Conceptual Model Development in Support of Ecosystem Restoration Project Planning

Why does a Project Delivery Team need a Conceptual Model for Restoration Planning?

Conceptual model development is a requirement for any Corps Planning Project. These models are needed for the efficient communication of ecosystem processes and characteristics to diverse sponsors and stakeholder audiences (EC XXXX).

When created early in the planning process (as early as a recon study) , a conceptual model can help guide and narrow choice of activities and alternative plans, providing a key link between early planning and implementation (USACE, EAB 2006). A good conceptual model provides a PDT with:

- A current understanding of ecosystem components and linkages,
- Help in understanding causes and effects and diagnosing the underlying problem,
- A common framework to develop alternatives,
- A tool for making qualitative predictions of ecosystem response,
- A means to identify appropriate monitoring indicators, metrics and models, and
- A basis for implementing adaptive management strategies.

Guidelines for choosing conceptual model framework:

There are several types of conceptual models – the specifics of each project should guide the PDT's choice of the most appropriate model for the project (Table 1.). No single model type is free of disadvantages and it is often useful to combine approaches to overcome weaknesses of any single model construct or presentation format.

Table 1. Advantages and disadvantages of various model constructs (adapted from Fischenich, 2008).

Model Type	Advantages	Disadvantages
Control models	• accurately represent feedbacks and interactions • usually most realistic structure • insights from construction	• often complicated and hard to communicate • state dynamics may not be apparent
State and transition	• clear representation of alternative states • can be simple • excellent communication with most audiences	• generally lack mechanism • usually too general to directly link to indicators and measures
Driver-stressor models	• provide clear link between agent of change and state • simple and easy to communicate	• no feedbacks • few or no mechanisms • frequently inaccurate and incomplete

Guidelines for choosing conceptual model format:

Conceptual models summarize important attributes and interactions of complex ecosystems and can be presented in graphical, tabular (matrix) or narrative formats. The PDT should keep in mind that a conceptual model will be reviewed by several audiences with different perspectives and needs during the planning review process. There are contrasting ways to meet this planning review challenge *is to use either a single highly detailed model or alternatively to include several versions of a project model, each that emphasize different type/level of information (Casper et al. 2009)* .

Table 2. Comparison of model presentation types (Gucciardo, et al., 2004, adapted from Fischenich, 2008).

Type of model	Description	Strengths	Drawbacks
Narrative	Use word descriptions, mathematical or symbolic formula	Summarizes literature, information rich	No visual presentation of important linkages
Tabular	Table or two-dimensional array	Conveys the most information	May be difficult to comprehend amount of information
Picture models	Depict ecosystem function with plots, diagrams, or drawings	Good for portraying broad-scale patterns	Difficult to model complex ecosystems or interactions
Box and arrow (Stressor model)	Reduce ecosystems to key components and relationships	Intuitively simple, one-way flow, clear link between stressor and vital signs	No feedbacks, few or no mechanisms, not quantitative
Input/output matrix (Control model)	Box and arrow with flow (mass, energy, nutrients, etc.) between components	Quantitative, most realistic, feedback and interactions	Complicated, hard to communicate, state dynamics may not be apparent

What Conceptual Models can NOT do for the PDT:

While conceptual models may help identify core ecosystem components and the relationships among them, they don't replace the need to clearly identify project goals, objectives and endpoints – rather, the process of developing a good conceptual model will enable the PDT to better identify and articulate problems, needs, opportunities and constraints as part of the Corps Project Planning Process. They do not directly contribute to the negotiations and trade-offs common to ecosystem restoration project planning.

The PDT should recognize other limitations of conceptual models. Conceptual models are NOT:

- *The Whole truth* – They are simplified depictions of reality.
- *Strictly predictive* – They show the current understanding of relationships between ecosystem components.
- *Final* – They provide a flexible framework that evolves as understanding of the ecosystem increases.
- *Comprehensive* – They focus only upon those "parts" of an ecosystem deemed relevant to the PDT while ignoring other important (but not immediately germane) elements.

Points of Contact

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