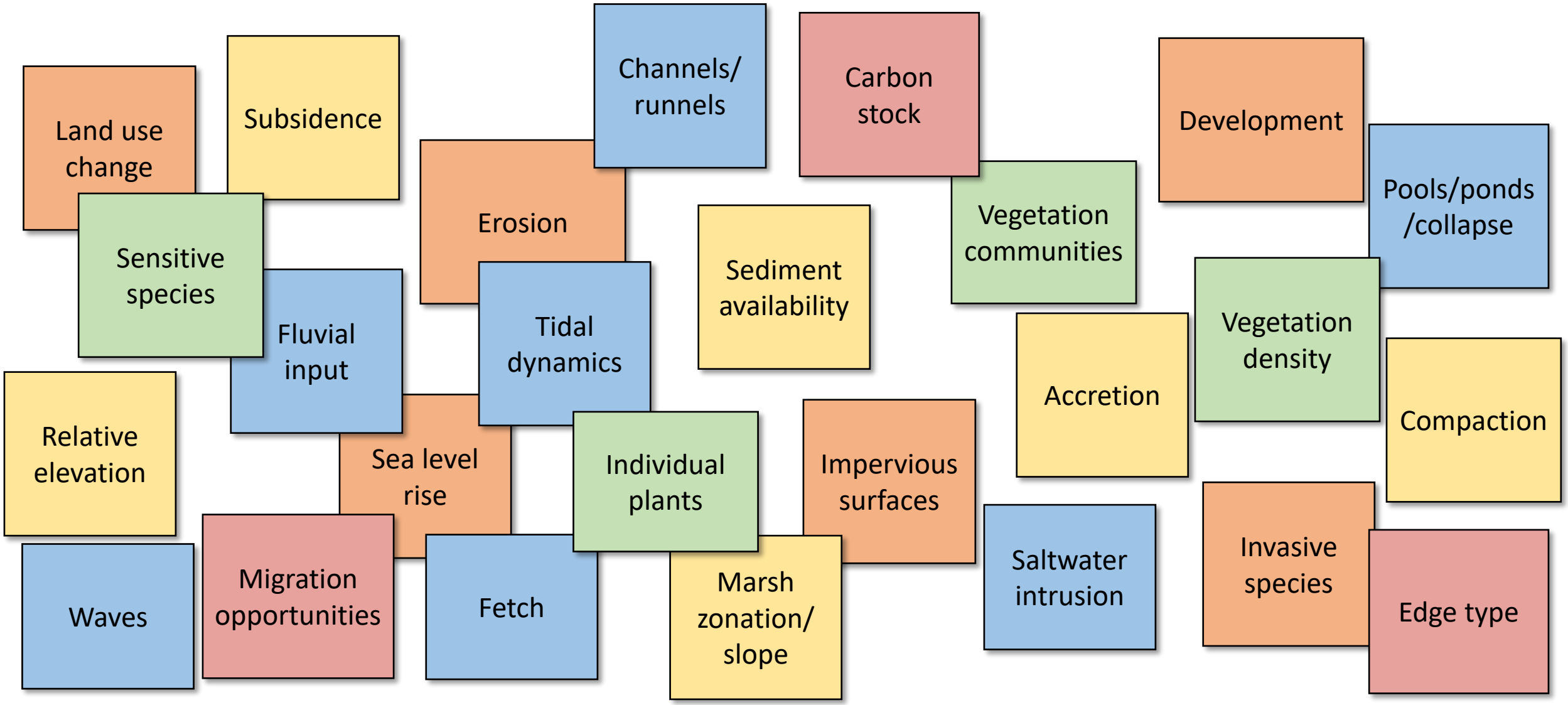
# Creating a conceptual model

## Step 3: What are the characters in your story?



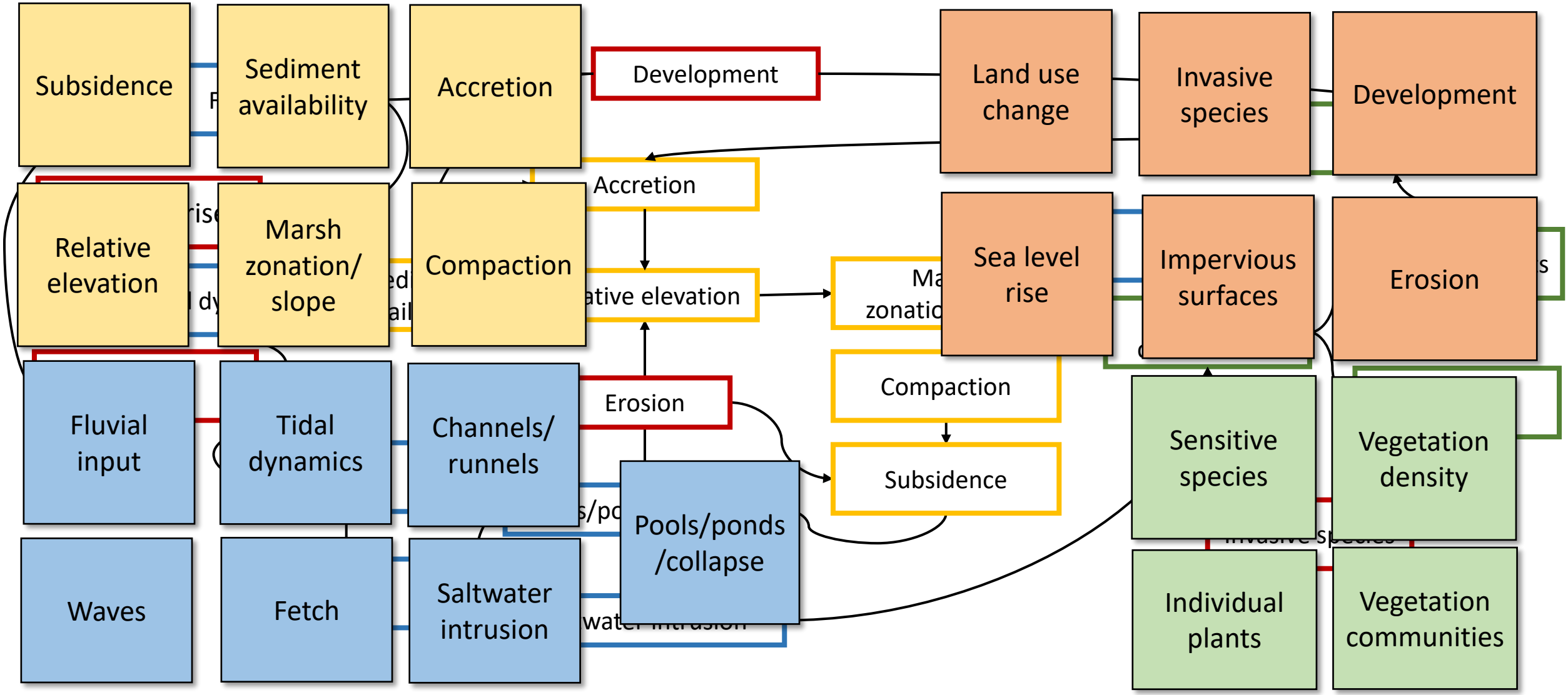
# Creating a conceptual model

## Step 3 continued: Refine and organize your cast



# Creating a conceptual model

## Step 4: What is the plot of your story?



Carbon offsets

Nature-based solutions for design to create habitat

Soundscape (underwater) under potential fleet configurations

Long term maintenance and ecological effects

Indirect effects to habitat & Critical Habitat Area

Changes in haul out space footprint

Invasive species (ballast water & Hull fouling

Contaminants/ Water Quality

Recovery of critical species

Climate change effects on species assemblages

Intangible values (e.g, viewscape, bike path)

Maintaining species diversity eco. processes & eco. services

Tourism

Impacts to fishing lagoon

Changes in current and impacts to ecological communities

Fleet configuration under different future scenarios

Impacts to native habitat & protected (don't lose existing native habitat)

Potential for human pop. Growth, impact on spit/bay & demands on on harbor

Sourcing material removal effects on ecosystem dynamics

Protecting overwintering habitat for waterfowl

Capture realistic impacts across system

Changes in current and impacts to ecological communities

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Contaminants/Water Quality

Soundscape (underwater) under potential fleet configurations

Long term maintenance and ecological effects

Climate change effects on species assemblages

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Potential for human increase and greater impact of human use on spit/bay as a result; what are demands on harbor

Impacts to fishing lagoon

Changes in current and impacts to ecological communities

Fleet configuration under different future scenarios

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Protecting overwintering habitat for waterfowl

Capture realistic impacts across system

Changes in current and impacts to ecological communities

Maintaining species diversity and ecosystem processes and ecosystem services

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# What you will do in today's break-out sessions

**Session 1**

- Decide on a story you want to tell about the Homer Harbor
- Identify the characters in your story
- Gather relevant information
- Pick a spokesperson

**Tonight & tomorrow morning**

- Reflect on the discussion
- Think about Homer Harbor
- Don't think about Homer Harbor
- Doodle and draw

**Tomorrow's session**

- Revisit the discussion
- Tell a (collective) story Homer Harbor
- Pull together the pieces
- Report-out in the main session

# A few notes about these sessions

- **Enter into a dialog about Homer Harbor**
  - This is a first volley. Don’t feel like you have to finish the conversation
- **Have fun!**
  - Really. This meeting is about building relationships
- **There are no “right” or “wrong” answers**
  - Your story is your story.  There are no expectations about what will (or will not) emerge from these sessions
  - Choose your own adventure

# Extra slides

# Different audiences require different models