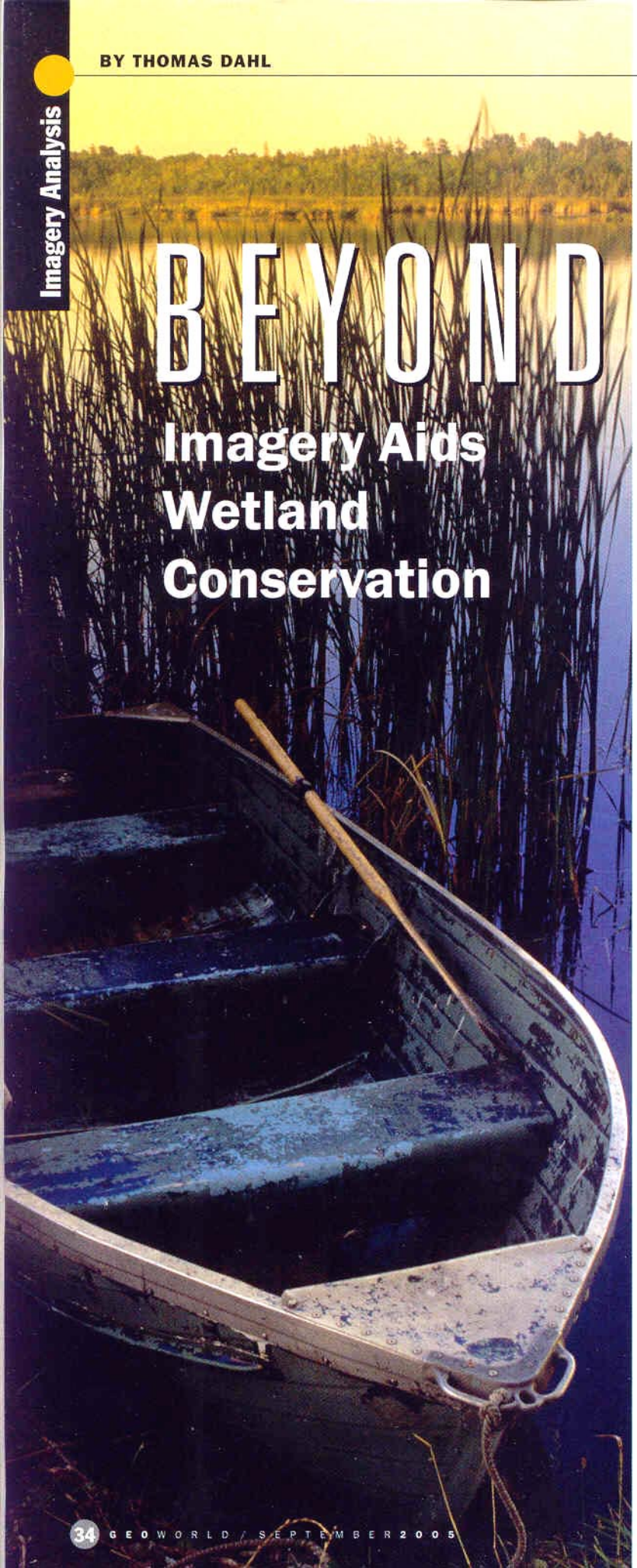
BY THOMAS DAHL



BEYOND NO NET LOSS

Imagery Aids Wetland Conservation

The mission of the U.S. Fish and Wildlife Service is to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. The service supports active programs relating to migratory birds, endangered species, certain marine mammals, inland sport fisheries and wildlife refuges.

The service communicates information essential for public awareness by understanding the importance of fish and wildlife resources as well as the changes that reflect environmental conditions ultimately affecting the welfare of human beings. To this end, the Fish and Wildlife Service maintains an active federal role in the inventory and monitoring of wetland habitats of the nation.

Increasing Wetlands

U.S. wetland goals have traditionally been based on wetland acreage and the ability to provide a quantitative measure of the extent of wetland area to measure progress toward achieving the national policy goal of "no net loss." The Fish and Wildlife Service has a long history of tracking wetland trends through the acquisition and analysis of various types of remotely sensed imagery for about 4,500 sample plots throughout the conterminous United States. It's a quantitative measure of the aerial extent of all wetlands in the lower 48 states.

On Earth Day 2004, President Bush announced his Wetlands Initiative, which set a goal of moving beyond the federal policy of "no net loss" of wetlands and called for a new commitment to attain an overall increase in the quality and quantity of wetlands in America. To achieve this objective, the president set an aggressive goal to restore, improve and protect at least 3 million acres of wetlands during the next five years.

To continue tracking the progress in meeting this goal, the president directed the Fish and Wildlife Service to accelerate completion of its scientifically based statistical wetlands status and trends report by the end of 2005, five years ahead of schedule. This national analysis is a key component of the Wetlands Initiative and will provide the nation with conclusive scientific and statistical results on progress toward national wetlands goals.

The Department of the Interior and a consortium of federal agencies (i.e., the Environmental Protection Agency

as well as the Departments of Agriculture, Commerce and Defense) are cooperatively funding the analysis and updated report to be provided by the service.

