

Systems Thinking using the DPSIR Framework

www.epa.gov/ged/tutorial

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Problem:

The sustainable well-being of communities is inextricably linked to both the health of the earth's ecosystems and the health of humans living in the community. Modern problems are increasingly complex and communities cannot afford to simply add up single-purpose, single media approaches to complex interconnected problems. The results are often environmentally insufficient, economically inefficient, and socially unjust or unacceptable. There is growing recognition that the complexity of modern problems requires a new way of making decisions.

Action:

EPA scientists have developed a tutorial for using a conceptual systems framework to help capture, organize and visualize the environmental, social, and economic outcomes of human decisions. The framework establishes links between social and economic factors that drive human activity and the effect of those activities on the environment and future provisioning of ecosystem goods and services.

Result:

The Tutorial on Systems Thinking provides 1) an overview of how to incorporate systems thinking into decision-making, 2) an introduction to the Driver-Pressure-State-Impact-Response (DPSIR) framework for linking socioeconomic and environmental factors in decision-making, 3) an illustration of several tools, including concept mapping and keyword lists, which can be helpful in generating a DPSIR, and 4) an example of using DPSIR to integrate human health and ecosystem health into a single framework.

Impact:

With the guidance provided in this tutorial, scientists, stakeholders, and decision-makers will more easily grasp the interwoven nature of social, economic, and environmental elements, and will better anticipate any unintended consequences of decisions.

ReefLink Database

A Decision Support Tool for Linking Coral Reefs and Society through Systems Thinking

www.epa.gov/ged/coralreef

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Problem:

Coral reefs provide the ecological foundation for productive and diverse fish and invertebrate communities that support multibillion dollar reef fishing and tourism industries. Yet reefs are threatened by growing coastal development, climate change, and over-exploitation. Efforts by numerous federal, state, academic, and non-governmental organizations have generated a wealth of knowledge on coral reef ecology, yet reef ecosystems continue to decline. A key issue is that scientific and management efforts are often narrowly defined. As a consequence, there is often difficulty in predicting the indirect consequences and benefits of decisions. There is an urgent need for a decision framework which integrates environmental concerns with social and economic needs.

Action:

EPA scientists have developed the ReefLink Database utilizing a systems approach to integrate ecosystem services into the decision process, including elucidating the linkages between decisions, human activities, and provisioning of reef ecosystem goods and services. The database employs the Driver-Pressure-State-Impact-Response (DPSIR) framework as a systems framework to ensure that critical concepts are not overlooked.

Result:

This scientific and management information database utilizes systems thinking to describe the linkages between decisions, human activities, and provisioning of reef ecosystem goods and services. This database provides a navigable hierarchy of related topics and information for each topic including concept maps, scientific citations, management options, and laws.

Impact:

The database can be used by 1) the public to learn how their community may affect or benefit from coral reefs, 2) scientists to identify decision scenarios for which their research may be relevant, and 3) reef managers to understand how systems thinking can aid in identifying alternative management options. Although specifically designed for coral reefs, the database provides an example of using a systems thinking framework to integrate scientific research with decision-making, and in concert with the systems thinking tutorial (www.epa.gov/ged/tutorial), presents approaches which are broadly applicable to any environmental management problem.