

Conceptual Models and Louisiana Coastal Ecosystem Restoration

Common habitat types in coastal Louisiana, moving along an inland–fresh salinity gradient to coastal–saline.



Swamp forest

Fresh marsh

Brackish marsh

Salt marsh

What Conceptual Models are...

Conceptual models are flexible descriptive tools – often maps, flow charts, tables, diagrams or pictures – that effectively communicate ecosystem processes, characteristics and relationships. They also provide a means for diverse project partners, or stakeholders to communicate their goals, interactions and interdependencies with other groups to reach consensus. The US Army Corps of Engineers uses conceptual models to guide ecosystem restoration planning, implementation and evaluation.

What a Conceptual Model does...

A good conceptual model tells the story of “how the ecosystem works,” providing:

- current understanding of the ecosystem in simplified terms
- help in understanding and diagnosing the underlying problem
- a tool for identifying potential causes/effects responses
- a common framework or “mental picture” used to develop alternatives
- a means for grading and evaluating project success

What a conceptual model looks like...

Conceptual models can take many different forms – no single type will be useful for all applications. The three most common types are narrative, tabular or matrix, and schematic or picture representations. Regardless of type, the best conceptual models should focus on key ecosystem attributes, should be relevant, reliable and practical, and finally should clearly communicate important concepts

- Schematic or Picture Conceptual Models come in a seemingly unending variety, with variations of picture models or box-arrow (“flow chart”) models most commonly used (See Figure 1 right).

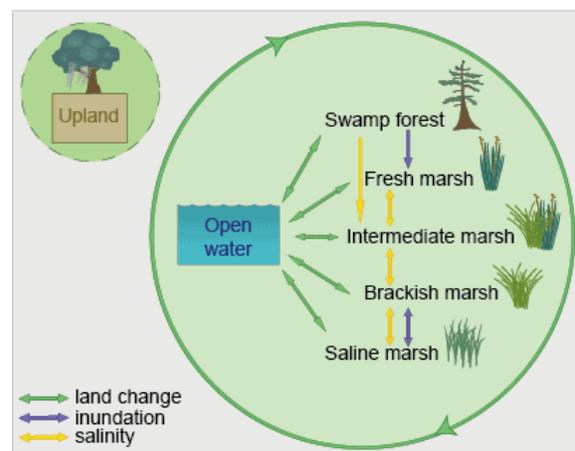


Figure 1. Conceptual Model of changes in coastal Louisiana habitats (Visser et al. 2003. Habitat Switching Module, Chapter 9. In, R.R. Twilley (ed.), Coastal Louisiana Ecosystem Assessment and Restoration (CLEAR) Model of Louisiana Coastal Area (LCA) Comprehensive Ecosystem Restoration Plan. Vol I: Tasks 1-8. Final Rep to DNR, Coastal Restoration Div, Baton Rouge, LA. Contract . 2511-02-24. 319 pp.

- **Narrative Text:** Conceptual Models present a story form including formal or informal hypotheses and using a few sentences, formulae, or combinations of both.

‘Our current understanding of shifts in vegetative community type is related to long-term shifts in salinity & inundation. For instance much higher inundation levels are required to convert established vegetation into open water than can be tolerated by vegetation establishing on created mudflats. However all these switches assume that seed sources for these habitats are available. It is also assumed that upland habitats will remain upland habitats. Emergent plant communities will change in progression from one community type to another along a salinity gradient (i.e., fresh < > intermediate < > brackish < > saline while upland habitats remain upland habitats. Deviations in this community progression are likely to be mediated by factors including invasive species (Nutria), competition, fire, and grazing.’ (Visser et al 2003)

Table or Matrix: Conceptual Models present an array of ecosystem components or relationships in some form of a row-column structure and can vary in complexity from a few to many hundreds of cells (right, from Visser et al. 2003).

Habitat	Salinity (yearly average)	Source for Salinity Restrictions	Inundation (% of year)	Source for Inundation Restrictions
Bottomland Hardwood Swamp Forest	< 2 ppt	Conner et al. (1997)	< 30%	Conner et al. (1997)
Fresh Floating Marsh	< 4 ppt	Höppner (2002)	Up to whole year if not stagnant Not Applicable	Höppner (2002)
Fresh Attached Marsh	< 2 ppt	Chabreck (1970), Hester et al. (2002)	Up to whole year if not stagnant and below 30 cm of water on marsh	Evers et al. (1998)
Intermediate Marsh	< 2 ppt	Chabreck (1970)	Up to whole year if not stagnant and below 30 cm of water on marsh	Evers et al. (1998)
Brackish Marsh	2-6 ppt	Chabreck (1970)	< 64%A	Sasser (1977)
Saline Wetlands	6-15 ppt	Chabreck (1970)	< 80%A	Sasser (1977)

How Conceptual Models can be applied in Ecosystem Restoration:

Conceptual Model development comes from a consensus among diverse project team representing the public, the Corps and other to create a model that best represents our current understanding critical ecosystem components, services/human uses, ongoing problems and proposed alternatives. Additionally, cause-and-effect relationships may be used to forecast and evaluate effects on system integrity, stressors, risks and other changes.

What Conceptual Models are not...

While conceptual models may help identify core ecosystem components and relationships, they are not a substitute for analysis and debate among the project team to identify the most significant natural or cultural resources and to prioritize issues or solutions. Most importantly, conceptual models are **NOT**:

- *The whole truth* – instead, they are simplified depictions of reality.
- *Final* – instead, they provide a flexible framework that evolves as understanding of the ecosystem increases.
- *Comprehensive* – instead, they focus only on those “parts” of an ecosystem deemed relevant while leaving out other elements not determined to be as important.

Additionally, conceptual models do not allow prediction of specific restoration outcomes. However, because they represent current understanding of how the ecosystem works, they can assist in generalized predictions and provide a foundation for determining benefits, developing monitoring plans and evaluating performance.