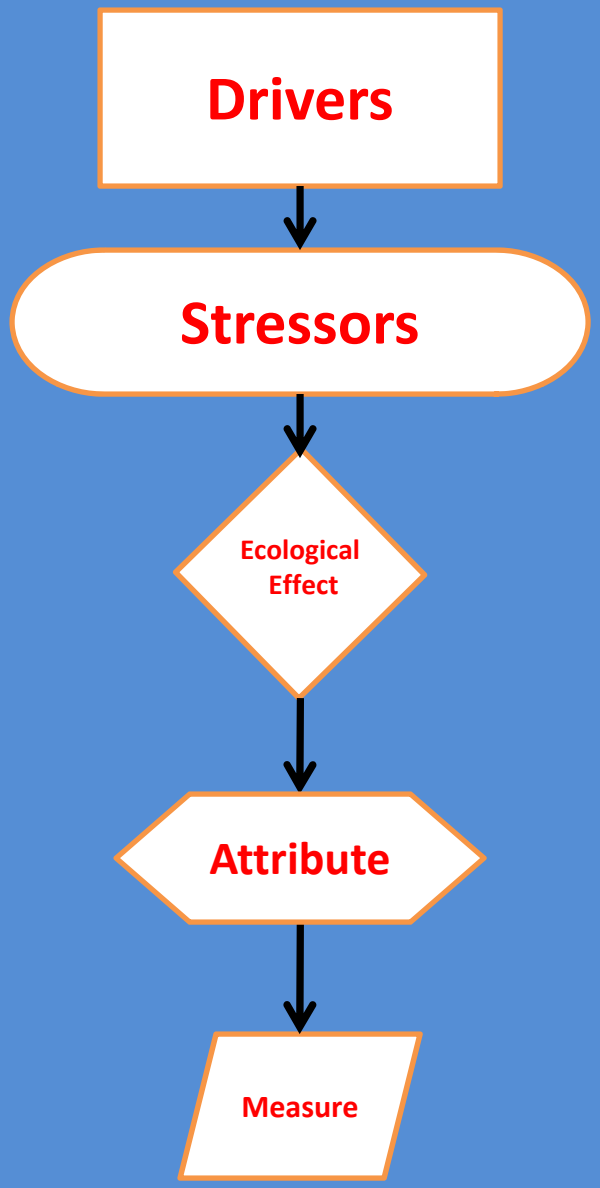
Conceptual Ecological Models



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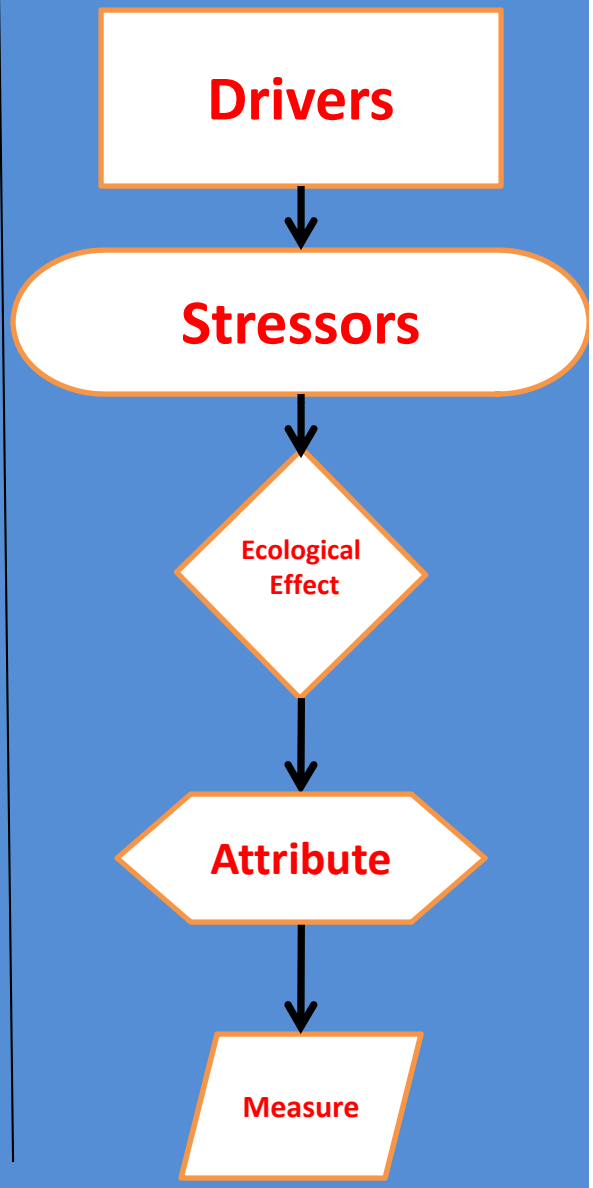
USGS

