Report

For Geographic Information System work on

Eastern Navajo Agency

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## Introduction

This report summarizes to date, the planning and collection of data elements to assist in the development of a geographic information system for Diné Citizens Against Ruining our Environment. This project seeks to identify and link historical exposures to radiation sources and contemporary illnesses that may be attributed to radiation exposure. The main component of the project is based on a health survey whose data elements will be geocoded and displayed in a map format using GIS software.

Progress to date includes 1) the development of the health survey, 2) the collection of spatial data from various sources for electronic mapping, 3) the development of a preliminary geographic information system that displays the data collected in the health survey, 4) training members of ENUW and Diné CARE in the use of Geographic Information System software, and 5) training for ENUW and Diné CARE on the use of Global Positioning System (GPS) equipment to identify and mark spatial elements using latitude and longitude readings.

This project is advancing steadily and we will likely implement the health survey instrument by the end of the summer of 2003.

### 1) Development of a Health Survey

The foundation for this study will be the data gleaned from the health survey which posits questions of historical lifestyle characteristics and contemporary health issues. A copy of the latest survey version is available from Diné CARE.

The health survey has been carefully developed in a manner that will elicit useful information from the resident population in a format that is culturally respectful and sensitive. A few minor revisions are warranted to ensure that the information that is collected is geo-codable, or GIS friendly.

### 2) Collection of Spatial Data for Electronic Mapping

Xavier Morales has been working closely with the staff of Diné CARE and the Eastern Navajo Uranium Workers to identify relevant basemaps and to prepare the requests for these data from the appropriate agencies, departments, and administrative offices. To date, Dr. Morales and the ENUW staff have collected boundary data from the Navajo Nation Department of Transportation

for the Eastern Navajo area. We also have received from the Navajo Nation Land Management Office's GIS Department other spatial data that include (file names are in parentheses):

- Zuni Area Watershed (zuni_wtr.shp)
- Sacred Areas (sacredawd-pts.shp, sacred-pts.shp)
- Roads (roads.shp)
- Rivers (rivers.shp)
- Powerlines (powerline-arc.shp)
- Major Mines (pmcm.shp, pbcm-poly.shp)
- Pipelines (pipeline-arc.shp)
- Navajo Nation Chapter Data (nnchp_pts.shp, nnchp.shp)
- Navajo Nation Boundary Data (navnationbnd.shp, navnation.shp)
- Eastern Navajo Checkerboard Area Gridmap (enatnrg_grid.shp)
- Eastern Navajo Checkerboard Area Surveyed Lands (ena-ldstat.shp)
- County Gridlines for AZ, NM, UT, and CO (counties.shp)
- Census Tract Shapefiles for Navajo Nation (cens80.shp, cen80_arcs.shp)
- Traditional Navajo Landmap (aborgbnd.shp), and
- Geographical Points of Interest (geopoints.shp)

o valleys, trails, tanks, minor mines, canals, streams, areas, capes, flats, cliffs, gaps, ridges, basins, summits, wells, reservoirs, and other elements that will assist with the mapping and analysis.

As was mentioned above, these data will be used as basemaps for the health survey. The basemaps are included on the CD that has been included as Appendix A. Appendix B provides paper printouts of most of the maps listed above.

3) The Development of a Preliminary GIS to display the Survey Data

A comprehensive inventory of electronic maps is the basis for a geographic information system. The mapfiles listed above have been integrated into a single file that is accessible using ArcView, the leading geographic information software. Using this GIS software, the maps may be superimposed upon one another for detailed spatial analysis.

A challenge for the continued development of this GIS system will be to project these basemaps using a standard projection format. Currently, the maps are all projected in relation to one another, but do not have a reference point that ties them to a geographic location on the earth's surface. Until the maps are projected correctly, the ability to conduct accurate spatial analysis will be limited. We estimate that it will take about four to six hours of data manipulation to get all the maps projected in a format that is useful to the project. This work will be completed by the end of July 2003.

4) Training of Volunteers and Staff to Use GIS

In June of 2003 a training session was provided to staff members of ENUW and Diné CARE on using ArcView software to organize and analyze spatial data. This training was held at the Southwest Network for Environmental and Economic Justices' training site in Albuquerque, New Mexico.

The goal of this training was to familiarize the workshop participants in the use of GIS software using existing data. The data that were used for this exercise were collected from various agencies, departments, and administrative offices. The training focused on four primary goals: 1) preparing the user's computer to conduct GIS, 2) increasing the user's familiarity with the ArcView software, 3) understanding the electronic basemap files, and 4) conducting simple spatial analysis.