Wetland Change Detection

Remotely sensed imagery provides the primary data source for wetland change detection.

Image analysts must primarily rely on physical or spectral characteristics evident on imagery to make decisions regarding wetland identification and classification. Accurate delineation of wetlands rely on characteristics of the remote-sensing data source(s), seasonal conditions at the time of image capture, the quality of collateral data and ground-truth information. The Fish and Wildlife Service uses remotely sensed imagery in conjunction with reliable collateral data such as topographic maps, coastal navigation charts, soils information, and historic imagery or studies.

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Field verification also plays an important role and is used to address questions regarding image interpretation, land-use classification and attribution of wetland gains or losses. Fieldwork also is done as a quality-control measure to verify accurate sample-plot information. Field verification includes a cross section of wetland types, geographical settings, and sample areas with different image types, scales and dates.

To respond to the Wetlands Initiative, the Fish and Wildlife Service is employing the latest technological innovations in remote sensing and computerized mapping. The identification and delineation of wetland habitats through remotely sensed image analysis forms the foundation for deriving wetland status as well as trends data and products. In support of the administration's policy to encourage the use of commercial satellite data, the service has actively pursued high-resolution satellite imagery for its status and trends study.

The use of Thornton, Colo.-based Space Imaging's IKONOS satellite imagery is proving to be an effective tool in this process (see Figure 1). Physical alterations to wetlands such as drainage, filling, flooding, "channelization" or vegetation removal can be detected using IKONOS satellite imagery, and wetland types (e.g., forested, marsh, bog, etc.) can be accurately distinguished.

Imagery Specifications and Use

High-resolution satellite imagery has become the preferred source material to monitor wetland habitats for a variety of reasons. Color-infrared imagery is the preferred type, as experienced wetland interpreters have found color infrared to be superior to other imagery band combinations for recognition and classification of wetland vegetation.

Wherever possible, imagery collected during "leaf-off" (early spring or late fall) is preferred. Several studies have found that imagery obtained when forested canopy cover is at a minimum allows for better identification of wetland boundaries, areas covered by water, drainage patterns, separation of coniferous from deciduous forest and classification of some understory vegetation (see Figure 2).

There are distinct advantages to using leaf-off imagery to detect the extent of forested wetland. Visual evidence of hydrologic conditions such as saturation, flooding or ponding combined with collateral data sources, including soil surveys, topographic maps and wetland maps, are used to identify and delineate the aerial extent of forested wetlands. Leaf-off imagery is an important tool in this process.

Technological advancements in viewing digital imagery on desktop computers have further enhanced wetland analysts' ability to view digital imagery as well as map data and other layers of information.

Figure 1. An IKONOS image shows newly formed sandbars and shoals in coastal Virginia.

Data updates can be made onscreen, checked and saved, or exported. This "heads-up" method employs geodatabase formats for viewing, editing and storing the status and trends digital data, and it improves the administration, access, management and integration of spatial data. The heads-up method has several distinct advantages:

- It uses digital satellite or aircraft imagery
- Digital Raster Graphics provide a direct backdrop for

image reference, interpretation and data checking

- Automated analysis and verification routines can incorporate GIS or image-processing capabilities

Working through a Commercial Remote Sensing Data Contract (established with the Commercial Partnerships Team of the U.S. Geological Survey), the Fish and Wildlife Service developed the technical specifications for imagery best suited for wetland change detection. The specifications included relatively cloud free, high-resolution color-infrared imagery of one meter or less rectified to meet 1:24,000 National Map Accuracy Standards. Imagery is georeferenced in the North American Datum of 1983 (NAD83), Universal Transverse Mercator projection, with coordinates in meters.

The dates and timing of the imagery acquired were established by the project objectives. Close coordination among technical personnel from Space Imaging and the Fish and Wildlife Service's project manager assured the imagery met the project's needs.

The resulting products delivered by Space Imaging covered portions of 12 states, extending from California to Michigan and as far south as the Florida Keys. The products provided were high-quality images from which varying wetland types, sizes and geographical locations were determined.

Figure 2. An IKONOS image shows a large forested wetland complex in Wisconsin on early spring imagery. Darker tones along the river are primarily deciduous forested wetlands; red tones are evergreen upland forest.

Added Benefits

The Fish and Wildlife Service also realized some additional benefits from the acquisition of this imagery, including quick turnaround for products. In some instances, Space Imaging delivered processed images within two days of acquisition. This was important to correlate water conditions captured on the images with on-the-ground conditions.

In addition, imagery was customized to discrete target areas, making data handling, tracking and storage easier. The timing and specifications for image acquisition also could be modified to accommodate weather conditions and internal priorities.

The Fish and Wildlife Service has produced four national reports on wetland trends. All are referenced in scientific literature and used by federal and state agencies, the scientific community, and conservation groups for planning, decision making, and wetland policy formulation and assessment.

The current effort to update the status of wetlands for the nation will constitute the most intensive, scientifically based effort to date. The IKONOS satellite provided essential data toward successful and timely completion of the project.

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