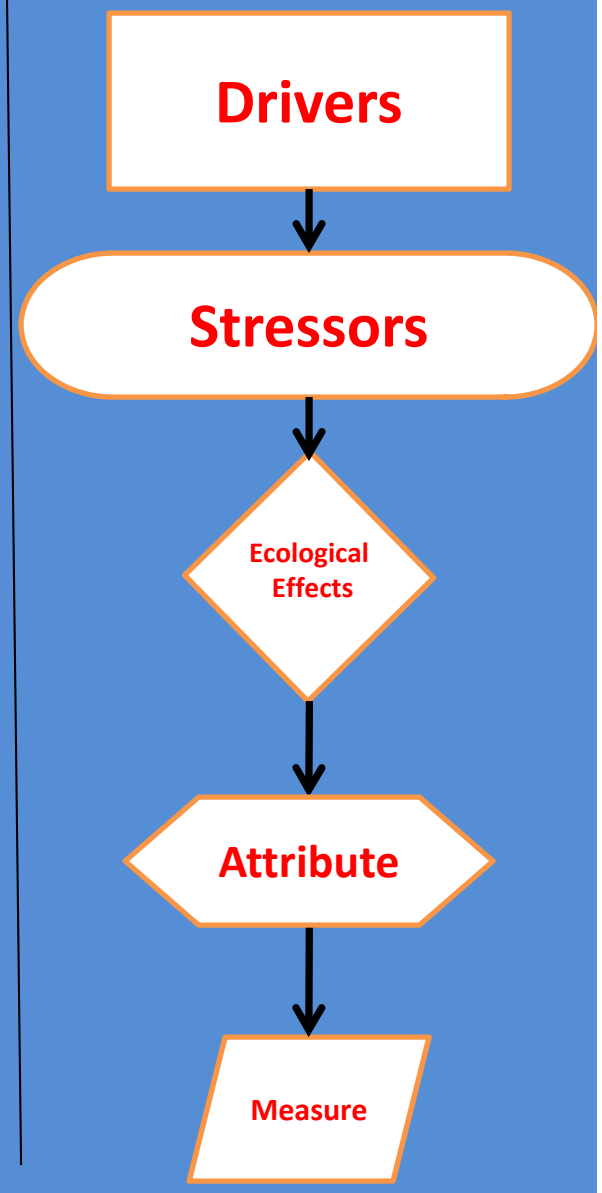
Drivers: The major external driving forces that have large-scale influences on natural systems. Drivers can be natural forces (e.g., sea-level rise) or anthropogenic .

Stressors: The physical or chemical changes that occur within natural systems that are brought about by the drivers, and which are directly responsible for significant changes in the biological components, patterns and relationships in natural systems.



