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Models supporting a reference/desired future condition for Ecosystem Restoration of the Upper Mississippi River

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The Upper-Mississippi River ecosystems have been hydrologically altered since the locks and dams were put into operation in the 1930s. As a result, landscape patterns have been changed in historical floodplains and large open water areas were created above the dams. Islands characterized by woody vegetation experienced unusually prolonged unfavorable hydrologic conditions and were eliminated from many areas of the river. The distribution and extent of other habitat types characteristic of large rivers were also altered. These historical conditions can be used to define objectives in the restoration and management of the Upper Mississippi River. Derivation of desired or reference conditions must also recognize that the system now consists of a series of connected impoundments that are regulated to facilitate commercial navigation. Ecosystem restoration goals and objectives must be compatible with navigation and other human uses of the river. In the context of Upper-Mississippi River ecosystem restoration, alternative desired future ecosystem conditions can be evaluated through the use of dynamic landscape models, such as the Spatial Explicit Comprehensive Aquatic Systems Model (SECASM). The SECASM simulates long-term (e.g., 100 years) changes in landscape pattern and vegetation succession in floodplain ecosystems. The model exhibits a spatial resolution of 100 x 100 meters and uses a time scale of one day. The model can be used to forecast the likely outcomes of varied restoration alternatives that are undertaken to achieve pool-specific and system-wide objectives, design effective management actions, and estimate corresponding ecosystem goods and services. The SECASM was applied to Navigation Pool 5. The model was able to reproduce observed vegetation succession and land-use patterns from 1889 through 1989. Comparative simulations were made with and without the introduction of the Pool 5 Lock and Dam. The SECASM was also used to explore vegetation responses and resulting landscape patterns to different scenarios for water level management (i.e., planned drawdown ranging from 0.5 ft to 3.ft). The SECASM exists as one modeling tool that can be used to explore the feasibility of using selected historical conditions as desired conditions for restoration and management of the Upper Mississippi River system.