

A New Approach to GIS Implementation At Colonial National Historical Park

By Hugh Devine, Charles Rafkind, Jean McManus, and John Karish

Colonial National Historical Park is a 9,327 acre park along the James and York Rivers, comprised of Jamestown Island, Yorktown Battlefield, the Colonial Parkway, Green Springs, and Swann's Point. For the past year the Geographic Information System (GIS) Research Group of the College of Forest Resources at North Carolina State University (NCSU) has been working with Colonial NHP to develop a GIS implementation plan.

The plan is unique in three ways. First, it outlines a phased implementation program for a park based system to service the full range of park management activities. Second, Colonial is basically a medium size cultural park (with significant natural resources) and most national park GIS efforts to date have focused on large natural resource based parks. Third, the implementation is designed to allow distributed access to the GIS through the three major park divisions as opposed to a single centralized system as is characteristic of most natural resource GIS applications. The park divisions include resource management and visitor protection, maintenance, and historic interpretation and preservation.

Anakeesta Acid (Continued from page 3)

agement. While it is assumed that covering the debris materials with soil and vegetation will reduce or eliminate the oxidation processes, it is not known how much soil and what type of vegetation will work best to reduce the formation of acid and metal leachate into GSMNP streams.

Research currently is being planned for on-site plot experiments to determine what depth of topsoil cover is required to reduce the formation of acid and metal leachate to the levels necessary to re-establish viable aquatic ecosystems. This proposed research will provide the necessary information for determining whether, and to what extent, streams such as BFC could be restored to viable trout streams through a strategic, low cost program of soil cover introduction. It is hoped that this method of mitigation will prove a permanent and low cost solution to an on-going and extensive problem within the GSMNP.

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Training and Needs Assessment

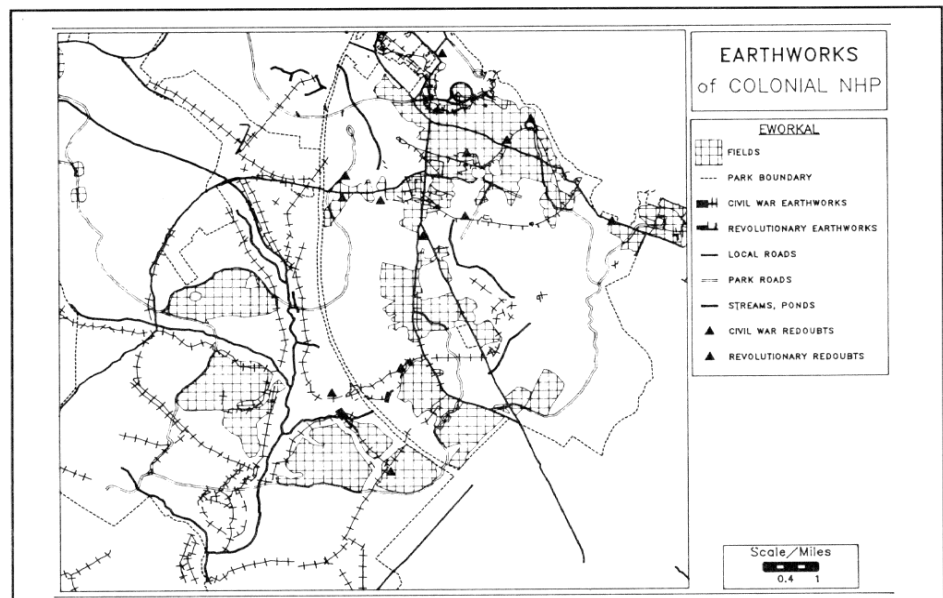
The assessment of needs was performed through a training session, followed by a series of interviews to determine prioritized division needs. Considerable time was spent training managers in both the potentials and costs of GIS for their divisions prior to determining the list of map needs. A brief written description of GIS for park management was prepared and distributed to the Colonial participants in advance of the training.