Ecological effects

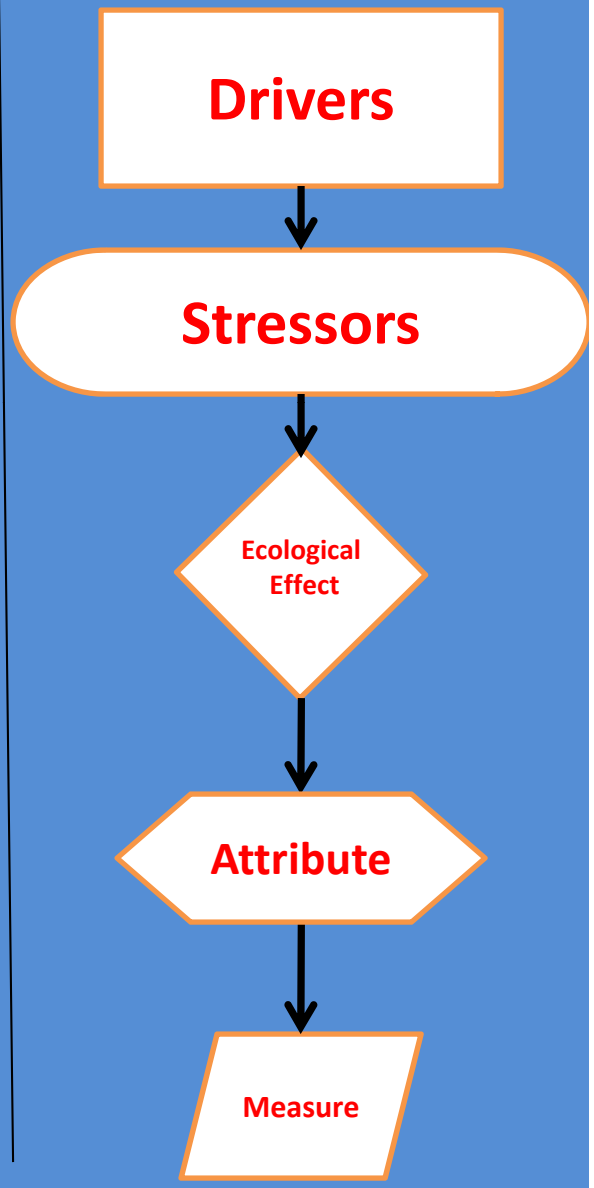
The biological responses caused by the stressors. The links in the conceptual models between one or more stressors and the ecological effects and attributes are diagrammatic representations of the working hypotheses that explain the changes that have occurred in the ecosystems.



Attributes

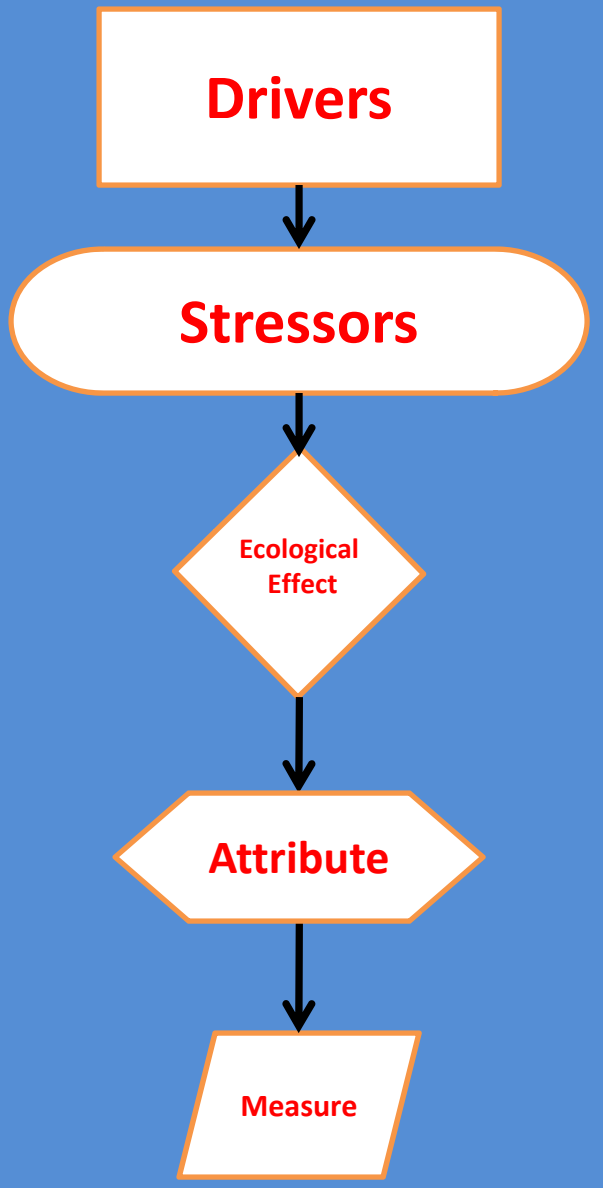
A parsimonious subset of all potential biological elements or components of natural systems, which are representative of the overall ecological conditions of the system.

Attributes typically are populations, species, guilds, communities or processes. Attributes are selected to represent the known or hypothesized effects of the stressors (e.g., numbers of nesting wading birds), and the elements of the systems that have important human values (e.g., endangered species, sports fishing).

