

# **BRINGING THE PAST TO LIFE: EXTRACTING SPATIAL INFORMATION FROM HISTORICAL MAPS FOR A DIGITAL ATLAS OF AMERICAN INDIAN TREATIES AND TERRITORIES**

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## **Abstract**

The land base of the American Indian has changed dramatically since the first landfall of Columbus in 1492. Land transfers from Indians to Whites were sometimes piecemeal and sporadic, at other times organized and intense. Actions such as treaties, purchases, de facto seizures, and other forms of acquisitions, diminished American Indian land holdings to less than five percent of total U.S. territory. Deciphering American Indian land tenure and population change over the past few hundred years is difficult enough, given earlier recorders' incomplete knowledge of the physical and cultural landscapes in the United States. Compounding that problem, treaties were often unratified (and thus unsurveyed), or had poorly defined boundaries at times. Regarding population estimates, we are using spatial data sets provided by the earlier cartographers on their maps and in their field notes and contrasting those data with the official demographic figures, e.g. Lewis and Clark. We are cartographically analyzing the historic configuration of American Indian lands using individual maps and map series from the colonial era through the federal period to the present. The scanned historic maps are being corrected to current map accuracy standards by rubber-sheeting antique maps to fit current digital map bases and then by checking the correctness of mapped land tenure. In the past, many of these historic maps have been used for legal purposes in terms of defining the number, location and distribution of Native Americans, as well as determining land claims and reparations. So merely warping these antique maps is not enough since our cartographic predecessors were not familiar with adjusting adjacent map sheets for edge-matching or mosaicking, nor were they as cognizant of the actual delineation of drainage divides which often defined territories. The ability to integrate digital environmental variables provides a more complete understanding and more accurate interpretation of Native American tribal distributions. Not only having the location of the villages, but to have these villages portrayed in the correct topographic position or within a river floodplain adds to the interpretation of their distribution. Similarly, digitally modeled vegetation cover and bio-diversity landscapes can assist in examining transhumance and seasonal changes of Native American locations and the impacts of modifying their movements or creating barriers to movements. Spatial modeling techniques can provide a wider range of analytical possibilities to the use of historic maps and illustrations. The planned output will be a Digital Atlas of American Indian Treaties and Territories for the National Museum of the American Indian at the Smithsonian Institution.

## **Introduction**

This project is designed to integrate the spatial distribution of U.S. tribal groups with their populations and land tenures over the period 1500-present and create a digital query system to make this information more readily accessible. Three main goals exist for this project: 1) create a computer-based system for immediate access to land

tenure and population statistics for designated U.S. tribal groups; 2) create historic maps in digital form that are geo-referenced to a standard USGS map base that locate tribal groups; and 3) create a printed atlas with digital records of population and land tenure for each U.S. designated tribal group. Three cooperating research institutions (Smithsonian Institution's National Museum of the American Indian, National Museum of Natural History, and University of Wyoming) are conducting the research, with input from the Newbery Library's D'Arcy McNickle Center for American Indian History, the Geography and Map Division of the Library of Congress, the National Archives, and other library and archive sources.

This project will produce a unique, digital database of Treaty maps and legal documents.<sup>1</sup> The Digital Atlas will provide an interactive resource, available online and in the NMAI Resource Center, including a visually based, searchable, digital map library and documentary chronology of the historical transformation of Indian territories into the United States of America. This will allow visitors to investigate treaties and land transfers for affected tribal groups in any area of the continental United States. (slide 2)

The geo-referenced historic maps will be used to create a digital location file of tribal groups over the 500-year time span. The tribal locations provide a foundation upon which location, movement, and land occupation can be based. The digital files will contain the 561 recognized tribal groups in the United States, including Alaskan Native Villages and Native Communities. Additionally, the over 100 tribal groups that have disappeared will be included based on map references. The population statistics will be gathered from written public documents either by the colonial powers or the US government spanning the time period. The Atlas will contain approximately 150 maps of American Indian population, land tenure, environment, and socio-economic data.

