PROJECT DESCRIPTION

This project proposed to develop spatial data related to the extent of inundation and environmental characteristics of flooding at known river stages on the Mississippi River through analysis of remotely sensed satellite imagery. These data will form the backbone of analytical products including models, maps, GIS projects, and visualization tools that will characterize and assess the aquatic habitat on the refuge and adjacent areas. These data are necessary to evaluate fisheries habitat needs for species like alligator gar (AG) which has been identified by the Service the Gulf Coastal Plain Ozarks Landscape Conservation Cooperative (GCPO LCC) as a species of concern in the LMV. They will also provide a finer resolution for evaluating the availability of waterfowl habitat during critical migration periods, and even project potential changes in forest type that may guide habitat management strategies for upland species.

OBJECTIVES AND ALTERNATIVES

The objectives of this proposal were: 1) to apply previously used remote sensing techniques to the Mississippi River floodplains to define inundation, turbid water patterns, and thermal aquatic gradients, 2) to use these results in conjunction with expert knowledge and ground-truth data to identify the aquatic landscape dynamics that may provide suitable habitat for alligator garfish and other floodplain dependent species, 3) apply the data products developed in this effort to other non-protected areas within the same Landsat scene that may provide similar aquatic habitat and landscape dynamics.

METHODS AND PROTOCOLS

Although the primary target of this research focused on describing conditions present on St. Catherine Creek NWR, satellite imagery was analyzed for the entire Mississippi River floodplain in the same Landsat scene (Path 23 Row 38) as acquired from USGS through the Earth Resources Observation and Science Center (EROS) (http://glovis.usgs.gov/). Twenty-four cloud free, leaf-off Landsat 5 and 7 images were used to determine the extent of inundation from 1985 to 2011 and at a variety of river stages. For each image, simple thresholding of Landsat band 5 (1.55 - 1.75 μm) was used to classify categories of dry land, flooded land and open water. To determine the potential thermal refuge offered in inundated areas, thermal habitat was characterized using the same 24 images and the associated thermal band from Landsat.

The 2006 National Land Cover Database from the Multiresolution Land Characteristics Consortium was used to identify land cover types. http://www.mrlc.gov/nlcd2006.php

DATA MANAGEMENT

Landsat imagery was downloaded from the USGS GloVis. Imagery was corrected for radiance and reflectance using ERDAS Imagine. Frequency models constructed using the model maker module in ERDAS Imagine. Data display and final maps were constructed using ESRI ArcGIS. All products are now stored on the Conservation Planning Atlas (CPA), a web interface maintained by the GCPO LCC (http://gcpolcc.databasin.org/).

DATA ANALYSIS / MODELS

Frequency of inundation for each location in the study area was measured as the number of times that pixel was classified as wet over all twenty-four images. Thermal habitat for each image was characterized as the temperature difference from the river for each wetted location. All images were then averaged to determine the average thermal refuge from river conditions. Both new data tools have been useful in developing management tools for the NWR system.

Floodplain inundation frequency and thermal gradient data developed for this project were combined with existing land cover data and telemetry information to produce a Habitat Suitability Index for alligator gar spawning in the Lower Mississippi River (LMR) floodplain.

We also began development of a decision support framework for assisting refuge managers in selecting reforestation sites in the floodplain in a manner that considers aquatic parameters. Inundation frequency information gives refuge managers new tools to evaluate potential forest viability in the floodplain. At the same time, the influence of reforestation on alligator gar or other floodplain dependent fish species can be considered by incorporating the HIS data. The ultimate decision on where to convert areas to forest can now include an assessment of its relative benefit to floodplain fisheries.

ACCOMPLISHMENTS AND MANGEMENT IMPLICATIONS

The products developed in this project have improved our capacity, efficiency, and effectiveness in monitoring aquatic habitats on NRWs. Our monitoring design for both the water quality and gar movement portions of this study was much more effective due to the spatially explicit characterization of the floodplain in terms of inundation frequency and thermal gradient. The spatial arrangement of water quality loggers and telemetry receivers covered a broad array of environmental conditions that were defined by those products and provided a more powerful dataset from which to in interpreting field observations. Analysis of *in situ* measurement showed close agreement with the derivative products.

On a landscape scale, these products have been applied to a large part of the LMR floodplain and other aquatic areas outside the Mississippi River levees to characterize aquatic habitats. The spatial footprint of these data include six NWRs, each of which can be evaluated in terms of inundation frequency, thermal gradient, and suitability for alligator gar spawning. Since temperature and water availability are drivers of aquatic ecology, these products will be useful in interpreting existing conditions and suitability for many other species on and off of refuges.

Finally, the spatially continuous nature of these data makes them highly suitable for integrating terrestrial and aquatic conservation plans. Our initial collaboration for reforestation planning on SCC NWR resulted in prioritizing areas based on both forestry and fisheries needs. We have also discussed the potential to use thermal data to evaluate the influence of elevated landscape temperature on aquatic habitats in areas like Tensas NWR where individual temperature images show significant differences among forested and un-forested areas, particularly in the summer

PARTNERS

Southeast Aquatic Resource Partnership (SARP)
National Fish Habitat Action Plan (FHAP)
Baton Rouge Fish and Wildlife Conservation Office
Private John Allen National Fish Hatchery
St Catherine Creek NWR
Gulf Coastal Plains and Ozarks LCC

SOURCES OF SUPPORT

SARP - $90,000 water quality monitoring

National Fish Habitat Action Plan (NHAP) - $50,000 biological monitoring – fish community structure.

Field work : Baton Rouge Fish and Wildlife Conservation Office, Private John Allen National Fish Hatchery, St. Catherine Creek NWR

Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative – GIS and modeling support.

MORE INFORMATION

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