Hydrogeomorphic (HGM) Analysis
Natural Resource Program Center

The National Wildlife Refuge System, administered by the U.S. Fish & Wildlife Service (FWS), is the world's premier system of public lands and waters set aside to conserve America's fish, wildlife, and plants. The Refuge System includes 556 National Wildlife Refuges and 38 Wetland Management Districts.

What it is

Hydrogeomorphic (HGM) analysis is a three-step process used to evaluate riparian and wetland ecosystems and surrounding landscapes. It is used to identify options for restoring areas to their original functions, before human-induced alterations, all within the context of landscape-scale conservation and species preservation.

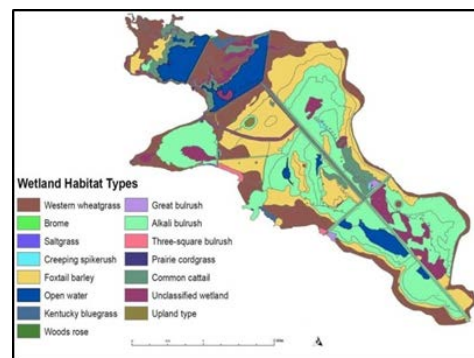
Benton Lake NWR, Credit: USFWS

The HGM Process

The first step in an HGM analysis is to evaluate the historic conditions of the land and its surroundings by studying the soil, vegetation, topography, hydrology, flora and fauna. Maps and reports also can provide useful information. Using comprehensive scientific data discovery and field calibration, soils, water, and other elements of a landscape are then arrayed in a matrix--a process that allows for the mapping of individual refuges as well as entire landscapes. The end result is an objective collection of information on where communities belong and how they historically have interacted.
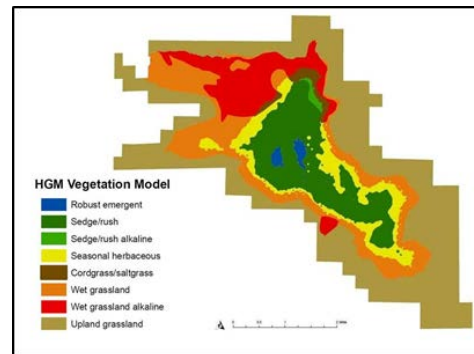
Probable historic vegetation communities on Benton Lake NWR

The second step is to evaluate how the land has been altered through manipulation of drainage systems, topography, or vegetation communities, and how those changes have affected the natural ecological processes. Current conditions are assessed as well as each community's resilience to change and potential for restoration.

Current distribution of major vegetation communities on Benton Lake NWR

Ouray NWR, Credit: USFWS

The third step is to identify strategies for restoring an area to the historical condition within the context of the larger landscape.

Common approaches might involve removal of invasive species or undoing human-induced changes to hydrology. Through the matrix developed in the first step, managers can set priorities, identify landscapes that offer the best opportunities for successful restoration, and determine which management methods will be needed to sustain the restorations.

Why it is needed
Understanding biodiversity within a landscape is a critical component of the overall inventory and monitoring process, which is required under the National Wildlife Refuge System Improvement Act of 1997. Climate change is predicted to accelerate species extinction rates across the globe as well as cause changes in other ecological processes. Scientists believe landscapes restored to their original functions will be more resilient to climate change or better able to adapt to those changes and thus facilitate the preservation of biodiversity.

HGM analyses help to insure that such restorations will be successful by matching restoration strategies with the historical conditions of the targeted ecosystems.

Wetland habitat, Credit: USFWS

When it will start
The National Wildlife Refuge System's Natural Resource Program Center is hiring contractors and working with most regions throughout the National Wildlife Refuge System to identify refuges that would be good candidates for HGM analyses. Several dozen refuges already have started or completed the HGM process.

For more information:

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