#### Existing Resources:

(1) Treaty documents: *Indian Affairs: Laws and Treaties*, compiled and edited by Charles J. Kappler, is a seven-volume compilation of U.S. treaties, laws and executive orders pertaining to Native American Indian tribes. The work was first published in 1903-04 by the U.S. Government Printing Office. The seven volumes extend to legislation through 1971. Kappler's work is available online through the Oklahoma State University Library Electronic Publishing Center (<http://digital.library.okstate.edu/kappler/>). The Center states that the information "is in high demand by Native peoples, researchers, journalists, attorneys, legislators, teachers and others of both Native and non-Native origins." The Oklahoma State University Library's digital collection of the Kappler Treaties is well indexed, but is not easily searchable, and does not link to maps. And the nine earlier treaties, created between the years 1722 and 1805 but not included in the Kappler collection, have been digitized by the University of Nebraska-Lincoln, Center for Digital Research in the Humanities (<http://earlytreaties.unl.edu>).

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<sup>1</sup> "Treaties" in this context includes not just formal treaties per se, but Executive Orders, Supreme Court rulings, and other legal documents that have determined the territories occupied by Indian nations. Land tenure is often more complex than simple cessions, i.e., land grants, patents, sales, court orders, rights, executive orders, etc.

(2) Historical Maps: The major source of information for the U.S. negotiated materials is the records and maps of Royce (1899). His publication is a comprehensive listing of treaties, executive orders, and legislative actions, through 1894. This entire set of maps has already been rendered into digital form for use in Geographic Information Systems (GIS) software by Dan Cole and Bill Gribb, with follow-up mosaicking by Doug Herman. They have created the ability to “drape” these maps over hillshade images to produce three-dimensional images, allowing viewers to relate treaty boundaries to actual topographic features. The Royce collection provides the fundamental mapping database for the project which Cole and Gribb have downloaded as well as additional colonial (Slides 4-21) and federal era historical maps from the Library of Congress collection ([http://memory.loc.gov/cgi-bin/ampage?collId=gmd&action=browse&fileName=gmd370m/g3701m/g3701em/gct00002/ct\\_browse.db&displayType=3&maxCols=3&recNum=0&itemLink=r?ammem/gmd:@field\(NUMBER+@band\(g3701em+gct00002\)\)&title2=Indian%20land%20cessions%20in%20the%20United%20States,%20comp.%20by%20Charles%20C.%20Royce,%20with%20introduction%20by%20Cyrus%20Thomas.&linkText=Back+to+biographic+information](http://memory.loc.gov/cgi-bin/ampage?collId=gmd&action=browse&fileName=gmd370m/g3701m/g3701em/gct00002/ct_browse.db&displayType=3&maxCols=3&recNum=0&itemLink=r?ammem/gmd:@field(NUMBER+@band(g3701em+gct00002))&title2=Indian%20land%20cessions%20in%20the%20United%20States,%20comp.%20by%20Charles%20C.%20Royce,%20with%20introduction%20by%20Cyrus%20Thomas.&linkText=Back+to+biographic+information)). This collection is searchable by date, tribe, and state or territory. The limitations of Royce’s maps include: polygons drawn without survey input or from incompetent survey; assumption of straight Township and Range lines; edge-matching absent between state maps; poor geographic knowledge of drainage divides; and lack of acknowledgement of non-federal activities. (Slides 22-37) And this source does not include the actual treaties, only map descriptions. The Digital Atlas project will be far more complete in its information, allowing for much more effective use of the maps with the treaties in an integrated spatial database.

(3) Databases: The National Park Service’s Native American Graves Protection and Repatriation Act (NAGPRA) website offers tables compiled from Royce’s book. ([http://www.nps.gov/history/nagpra/onlinedb/land\\_cessions/index.htm](http://www.nps.gov/history/nagpra/onlinedb/land_cessions/index.htm)). Each table contains the map number assigned by Charles Royce, the name of the map or maps on which that number appears, the counties encompassed by the treaty as traced by NAGPRA staff, the tribal name used in the treaty, and the name of the present-day Indian tribe or tribes when it was possible to ascertain those names. When present-day tribes could not be determined, the field was left blank. NAGPRA web site documents that index the cessions on Royce maps by County, State and Tribe do not actively link to anything and one has to compare them manually to the Kappler collection and the Royce maps.