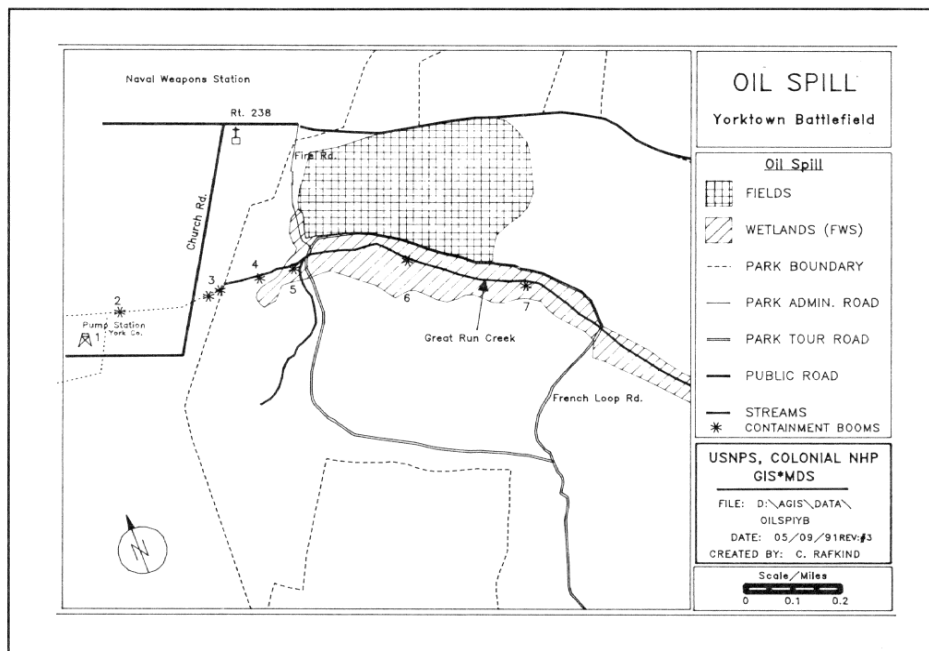
Training was completed in one full day at Colonial. A morning session focused on introducing a large cross section of the park staff to GIS and its potential for management. This session was completed in about three hours and included a variety of visual aids - video tapes, 35mm slides, and overhead transparencies.

The afternoon session concentrated on developing a more detailed exposure to GIS for Colonial division

chiefs and selected staff. This session, again about three hours, was designed to allow participants to work through an actual mapping exercise using Colonial data. Three computer work stations were used, in what was intended to be a step-by-step group experience in construction and plotting of a Jamestown Island vegetation map. However, the participants were quite able to work independently and the anticipated group technique was neither necessary nor efficient. The procedure, therefore, was shifted to three individual instruction efforts (i.e. one per station) with an instructor assigned to each group. The groups then proceeded at their own pace to produce the planned map, plus several variations.

The session also included a demonstration of a Computer Aided Design (CAD) system and a digitizing procedure. In addition, because of its informal structure, this session involved extensive question and





answer periods concerning GIS, CAD, and related computer and management topics.

Training Session Evaluation

Two recommendations for the training session were developed. The afternoon session should be designed to treat each management function separately; that is, each division should work with its own data and should produce a product relevant to its own needs. Secondly, a standard set of visuals for NPS GIS instruction should be developed.

The development of recommendations for a GIS at Colonial hinged on identification of management's need for mapped information. Such an identification can come only from the managers and users themselves, after they have considered the importance of mapped information in their operations and have evaluated the potential of GIS to produce and manipulate such data.

The training was followed by two days of interviews, which led potential park users through the process first of identifying the role of maps in their tasks, and then enumerating the types and sources of these maps. The information from the survey forms was used to catalog the responses of division personnel and to develop a map theme list.

Recommendations

Evaluation of GIS alternatives for the park was based on three criteria: (1) the appropriateness of raster versus vector data structures, and the need to exchange digital data with other GIS users (local government, state and university systems), (2) the ability to have several park divisions benefit from, and use, the GIS immediately, and (3) realistic staffing, budgeting, and training levels that the park could commit to a GIS.

