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How Archaeological Sites co-exist with Fast-paced, Intense Army Training Activities

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Abstract

GIS conversion of management information into easy-to-read spatial representations is the keystone to successful integration of cultural resource management at a fast paced Army training facility in the USA. It enables incorporation of cultural resource management issues into training plans and their implementation. An easy-to-use graphical user interface accesses data in a variety of formats such as high-altitude photography, archived documents and 35mm photographs. The system was designed with novice-level GIS end-users in mind: training officers and cultural resource managers and allows spatially based information from other sources to be used more efficiently in cultural resource management decisions. Inclusion of cultural resource issues in GIS-based Army planning and training products enables training officers to settle compliance issues early in the planning process.

1 Introduction

As a federal facility, Fort Lewis (WA, USA) is required to identify, protect, and nominate cultural resources potentially eligible for the National Register of Historic Places. Primary legislation directing these activities are the National Historic Preservation Act (NHPA), the Archaeological Resource Protection Act (ARPA), and the Native American Graves Protection and Repatriation Act (NAGPRA). A detailed and dynamic database linked with geographic information system (GIS) capabilities facilitates cultural resource monitoring and condition assessment under these laws, accompanying regulations, and Executive Orders from the President.

GIS is a keystone to successful integration of cultural resource management with training plans at Fort Lewis. GIS converts diverse data into easy-to-read and -access maps trainers and field personnel incorporate in their training activities. The cultural resource manager in cooperation with other environmental managers is able to identify areas sensitive to different training activities. For example, one area may not be sensitive to vehicles driving over it whereas another area is. GIS maps meet the diverse protection requirements of each cultural resource site.

2 Fort Lewis description and history

Fort Lewis covers approximately 87,000 acres (360 Km2) in Washington state (USA) (See Fig. 1). Training is the installation's primary purpose. Training areas encompass 75,573 acres (306 Km2) of deciduous Evergreen forest interspersed with open grassland prairies. Fort Lewis was established in 1917 when the county purchased approximately 69,000 acres (279 Km2) from homesteaders and allotment holders to induce the Army to establish a permanent facility in the Northwest. Another 18,000 acres (73 Km2) was added to the installation during World War II. The Nisqually River bisects the installation. Additional smaller water sources run through or dot the installation.

Native American Salish speakers of several tribes (i.e., Nisqually and Puyallup) inhabited the region relying heavily on the shores of Puget Sound and the large rivers (i.e., Nisqually) for food resources. The grasslands provided deer and smaller game to supplement water resources. After the region became a US territory in 1849 with the signing of a treaty with Great Britain, US Government officials arranged a treaty with Puget Sound Native Americans producing several reservations. The existing Nisqually reservation is the southern half of the original reservation. The northern half lies within Fort Lewis Boundaries. This land was attained by Pierce county through the reallocation of allotments that had been granted to Native Americans who then sold or forfeited them by not paying taxes.

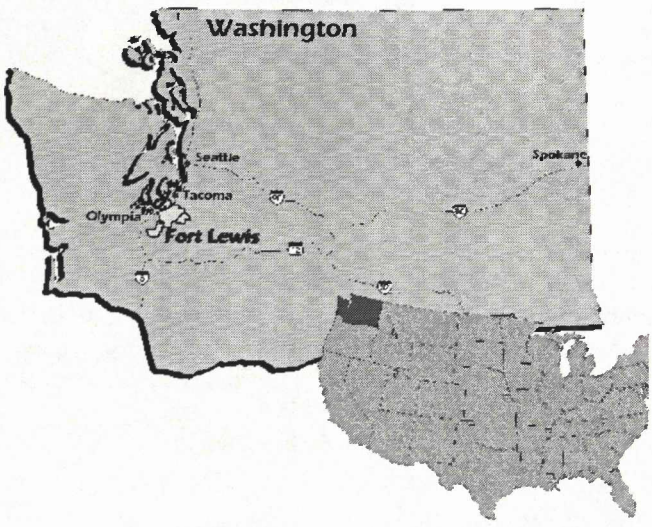

Figure 1: Location of Fort Lewis Military Installation.

