A MULTI-DISCIPLINARY MODELING APPROACH FOR WATER- AND ENVIRONMENTAL-RESOURCES MANAGEMENT

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Abstract: Single-issue management strategies are no longer sufficient to address the increased complexity of water- and environmental-resources management. The single-objective strategy does not consider the range of interactions that have physical, economic, and social consequences for other resources. The challenge for today's resource managers is to optimize the management of multiple resources while minimizing negatives impacts of any given decision. Scientific information can be used to assess alternative management decisions by providing improved understanding of the interrelationships among resource-related processes. The challenge to the science community is to enable and support collaboration among the large number of scientific disciplines needed to address these resource-management issues. To facilitate this collaboration, an objective methodology to integrate multi-disciplinary modeling approaches with the development and assessment of management strategies has been developed.

The FRAME (Framing Research to support Adaptive Management of Ecosystems) project is a collaborative, multi-disciplinary effort currently focusing on pinyon-juniper woodland management on the Colorado Plateau. The USGS Modular Modeling System (MMS) (http://wwwbrr.cr.usgs.gov/mms) provides a modular framework that supports the collaborative integration of a broad range of models and tools, from a wide range of scientific disciplines and management perspectives, to address a variety of pinyon-juniper management issues. MMS is being coupled with the U.S. Forest Service model SIMulating Patterns and Processes at Landscape Scales (SIMPPLLE) (http://www.fs.fed.us/rm/missoula/4151/SIMPPLLE) to enable the assessment of the effects of alternative resource-management options on a variety of hydrologic and ecosystem processes. SIMPPLLE is a spatially explicit model that can simulate changes in vegetation conditions that result from disturbances such as fire, insect infestation, and disease, as well as a variety of management actions such as harvesting and thinning. Output from SIMPPLLE is an ensemble of potential vegetation conditions years to decades into the future. Landscape conditions generated by SIMPPLLE can be used to estimate parameters in selected watershed, erosion, hydraulic, and ecosystem models to assess the effects of alternative management strategies on a variety of hydrological and ecological responses.

Initial application of the coupled MMS-SIMPPLLE modeling tools is to support fire-management planning at Mesa Verde National Park. A major objective of the development and application of these tools is to allow resource managers to develop more flexible management scenarios that can adjust to changing conditions, and to develop spatially explicit landscape-management scenarios that incorporate the social, economic, legal, and environmental constraints that managers face. A review of the modular framework and selected framework tools will be presented.