ABSTRACT

Wetland Functions, Values and Vulnerability

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Human settlements have historically been drawn to deltas, rivers, alluvial valleys, coastal zones, and other regions in which wetlands naturally occur due to the availability of water and other natural resources associated with these highly productive ecosystems. Population growth, coupled with man's increasing ability to manipulate the environment, has lead to wetland deterioration and conversion to other uses. Wetlands have been drained and impounded for agricultural development; levees have been constructed around them to prevent flooding and rivers that provide essential water and nutrients have been channelized, dammed and diked. Approximately half of the wetlands that existed in the conterminous United States at the time of European settlement have been lost or converted to other uses. The remaining 41 million ha of US wetland habitats provide economic income, recreation, water quality improvement, flood water retention, habitat for fish and wildlife, and several other important ecological functions that affect both our economic and social well being.

Over the past 30 years there has been an increasing interest in wetland conservation and protection in the US, inspired by a growing public awareness of wetland values. Wetlands are now protected under state and federal laws, and great investments have been made in the 1) inventory, 2) characterization, 3) acquisition ('reserves'), 4) management and protection, and 5) restoration of wetland ecosystems.

The US and China share comparable wetland types and problems. Each has vast areas of frigid and temperate wetland, and wetland losses in both countries can be attributed primarily to agricultural development. Societal impacts of these wetland losses are similar; among the most significant impacts are lowered flood water storage, water quality degradation, increased vulnerability of coastal communities, loss of biodiversity and loss of natural resources such as timber, waterfowl, peat, and fisheries. The two countries share common needs for wetland education, technology and science. Sharing of resources and expertise could prove beneficial to both countries; heightened mutual interests and bilateral research commitments may enhance the potential for protecting the remaining wetland resources in the US and China.

ABSTRACT

Lessons Learned To Date from Implementation of the Glen Canyon Dam Adaptive Management Program

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The Colorado River corridor from the forebay of Glen Canyon Dam to the upper reach of Lake Mead harbors significant physical, biological, cultural and recreational resources. Although it is the longest riparian segment in the United States free of development, the Colorado River and associated terrestrial ecosystems today differ significantly from their original natural character. Glen Canyon Dam, completed in 1963, has had dramatic impacts on downstream resources within the Glen Canyon National Recreation Area and Grand Canyon National Park.

As directed in the Grand Canyon Protection Act of 1992 (Public Law - 102-575) and in response to the findings of the Glen Canyon Dam Environmental Impact Statement (GCDEIS, 1995) and the subsequent Record of Decision (ROD, 1996), managers and scientists have been directed to monitor "the effects of the Secretary's actions" on the Colorado River ecosystem primarily between Glen Canyon Dam and Lake Mead, and research new alternatives that increase protection of resources and improve natural processes. The Act, the GCDEIS, and the ROD, called for the establishment of the Glen Canyon Dam Adaptive Management Program (GCDAMP) comprised of an Adaptive Management Work Group (AMWG), Technical work group (TWG), the Grand Canyon Monitoring and Research Center (GCMRC), and an Independent Review Panel (IRP).

The AMWG is comprised of managers and stakeholders who determine primary objectives and information needs to be addressed by GCMRC. GCMRC's mission is to determine short- and long-term ecosystem resource impacts of "the effects of the Secretary's actions", and other information needs as specified by the AMWG. The structure of the adaptive management program has been specified in legislation and the AMWG has been established under Federal Advisory Committee Act guidelines.

GCMRC was formally established in October of 1996 and the AMWG was chartered in February of 1997 and has been operating for more than two years. Lessons learned from the 1996 BHBF, the 1997 habitat maintenance flow and implementation, to date, of the Glen Canyon Dam Adaptive Management program will be discussed.

ABSTRACT

Chesapeake Bay Program

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The Chesapeake Bay Program is the oldest estuarine management program in the U.S. The Program began in 1983, and is a partnership among the federal government, led by the U.S. Environmental Protection Agency (EPA), and the states in the Bay watershed. The Program has devised an intricate and complex management web to restore the Bay by focusing efforts in the tributaries. Much of the work of the Bay Program concentrates away from the 200 mile (320 kilometer) long Bay and focuses on the 64,000 square mile (165,000 square kilometer) watershed that delivers the Bay's freshwater, as well as most of its pollutants.