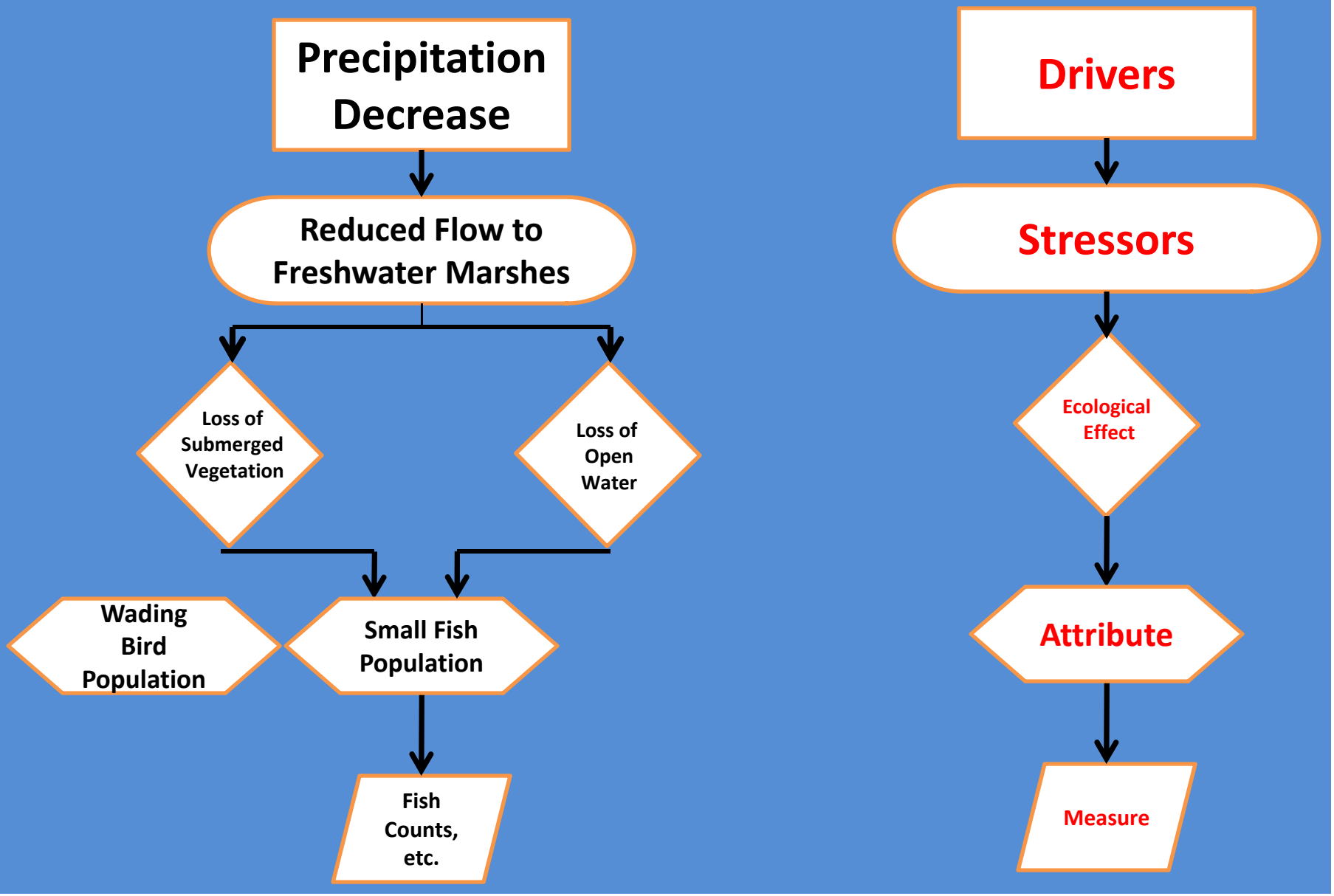


Measure

The specific feature(s) of each attribute to be monitored to determine how well that attribute is responding to projects designed to correct the adverse effects of the stressors (i.e., to determine the success of the project).



Working hypothesis via a conceptual model



John C. Ogden, Steve M. Davis, Tomma K. Barnes, Kimberly J. Jacobs and John H. Gentile. 2005. Total System Conceptual Ecological Model. Wetlands: 25: 955-979.