The Hudson Bay Company established trading posts in the region. Fort Nisqually was one trading post located near present day Fort Lewis. In addition to the trading post, stations such as Tlithlow were built to supply traders and settlers moving to the region. A subsidiary holding of the Hudson Bay Company was the Puget Sound Agricultural Company. Stations of this subsidiary focused on producing agricultural goods for the trading posts.

3 Cultural resource management

Fort Lewis' cultural resource management program includes three major regulatory compliance and coordination areas: Native American Issues, Prehistoric and Historic Archaeology, and Historic Structures. Compliance and coordination in these areas is driven by Federal laws and regulations on resource identification, evaluation and management. Cultural resources are defined as any prehistoric, historic, or traditional place, and related items, both important and not important. Currently we have an aggressive program of known-resource record verification, new resource inventory, evaluation of importance, and development of long-term management plans. Specific resource types include, historic buildings, historic districts, historic (pioneer and Native American) archaeological sites, prehistoric archaeological sites, and traditional cultural places.

Information, historical and graphic, on cultural resources has been traditionally gathered in a variety of formats: photographs (aerial and 35mm), site forms (according to state and federal guidelines), field sketch maps, and other archival documents. While these formats are descriptive and useful, every-day upkeep and quick retrieval of information can be burdensome and space-intensive. Modern day technology enables these traditional formats to be combined with non-traditional formats and computer analytical capabilities.

Data needed for cultural resource management overlaps other management programs on the installation: forestry, fish and wildlife, and environmental engineering. Due to the large storage requirement for geographical electronic data, each program must access a shared data repository instead of maintaining individual databases.

4 Decision support system components

The system was based on an analysis of two groups of end users: cultural resource managers and training officers. Both groups are decision-makers that require immediate access to spatially distributed information yet they have purposes that appear to contradict. The system developed from a need to examine and evaluate the impact of installation activities, both training and general operations, on cultural resources in an expedient manner yet comprehendible to non-Cultural Resource Management (CRM) personnel. The system is based on CRM needs and manual procedures in addition to the needs of integration with existing computer systems within Public Works and particularly, other environmentally related programs.

Descriptions of the major system components are as follows:

Geographic Information System (GIS): A GIS is an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. The GIS will answer a basic set of questions that other types of software systems can not answer or answer collectively: what exists at a particular location, what changes have occurred at a particular location over time, what spatial patterns exist, where are certain conditions satisfied, and what impacts will occur as a result of a specific activity. This translates to functionality such as watershed identification, drainage patterns, proximity analysis, planning and zoning, and land/property assessment.

Relational Database Management System (RDBMS): A RDBMS integrates files in a database for multi-facet access and manipulation. Compared to conventional file systems, data redundancy is reduced while integrity and management is improved. Many GIS link with database management systems or RDBMS. This allows non-spatial data to be queried with geographic data thus enlarging the analytical capabilities and flexibility of the cultural resource management system.

Field Computers/software: Portable computers equipped with database software reduces transcription errors and eliminates a time-intensive step in getting the data into the end user system. Data is quickly and easily downloaded into the RDBMS and can be utilized soon after.

Global Positioning System (GPS): Portable GPS field units have substantially improved the accuracy of geographic coordinate data at Fort Lewis. After error correction, the data is downloaded directly into the GIS so the maps can be updated accordingly.

To facilitate use of a sophisticated and complex type of GIS by novice-level end users, a graphical user interface (GUI) simplifies access by incorporating task-descriptive text instead of computer jargon. The GUI is an integral part of the project since a computer system is beneficial only if it gets the information to the intended recipients in a relatively smooth and timely manner. For example, Standard Query Language (SQL) queries are presented behind button options and multiple commonly used names are linked to unique spatial boundaries. In addition to GIS spatial data and a relational database management system, the interface access data stored in a variety of formats allowing full integration with a simple point and click process.

