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The ecological model web concept: A consultative infrastructure for researchers and decision makers using a Service Oriented Architecture

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Rapid climate and socioeconomic changes may be outrunning society's ability to understand, predict, and respond to change effectively. Decision makers such as natural resource managers want better information about what these changes will be and how the resources they are managing will be affected. Researchers want better understanding of the components and processes of ecological systems, how they interact, and how they respond to change. Nearly all these activities require computer models to make ecological forecasts that can address "what if" questions. However, despite many excellent models in ecology and related disciplines, there is no coordinated model system—that is, a model infrastructure–that researchers or decision makers can consult to gain insight on important ecological questions or help them make decisions. While this is partly due to the complexity of the science, to lack of critical observations, and other issues, limited access to and sharing of models and model outputs is a factor as well. An infrastructure that increased access to and sharing of models and model outputs would benefit researchers, decision makers of all kinds, and modelers.

One path to such a "consultative infrastructure" for ecological forecasting is called the Model Web, a concept for an open-ended system of interoperable computer models and databases communicating using a Service Oriented Architectures (SOA). Initially, it could consist of a core of several models, perhaps made interoperable retroactively, and then it could grow gradually as new models or databases were added. Because some models provide basic information of use to many other models, such as simple physical parameters, these "keystone" models are of particular importance in a model web. In the long run, a model web would not be rigidly planned and built–instead, like the World Wide Web, it would grow largely organically, with limited central control, within a framework of broad goals and data exchange standards. These standards would emerge naturally from the modeling communities they serve, as they must accommodate many disciplines with different needs and histories.

Building a model web is likely a gradual process, both because adapting existing models requires significant effort, and because many of the barriers to model interoperability and greater model access can only be lowered gradually. While most technical barriers have solutions in varying stages of maturity, there are also social and institutional barriers that are quite slow to change.

Ultimately, the value of a model web lies in the increase in access to and sharing of both models and model outputs. By lowering access barriers to models and their outputs there is less reinvention, more efficient use of resources, greater interaction among researchers and across disciplines, as well as other benefits. The growth of such a system of models fits well with the concept and architecture of the Global Earth Observing System of Systems (GEOSS) as well as the Semantic Web. And, while framed here in the context of ecological forecasting, the same concept can be applied to any discipline utilizing models.