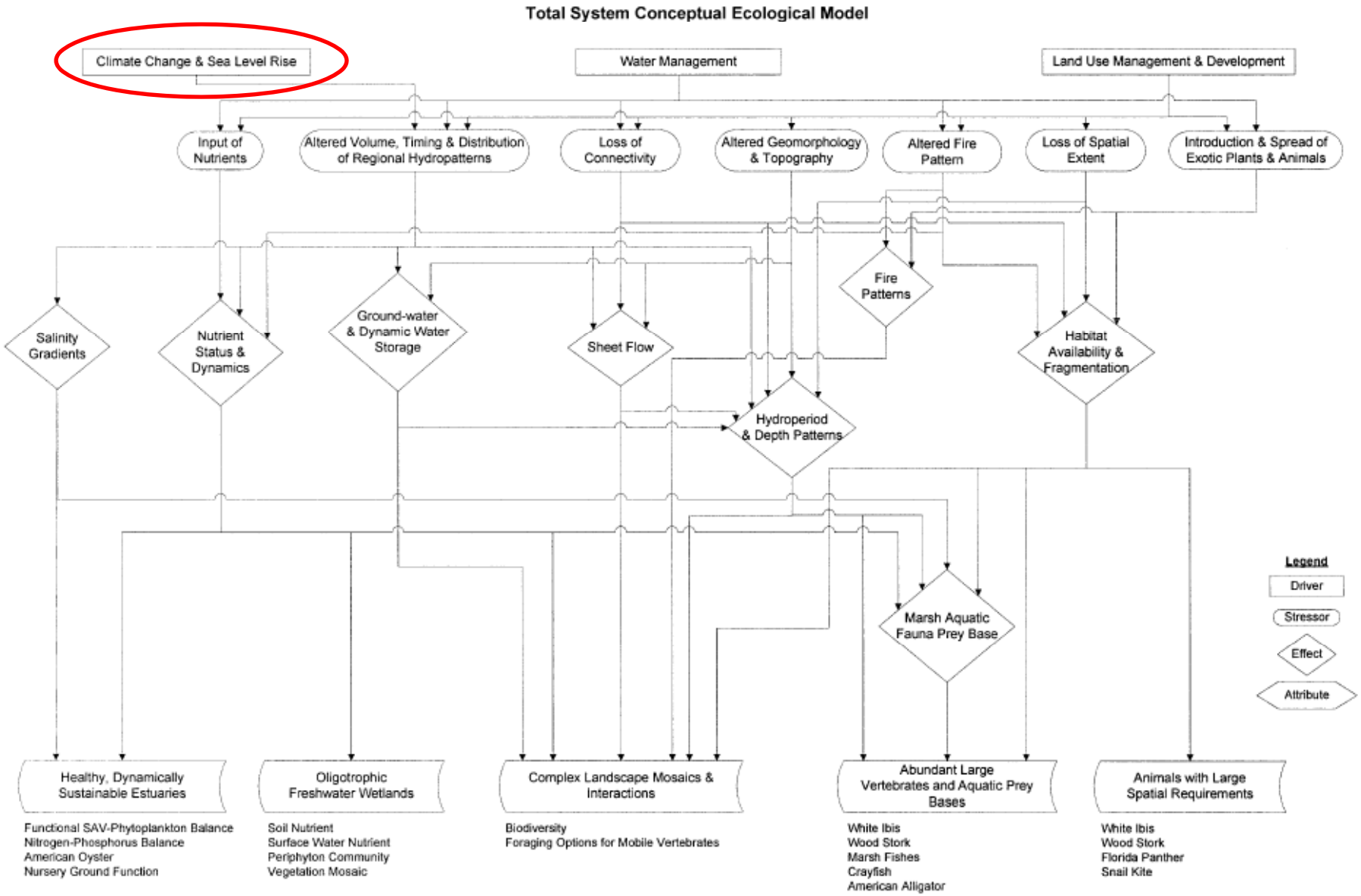
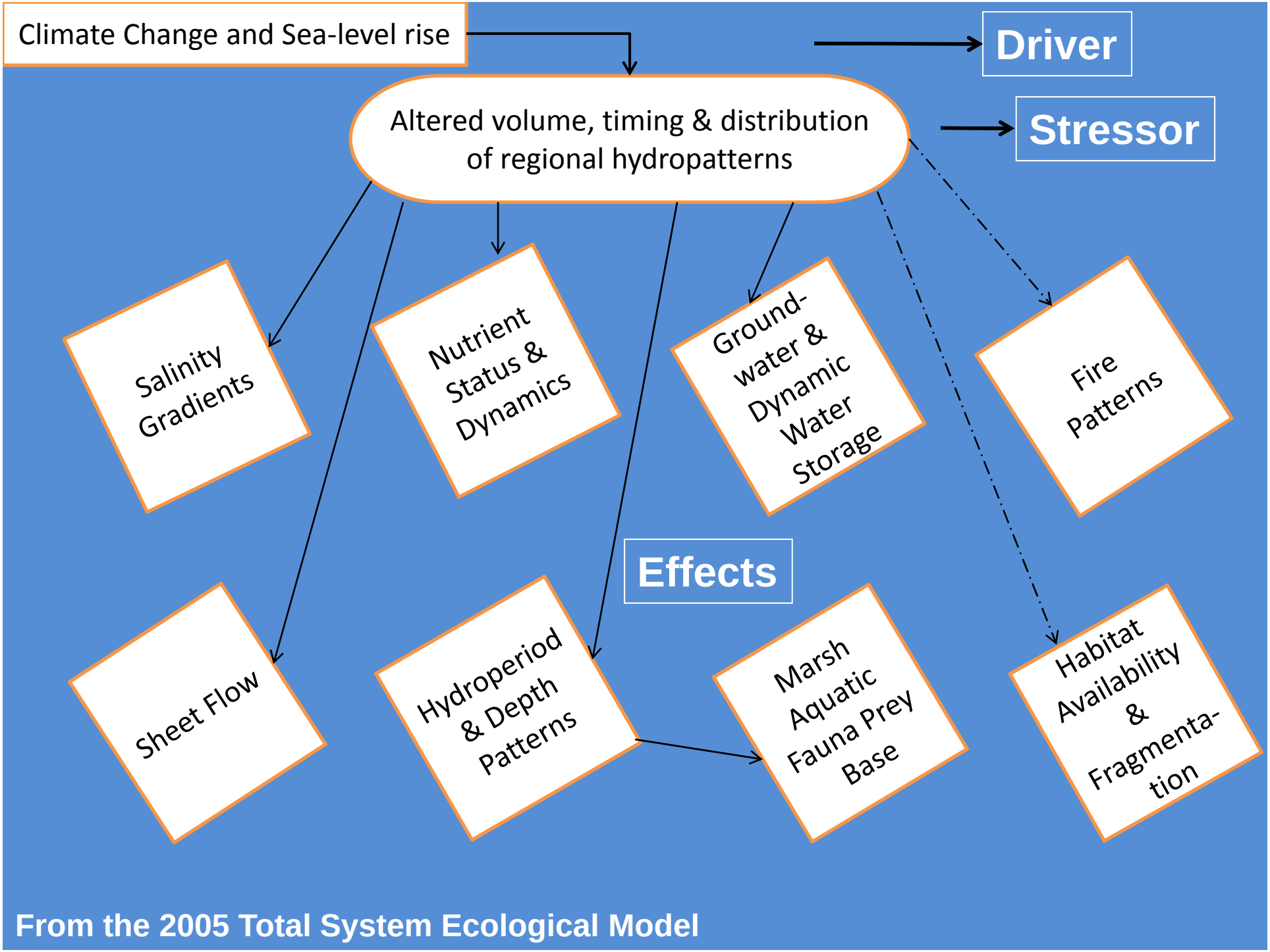