The main system is run on a SUN™ Microsystems UNIX workstation platform. PC access extends usage through additional ARCVIEW™ licenses linked through a network. Data access is controlled through monitored access privileges within the programs and the computer network. Input of data is supervised by the cultural resource manager and all other users will have read-only access to designated files based on access requests submitted to the cultural resource manager. For example, training officers only access non-descriptive buffered areas that are designated as environmentally sensitive to training activities. No other information is supplied or accessible. Yet the field trainers have the information needed to identify landscape strengths and weaknesses relative to training objectives and equipment capabilities while meeting environmental compliance requirements.

Cultural resource locations spatially link to other geographically represented information such as topography, wetlands, elevations and vegetation diversity. Additional environmental concerns such as threatened and endangered species, wildlife distributions, timber harvesting and water quality, use and enhance these other information sources.

Spatial qualities of these diverse data types facilitate their analysis with ARC/INFO™ (ESRI, Inc.) to produce integrated maps.

5 Conclusions

The benefit of this program is the integration of cultural resource information into GIS products (see Figures 2 and 3). This enables spatially based information from other sources to be employed in cultural resource management decisions. Analysis and queries are performed in minutes rather than hours and the results can be presented in the short time it takes to print out the hardcopy map. Report generation in other formats is delivered with equal time efficiency.

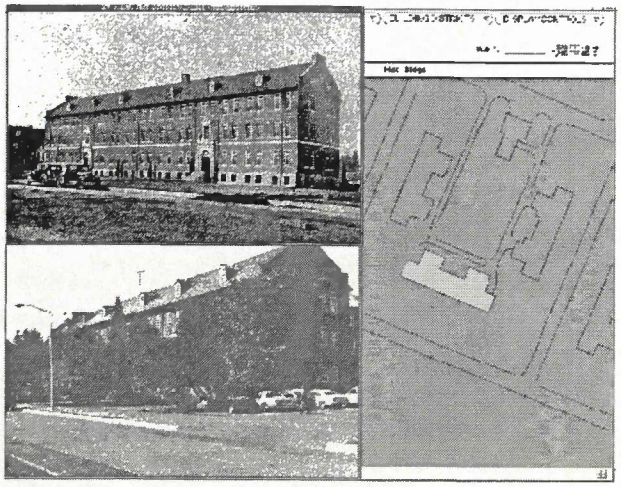

Figure 2: Clicking on the corresponding building on the map accesses historical and / or present day photographs (as well as architectural drawings) of buildings.

Inclusion of cultural resource issues in GIS based Army planning and training products enables training officers to settle compliance issues early in the planning process before they can affect finalized training plans This avoids delays in project and exercise commencement dates and assures the protection of sensitive and unique cultural resources for future generations.

The natural progression of this project is to enhance the interface and product capabilities such that they are compatible with many technologies employed by personnel at a training facility. In addition, such enhancements will expedite planning inquiries and environmental compliance clearance for a variety of activities. Future inclusion of additional environmental areas of concern such as endangered species, wetland habitat preservation, stream preservation, etc., will make environmental compliance a more accessible and efficient part of training planning.

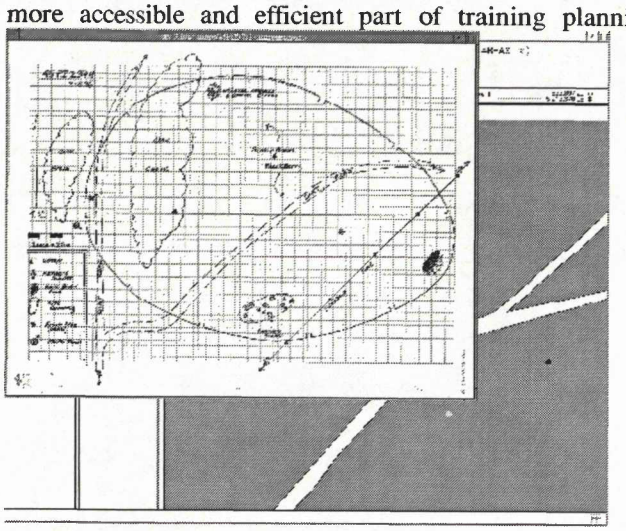

Figure 3: Simply clicking on the corresponding archaeological/historical site on the map, accesses field sketch maps. Photographs of the site are accessed in the same manner. Access to this type of sensitive data is limited only to designated users.

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