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Short Communications

The State of United States Aquatic Restoration

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The last twenty-five years have seen increasing interests in both the science and practice of aquatic ecosystem restoration in the United States. Aquatic ecosystems were heavily altered in the U.S. during the early and mid-twentieth century for purposes of flood control, navigation, water supply, and agricultural and urban development. Over time, and with changing social preferences, it became clear that past successes in water resource development often led to the loss of important functions and services provided by aquatic ecosystems. Restoration activities began as a result, in part driven by legal imperatives, such as the 1973 Endangered Species Act and 1972, 1977, and other amendments to the Clean Water Act.

Aquatic restoration activities span a range of activities and scales. Examples include: systematic, long-term restoration of some degree of pre-regulation river and stream flow; discrete river flow or reservoir release experiments; deliberate drawdown of river levels in navigation pools behind dams; and, physical construction of meanders, cutoffs and wetlands in floodplains and adjacent to river channels. At smaller scales, restoration activities may be carried out by individual landowners, or farmers; at larger scales, the resources and authorities of state and the U.S. federal government often are required. To this end, in 1996 the U.S. Army Corps of Engineers added a new mission area of ecosystem restoration to its traditional responsibilities of flood risk management and support of navigation. Their focus is on integrated restoration including wetland, riparian, river and coastal habitats.

As the demand for aquatic ecosystem restoration in the U.S. has increased, the science of restoration and the need for regionally-based restoration programs, has grown accordingly. The challenges of restoration are many and include our incomplete understanding of the complexity of ecosystems and the limit this places on our ability to predict ecosystem response to restoration efforts. As a result, many U. S. federal and state agencies now employ an adaptive management framework to advance the science of restoration while working to achieve project goals. Adaptive management couples predictions on what is expected to occur in a restoration project, with appropriate monitoring to discover what did occur, and stipulates that management actions be revised to align the two. It provides a flexible approach to learning so that the most effective and sustainable restoration strategies can be implemented (NRC, 2004).

The best restoration projects have been designed to add to our scientific understanding of ecosystems and their functions, and to provide social and economic benefits such as water supply enhancement, or species preservation. Adopting an experimental approach to restoration, in which alternative approaches are tested systematically and cause and effect relationships are explored, moves the science of restoration forward more rapidly. Adaptive, science-based restoration has been laid out as a series of steps including: 1–making project goals explicit; 2—basing project design on the most current ecological knowledge; 3—assessing the response of the system quantitatively by collecting data both before and after the project is implemented; and 4—analyzing the data to determine whether project goals are being met (Zedler, 2005).

Adaptive management in restoration is particularly valuable for projects centered on unique, large-scale ecosystems such as the Florida Everglades or the Chesapeake Bay. The

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Everglades, a once vast mosaic of interconnected habitats, has experienced nearly 150 years of drainage, channelization and water control (NRC, 2012). The Chesapeake Bay, the largest and most diverse estuary in the U.S., is threatened by nutrient and sediment inputs that have substantially altered its ecological condition, leading to harmful algal blooms and reduction of fish populations (NRC, 2011). Adaptive management actions in both ecosystems recognize that continued assessment and feedback will help fill critical knowledge gaps, acknowledge tradeoffs in decision-making, and ultimately maximize restoration success, leading to more successful restoration efforts elsewhere.

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NB in the above, the title «Adaptive Management for Water Resources Project Planning» should be italicised.

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