The recommended GIS software is ATLAS*GIS with appropriate data exchange modules. The choice of ATLAS*GIS was dictated by the low initial cost, user friendly menu system, minimal training requirements, capacity to perform the mapping analyses and production task identified in the interviews, and conversion abilities to and from ARC/INFO. ARC/INFO is used by all government jurisdictions that surround the park, and data exchanges will be performed on a regular

basis. USGS, EPA, State of Virginia, Council on the Environment GIS, and VA Institute of Marine Science are the cooperators with whom the park exchanges data regularly.

Current and Future Direction

Currently, the park is developing a series of data themes for the GIS. These themes are being prepared under agreements with the NCSU GIS Research Lab, VA Institute of Marine Science, and the USDA Soil Conservation Service (SCS). During March 1989, winter aerial photography was flown using 70mm true color film at 1:12,000 scale. From this photography, NCSU has interpreted, delineated, and digitized vegetation types, wetlands, streams, ponds, earthworks, roads, and adjoining landownership use (residential, military, commercial), and rare species occurrences and critical habitats. In addition, several communities surrounding the park are developing themes useful for park management (e.g. floodplain, topography, utilities, and tax parcel ownership maps). State agencies have provided USGS digital line graph information on roads, shorelines, hydrology, and political boundaries.

Current efforts also include compilation of the numerous historical and archaeological base maps for Jamestown Island into one data base and map, input of the 100+ right-of-way grants involving road access, security fencing for military bases, and numerous types of public utilities. The soil surveys for the park and a 1000 foot buffer are being recompiled and digitized by SCS. The VA Institute of Marine Science will provide watershed and sub-basin information, near surface geology, water quality and quantity data, floodplains, aquifers, springs, seeps, recharge areas, non-tidal and tidal wetlands. NCSU is developing UTM and Long/Lat grid overlays for wildlife sightings, fire management, and vegetation management projects, road kilometer marking overlay, and a series of applications dealing with historical vegetation pattern changes, adjoining potential developable lands/viewshed impacts, and fire unit maps of values at risk.

The park and NCSU are continuing to develop standard operating procedures to guide the development of new geographic and database files, and cartographic map production. Areas covered include file and

In the Next Issue

The *Park Science* Spring issue will contain several articles describing research on marine and terrestrial ecosystems in Virgin Islands NP. Much of the ongoing work builds on previous studies by members of the Virgin Islands Resource Management Cooperative (see Rogers and Zullo, Spring 1985 *Park Science*, cover and p.3).

A number of studies are addressing the long-term effects of Hurricane Hugo, which swept through the U.S. Virgin Islands in September 1989. The park's research staff has quantified the effects of this powerful storm on long-term transects established on a coral reef in the park. Under a Cooperative Agreement, scientists from the U.S.V.I. Division of USFWS have censused coral reef fish assemblages at several sites inside the park and documented storm effects.

Scientists from U/GA, U/WI, and the Institute of Tropical Forestry have recorded the hurricane's effects on long-term plots established in the dry and moist forests of St. John. Also, in 1991 as part of a network of MAB biodiversity sites, the Smithsonian established a long-term plot in a dry forest area on the island.

In addition, the Soil Conservation Service recently mapped the soils in two watersheds and established automatic data sensors that record soil temperature and moisture at several depths. The USGS and NPS will be collaborating in a paired watershed study to compare sediment loads from a developed and an undeveloped watershed.

attribute naming, database attribute development, quality control, and primary and secondary naming procedures for geographic data. With a leading cartographer from NCSU we are developing a GIS feature taxonomy covering colors, patterns, symbology, and sizing for maps produced on plotters and B/W laser printers. All this will be the focus of a future article.

These themes/databases will be used for fire management, habitat analysis, open fields management, earthwork vegetation management, wetland identification and preservation, and cultural resource management. Other analyses will include shoreline erosion, land cover and water quality changes, and information calculations (number of acres of Class A, B, or C lawns, acres of the different types of wetlands, miles of earthworks, boundaries, shoreline or trails, number of historic sites).

The park's GIS system already has played an important role in environmental analysis, in response to oil spills, special events, wetlands, vegetation, fire, and air quality management planning, development of new mowing regimes for the park's 1,100 acres of open fields, RTE survey, fire reporting, and historical research into changing vegetation patterns over the past 380+ years.

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