The Bay Program is a multi-governmental partnership that is funded by the EPA through its Chesapeake Bay Program Office in Annapolis, Maryland. Much of the focus of the restoration efforts concerns nutrient reductions, but there are significant efforts concerning toxics reductions, habitat restoration, fishery management, and population growth and development. In 1987 the Bay Program committed to reducing nutrients entering the Bay by 40 percent by the year 2000. All Bay Program restoration actions, including the nutrient reduction goal, are initiated to maximize the benefits to the Bay's living resources. In 1992, the Program took a tributary approach in order to achieve the reduction goal, and required a 40 percent nutrient reduction in each of the ten largest tributaries to the Bay. The Program is working hard to meet that goal by the end of next of year. The Bay Program has also continually set numeric goals and time frames in which to reach those goals.

The Bay Program is currently completing a Toxics Characterization of the Chesapeake Bay's Tidal Rivers. That report will be released this spring. This study is part of a broader review of the Program's Toxics Reduction and Prevention Strategy taking place through 1999.

The Bay Program has been a leader in habitat restoration in the United States. In 1996 the Program began an Initiative to protect and restore forested buffers along streams and rivers in the Bay watershed, with a goal of restoring 2,010 miles (3,234 kilometers) of forested shoreline by the year 2010. The Program has also embarked on efforts to protect and restore wetlands (a restoration goal will be set later this year), provide passages (or dam removal) for anadromous fish to reach historic spawning tributaries, and an array of other habitat projects in both estuarine (e.g., oyster reef restoration) and freshwater areas.

All of the efforts of the Bay Program are currently being assessed and evaluated and will culminate in a new "Chesapeake 2000" agreement, scheduled to be adopted in the spring of 2000. The China/US Water Resources Workshop is an excellent forum for the Bay Program to share our experiences, both our successes and failures, and to learn from others. It is an especially

important time for us as we embark on the formation of a new agreement that will set our path for the 21st Century.

ABSTRACT

Adaptive Management of the Colorado River Ecosystem Below Glen Canyon Dam, Arizona

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Closed in 1963, Glen Canyon Dam has drastically altered natural flood frequency and sediment-transport of the Colorado River through Grand Canyon. In fall 1992, the Grand Canyon Protection Act (GCPA) required that Glen Canyon Dam be operated to benefit downstream resources of the Colorado River ecosystem. The law also required that an environmental impact statement be prepared on dam operations. In March 1995, the *Operations of Glen Canyon Dam – Final Environmental Impact Statement (GCDEIS)* was completed. The GCDEIS proposed a "Modified Low-Fluctuating Flow" alternative (MLFF) for dam operations intended to achieve the intent of the GCPA. The MLFF alternative became the Secretary of the Interior's Record-of-Decision (ROD) in fall 1996. The GCDEIS also recommended that future operational impacts be monitored through a science-based, adaptive ecosystem assessment approach. The Secretary created the Grand Canyon Monitoring and Research Center (GCMRC) in 1995, and the Glen Canyon Dam Adaptive Management Workgroup (AMWG) in fall 1997 to support this adaptive management approach.

The role of the GCMRC is to conduct monitoring and research of river ecosystem response to the Secretary's 1996 ROD. Scientific information gathered by GCMRC is used by the AMWG to make recommendations to the Secretary as to the effectiveness of the ROD in benefiting downstream resources. The AMWG may also make recommendations on how current operations might be altered to best achieve restoration and preservation of resources, including endangered species, Native American cultural sites, and recreational resources.