Preparing the User's Computer to conduct GIS—The workshop participants were provided with a copy of ArcView GIS to use for educational purposes and an electronic copy of all the mapfiles described above. The application software was loaded and configured to operate on each of the training participants' computers. It is highly recommended that Diné CARE and ENUW purchase an organizational copy of the GIS application software. The Earth Sciences Research Institute (ESRI), the makers of ArcView, has a pricing schedule that provides their software at a reduced cost for not-for-profits.

Increasing the User's Familiarity with ArcView Software—Once the software and the electronic mapfiles were loaded onto the participants' computers, the participants were taught some simple commands including how to open a view, how to import basemaps, how to view basemaps, how to get attribute information, how to change the order of the maps, how to manipulate the feature characteristics (color, texture, symbols), how to conduct simple queries, and how to close the system.

A significant amount of time was also spent on explaining how the data from the health survey would be incorporated into a geographic information system. The increased understanding of the GIS software and its limitations will greatly help the survey developers and implementers to ensure that they will collect information that is relevant for spatial analysis.

Future training sessions should delve more deeply into methods of spatial analysis using GIS software and constructing layouts for printing and including the maps in printed reports. It is best if we use "real" data from the surveys for the next training session.

Understanding the electronic basemap files—A large portion of the training session was spent on understanding the spatial data files that had been compiled from various sources. The maps were indexed and each was explored with regard to content that is relevant to this project. The trainers and the project participants together developed each mapfile's description and collaborated on determining the strengths and limitations of the data. For example, it was agreed that, though the "geopoints" map had located on it many points of interest, there were many points of interest that were not included, specifically, the location of many of the abandoned or closed mines. These points will have to be located by the staff of ENUW using a GPS (explained below) and digitizing these data onto the GIS project folders.

Conducting simple spatial analysis—Once the GIS software and the basemaps were loaded onto the computers and each file was understood by the trainers and participants, the training focused on conducting simple queries for spatial analysis. The most powerful exercise was using the "geopoint" file to identify particular attributes (tanks, wells, mines, etc.) located within specified

chapters. This last exercise was the most relevant for the type of analysis that will be conducted in the near future using "real" survey data.

5) Training on the use of Global Positioning System Equipment

By triangulating information from a system of satellites that are in geosynchronous orbit with the Earth, global positioning system (GPS) equipment helps to define a point's elevation, latitude, and longitude coordinates. The ability to locate points will become very important during both the survey implementation and further research phases of this project. During survey implementation, it will be necessary to gather the location coordinates of the respondent's home. This information will be useful during the data analysis and interpretation phases of the project. Also, we expect many points that are identified in the survey process will need to be geocoded for inclusion into the data analysis. For example, if a respondent identifies a swimming hole they used as children and this point is not located on any of our electronic mapfiles, we will need to use the latitude and longitude data to place this point in our GIS.

The ENUW and Diné CARE staff members were given a cursory introduction to a "Garmin Gecko 101" GPS unit. A few of these units, retailing for about $100 each, should be considered for purchase by the project staff. GPS units can retail from about $100 per unit on the lower end up to over $500 per unit on the more expensive end. This project only needs a unit with the capability of calculating latitude and longitude. Any other features would add unnecessary expense.

Data Storage and Security Issues

All of the data collected to date are public data. There are no issues related to security. However, later, as the survey data gets collected and is stored into a database and incorporated into a GIS, some security precautions will need to be followed. These will be developed collaboratively between all of the project's partners. Some initial recommendations include: 1) installing a personal firewall on the computer to limit electronic access from internet sources, 2) storing the data on a computer whose access is password protected, 3) locating the computer in a room that is locked when the staff are not present, 4) this room should be located in a building (house, chapterhouse, school or other building) that may be securely locked when staff are not present, 5) data should be backed up onto CDs on a regular basis. These CDs should be securely stored off-site in case of fire or other natural disaster.

Next Steps

The most pressing steps for advancement in this project include 1) getting the health survey into final format, 2) the implementation of the health survey, 3) incorporating the survey data into the electronic mapping system that has been developed, 4) the analysis of the relationships between the historical exposures and the contemporary maladies, and 5) drafting a final project report. This project has advanced significantly and is now poised to make great strides to provide valuable information to the Navajo Nation, Diné CARE, and the Eastern Navajo Uranium Workers.