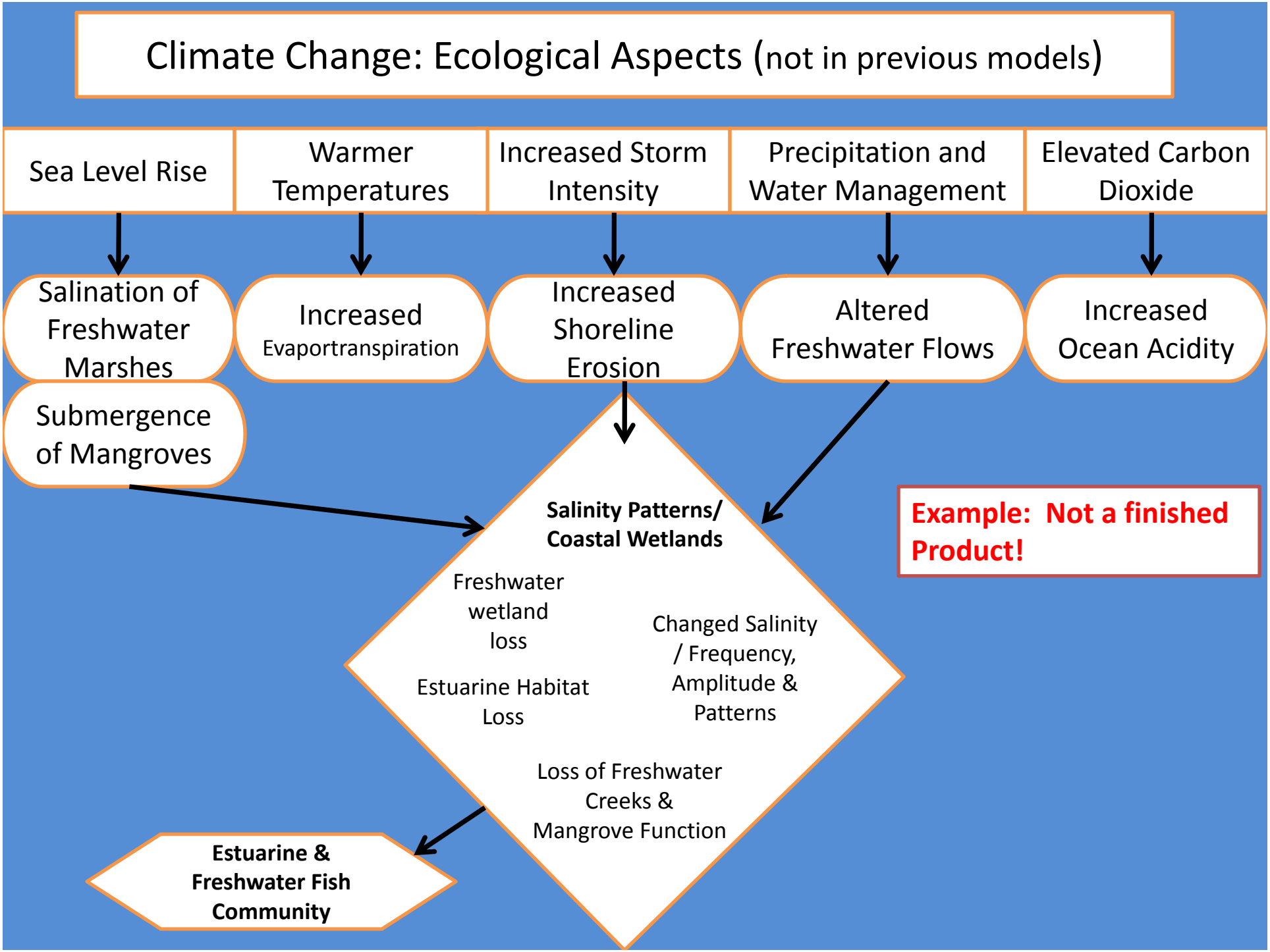