Current operations at Glen Canyon Dam consist of diurnal fluctuating releases from the dam within a limited flow range. Such flows are largely intended to reduce erosion of downstream terrestrial and aquatic habitats related to sand bars, and minimize transport of channel-stored sand out of the system. Under the ROD, a controlled flood-flow, termed a "Beach/Habitat-Building Flow (BHBF)" may also be initiated. The purpose of the BHBF is to rebuild sand bars, restore aquatic habitats, deposit nutrients, and restore a dynamic component to the river system. Although the dam has restricted about 85 percent of the sand formerly transported through the ecosystem, periodic inputs from unregulated tributaries provide sand for redistribution by the occasional BHBF. A test of the BHBF in 1996, showed that beaches were rebuilt, but that aquatic habitats important to the endangered humpback chub (*Gila cypha*) were not restored. Following the 1996 BHBF, the aquatic food base flourished, and there were no signs of negative

impacts to native or non-native fish species. Future large-scale flow experiments may also include low-steady flows, and warming of dam releases intended to benefit endangered fishes.

ABSTRACT

Watershed Restoration Efforts in Oregon

John D. Miller

To be added.

ABSTRACT

The U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program: An Ecological Perspective

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The NAWQA Program of the U.S. Geological Survey is designed to assess the status and trends in the quality of the Nation's ground- and surface-water resources and to link this information with an understanding of the natural and human factors that affect water quality. The building blocks of the program are study unit investigations in 60 major hydrologic basins. Results are analyzed at the study unit and national scale. Surface water data include flow, water-column chemistry, bed sediment and tissue chemistry, and ecological studies. The ecological studies evaluate the influence of physical and chemical water characteristics on ecological health and how biological and habitat characteristics differ among environmental settings. Ecological health assessments include riparian and stream habitat, benthic invertebrates, benthic algae, and fish communities.

As an example, the Central Columbia Plateau in eastern Washington State is an arid landscape dominated by dryland and irrigated agriculture. Physical alterations to streams include reduction of riparian habitat, stream bank erosion, increased water temperatures, and high sediment loading due to agricultural practices. Nutrient loading from both urban and agricultural practices has resulted in the eutrophication of some streams causing large fluctuations in DO concentrations. Concentrations of organochlorine pesticides, such as DDT, remain elevated in stream sediment and fish tissue, with concentrations in sediment or fish a function of land use practices. Presently used pesticides, such as organophosphate and carbamate insecticides, have been associated with a reduction in cholinesterase activity in common carp. Preliminary analysis of benthic invertebrate and algae data indicates that these assemblages respond strongly to environmental gradients within particular land uses. Many of the native fish endemic to the basin, such as rainbow trout, are rarely found; whereas, exotic fish, such as common carp, are now found at many sites. The inclusion of ecological studies in the NAWQA program has greatly enhanced our ability to understand how land use practices influence water resources.

NAWQA is presently near the end of its first complete cycle of assessments. The major successes of the first cycle include: 1) viewing water quality as an integration of its physical, chemical, and biological components, and 2) designing the program to be nationally consistent while permitting each study unit to address local watershed-scale issues. There is an increased need for scientists from different disciplines to work more closely together. In analyzing data, we have learned how important it is to include reference sites within a watershed, along with

establishing sites that capture environmental gradients throughout a land use.

ABSTRACT

South Florida Ecosystem Restoration

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Restoration of the Everglades and its associated riverine, lacustrine and estuarine ecosystems is the largest environmental restoration project in the United States. The Everglades proper is a marsh in south Florida that is approximately 100 miles long and 40 miles wide, and a few inches to a few feet deep. But the geographic extent of the restoration area includes the entire Everglades basin and extends another 100 miles north. That basin includes several rivers, the southeast's largest lake, major estuaries, three National Parks, a large agricultural area and a growing population of about 6 million people. A major water resources project, designed in the 1940s to provide flood protection and to provide water for both human and environmental purposes, has combined with a burgeoning population and major agricultural and residential development to severely threaten the biological functions of the Everglades. The restoration effort underway seeks to restore the biological functions primarily by restoring the natural hydrology and water quality to undeveloped portions of the system. In this paper I explain the history of the problem, the solutions developed, and the ecological principles that underlie the restoration process.