

Data Base Mapping and Management at Colonial NHP

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Since its modest beginnings in 1987, GIS use at Colonial has experienced rapid growth in both the range of resource management issues it addresses and the corresponding physical size of its database. Both natural and cultural resource information is being added to the system at an increasing rate, forcing the park to institute a more formal system of organization, management, and output of its GIS data.

In the summer of 1991, the park enlisted the GIS Research Program at North Carolina State University (NCSU) to design a Database Management System (DBMS). The objective was a system design that would facilitate expanded use of Colonial's GIS and provide better management and control of the database. Four major factors were considered: accessibility, usability, reliability, and adaptability.

The main accessibility concern was that the GIS be available at multiple locations throughout the park. There is little value in data that is not on-hand or accessible when needed. The second factor--usability--requires that the database be usable by personnel with limited GIS training and experience. A GIS DBMS that is too difficult will frustrate first-time or casual users and will tend to discourage all but the most experienced database users. The third factor--reliability--is contingent on at least three criteria: (1) the database must be secure from unauthorized access; (2) it must be properly stored so that a catastrophic event such as fire or hurricane does not destroy it; and (3) it must be updated, documented, and distributed to users in a timely manner. Adaptability--the final critical design factor--is about insuring that the DBMS design be flexible enough to allow for reconfiguration as GIS experience grows. It is unlikely that any one design will serve indefinitely as GIS use continues to expand and change.

DBMS Design

The GIS program at Colonial is managed by the park's Natural Resource Management Specialist and use of the system is distributed among four work areas. Two of these are within the park's Natural Resource Management and Protection division; the other two are located within the Interpretative and Cultural Resource Management division. Expansion to the Maintenance division is planned. The computers are DOS systems and are not networked. The park uses the ATLAS*GIS software program and exchanges data routinely with local and state governmental users of ARC/INFO. Currently, there are 148 layers of themes in the park GIS database.

The study developed and evaluated two basic DBMS designs: the first would combine all the GIS layers into one large file, eliminating the need for a user to keep track of multiple subdirectories or files of data within the system; the second would divide the database into a number of files that would reduce

the database size for an application and facilitate development of new layers and map products by linking multiple themes *logically*, not *physically*.

The first file design maximizes user accessibility, as any part of the GIS database could be retrieved without the difficulty of invoking separate files or subdirectories. Reliability is achieved in that the database is backed up, edited, and restored in its entirety. This means new versions of the database could be installed with very few commands, and back-ups could easily be performed and catalogued. Flexibility is a mixed result with this design, as the addition of new layers is simple, but the manipulation and cataloging of the numerous layers is complex. For example, just remembering the name of the layer for utility rights-of-way, let alone what is in it, could be a problem. This design's major drawback is usability. Stepping through 148 layers, turning them on or off for a mapping application, is a tedious process; further, the time and commands required to effect a mapping change would be significant due to the large size of the database.

The second DBMS design, one that employs multiple files as a way of grouping themes into logical categories, was chosen for implementation. This design divided the 148 themes into 10 files. The subdivided design was significantly easier to operate, since development of a map, application, or analysis involves manipulation of very few layers. Although his was offset somewhat by having to access several files, the net number of commands and time requirements for map production was greatly reduced. Accessibility and reliability are slightly compromised unless every file is maintained in every computer. Some infrequently used files may be temporarily unavailable from a given work area, but our experience has not shown this to be a major problem.

Finally, adaptability is enhanced, as the addition or reconfiguration of the master files involves the use of a small subset of the total database, and tracking where information is stored is considerably simpler.

Ongoing Work and Recommendations

The design of the DBMS has definite implications for both the symbolization (i.e. map representation) of map analysis products with the GIS and the operational procedures for managing the system. At Colonial, the development of the DBMS has proceeded concurrently with the construction of guidelines and procedures for these other activities. The results have been formalized into the park's *GIS Database Management System and Map Presentation and Feature Taxonomy* standard operation procedure.

The DBMS design and subsequent implementation has proven useful at Colonial. In addition to addressing the obvious need for data organization and control, it has produced the unexpected benefit of clarifying the role of GIS within the park and indicating the extent to which GIS can be utilized.

For the near future, the park is working to refine DBMS and Map Preparation and Feature Taxonomy operating procedures. During FY 93, a more complete data dictionary, detailed numerical classification system, and expanded input of attribute data will be undertaken. Also, as the ATLAS*GIS program is released in a Windows version, the park will explore linking it with digital photos from the resource management files. The park plans to embark eventually on digital orthophotoquad research with the USGS.

This design works well for Colonial, but we recognize it may not suit the needs of other parks. It is hoped however that this study will facilitate other GIS DBMS designs, and for those who elect this path, Colonial's construction processes can provide guidance.

'The GIS SOP is available from the park by sending a DOS formatted floppy diskette and self-addressed stamped diskette mailer to Colonial NHP, Natural Resource Mgt. Spec., PO Box 210, Yorktown, VA 23690.

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FILE NAME	CONTENTS OF GEOGRAPHIC FILE	DESCRIPTION OF GEOGRAPHIC FILE LAYERS	COLOR
HYDRO	1 HYDROGRAPHY	shorelines of rivers, ponds, lakes, rivers, streams, drainages, springs, floodplains, watersheds	blue
VEG	2 VEGETATION	forest, fields, wetlands	green, aqua, brown, cyan, yellow, sky blue
ACCESS	3 ACCESS	primary, local, public and park, administrative, fire roads; trails	black, red, orange
INFRAST	4 INFRASTRUCTURE	utilities (park, public-row's), structures - buildings, bridges, fences, man-made drainage, signs	black, red, blue, green, orange, brown, yellow
BOUNDARY	5 BOUNDARIES	park, local, county, state, reserved row's, park scenic easements and fee simple	black
CULTURAL	6 CULTURAL	pre-contact, 17th, 18th, 19th, 20th century, archaeological excavation sites - sites, buildings, other structures, earthworks, historic roads	purple, violet, red, orange, yellow, brown
ADJACENT	7 ADJACENT LAND USE	residential, commercial/industrial, military, public lands, agriculture	orange, red, violet, yellow, green
ENVIRON	8 ENVIRONMENTAL	soils, topography, wildlife sightings, vegetation monitoring, erosion problems, RTE, critical habitats, fire NFFL, fire NFDPS	brown, red,
REG	9 REGULATORY	Ches. Bay RPA/RMA, floodplains, tax parcels, zoning, land status within park	violet, black, orange
GEOD	10 GEODETIC CONTROL	kilometer markers, UTM grid, Long/Lat grid, geodetic controls points	violet, yellow

Colonial GIS database is divided into 10 master files. These files represent groups of layers combined by common features.