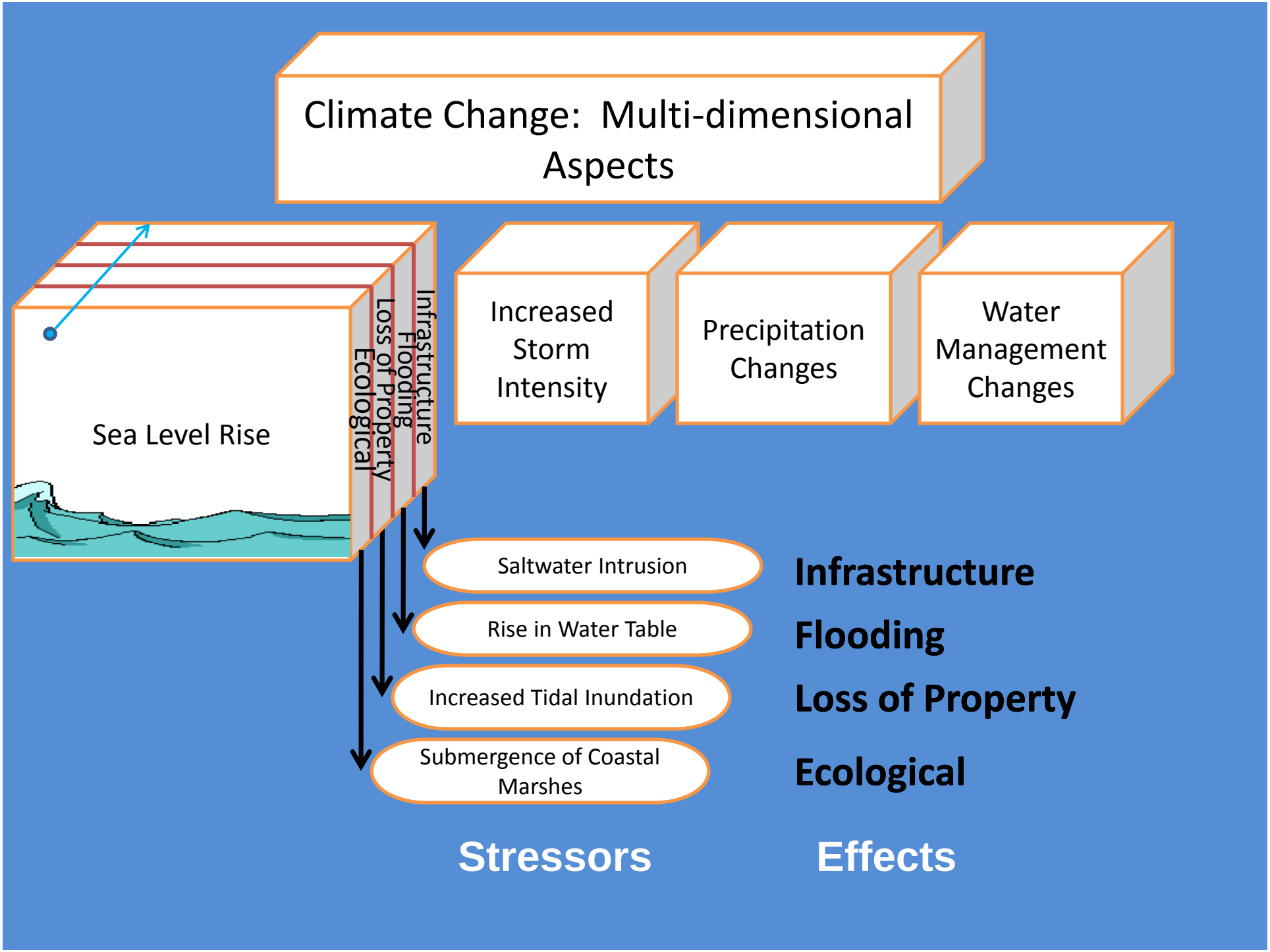
Figure 2. Total Systems Conceptual Ecological Model diagram.



From the 2005 Total System Ecological Model

	Model Name	Sea-Level Rise (Only)	Climate Change & Sea-Level Rise
1	Total system conceptual ecological model	-	yes
2	Loxahatchee watershed conceptual ecological model	-	yes
3	A conceptual model of ecological interactions in the mangrove estuaries of the Florida Everglades	yes	-
4	Lake Worth Lagoon conceptual ecological model	yes	-
5	Biscayne Bay conceptual ecological model	yes	-
6	A conceptual ecological model of Florida Bay	yes	-
7	Caloosahatchee Estuary conceptual ecological model	yes	-
8	St. Lucie Estuary and Indian River Lagoon conceptual ecological model	yes	-
9	Lake Okeechobee conceptual ecological model	no	no
10	Big Cypress regional ecosystem conceptual ecological model	no	no
11	Everglades ridge and slough conceptual ecological model	no	no
12	Southern marl prairies conceptual ecological model	no	no


Climate Change: Ecological Aspects (not in previous models)
Sea Level Rise
Warmer Temperatures
Increased Storm Intensity
Precipitation and Water Management
Elevated Carbon Dioxide
Salination of Freshwater Marshes
Increased Evaportranspiration
Increased Shoreline Erosion
Altered Freshwater Flows
Increased Ocean Acidity
Submergence of Mangroves
Salinity Patterns/ Coastal Wetlands
Freshwater wetland loss
Changed Salinity / Frequency, Amplitude & Patterns
Estuarine Habitat Loss
Loss of Freshwater Creeks & Mangrove Function
Estuarine & Freshwater Fish Community
Example: Not a finished Product!


Climate Change: Multi-dimensional Aspects
Sea Level Rise
Infrastructure
Flooding
Loss of Property
Ecological
Increased Storm Intensity
Precipitation Changes
Water Management Changes
Saltwater Intrusion
Rise in Water Table
Increased Tidal Inundation
Submergence of Coastal Marshes
Infrastructure
Flooding
Loss of Property
Ecological
Stressors
Effects