None of these projects explores treaties and maps prior to 1776, other than the nine “recognized treaties” located on the University of Nebraska Libraries’ Electronic Text Center website. Here, this project can open a whole new level of digital information. In addition, areas annexed from Mexico are also under documented. Large portions of the original 13 colonies and Texas would be blank spaces on the map. This project aims to fill this gap by including historical maps that provide a reasonably thorough coverage of the land-transfer history in these states. (slides 4-21) Much of the treaty information is available in the multi-volume set, *Early American Indian Documents: Treaties and Laws, 1607-1789*.

The three products of this project will include: 1) a maintained web-site and exhibit kiosk of the maps, population and land tenure information; 2) a DVD set of the maps and data; and 3) a printed Atlas of the materials. Other Atlases, books, articles,

websites and maps have produced portions of this project; there is an online database of Indian treaties, and there are a few online databases of historical maps. But none have integrated historic maps of tribal locations with population and provided the information in a digital form. So what does not exist is a single source that presents a visual, documentary chronology of the spatial transformation of tribal groups—including those affected prior to the formation of the United States—and in searchable format that combines maps with texts. And the web-site will provide the capacity for a wider-range of people to have access to the information and the available data at one location. This availability is at a time when the importance of American Indian trust lands, financial accounts and population impacts are the most critical.

### **Significance**

The legacy of their symbols, the adoption of their material culture, or the bundle of their everlasting truths and knowledge that are passed on to succeeding generations signify the importance of a cultural group. A key component to understanding the culture is to know where they began and what environmental and societal factors influenced their advancement. Over 500 different American Indian tribal groups existed in the United States at the time of first European contact. Debate has lingered as to the number of indigenous people at the time of the major contacts with Europeans, in North America estimates range from 900,000 to over 12,000,000 (Thorton, 1987). This project will not create the definitive answer to the number of original people, but instead portray the distribution of recorded population figures and the multitude of factors that either inhibited or contributed to their decline and growth. There are a number of atlases available that present information on American Indians; this is the first project to combine a comprehensive land tenure and population of American Indians, in a digital cartographic form. Further, this project will make available the location and population information for others to interpret and expand beyond these modest beginnings.

Several atlases exist that present glimpses of American Indian population through time. Some maps present hypothetical population density at the time of first major European contacts (Driver, 1969). These graphic portrayals are then followed by a sequence of historic census maps dating from the mid-1850s to the present (Prucha, 1990). This project will attempt to fill the 350-year gap (1500-1850) of population, location, and statistics and continue the information to the present, using a wide range of sources, both national and local. Local and regional examples will also be illustrated to demonstrate the variation in tribal location and populations through the entire time period, 1500 to present. Thus, the result will be the creation of an atlas with over 500 years of American Indian population and location change.

The first section of the atlas will present in greater detail the major physical, biological, and atmospheric variables that influenced American Indian cultures. So the possibility exists to illustrate the environmental context of each tribal group or cultural region and present a broader background to further the understanding of that tribal group's cultural traits, land occupation, and population dynamics. Because the data will be presented in a digital format, there will be an ability to overlay environmental characteristics and change scales for more clarity or higher resolution. This same information will be available for the different case studies or regional examples.

The Atlas is being designed for two specific scales 1:12,000,000 and 1:2,000,000. The 1:12,000,000 scale is the best format to portray the United States and Alaska on an 17" x 11" page. This is designed to keep the printing costs to a minimum, yet not be too restrictive for cartographic design. It allows enough detail to provide the distributional context of the tribal groups and the cartographic presentation of complementary and reference information. The 1:2,000,000 scale provides sufficient detail for most of the case study and regional maps. But other scales may be included based on their appropriateness to the information being portrayed. All data will be converted to JPEG2000 format which provides suitable compression with detail. And the digital cartographic files will be in an ESRI shape file format that can be downloaded and available to a majority of cartographic and geographic information systems (GIS) software.

A printed version of the Atlas serves two types of clients; those who do not have computer access or are uncomfortable with computers and those who just prefer printed documents. Not everyone can or wants to adjust to the computer age and this could eliminate their access to the atlas. Currently, only 65 percent of the population has computers in their homes, and only 35 percent of this group use computers beyond electronic communications. Some people prefer printed materials because of their clarity in illustrations, the vibrancy of colors, and their ease and familiarity of use.

The web-based and DVD products of this project provides a medium upon which the compiled digital information can be expanded as new information is made available. Further, the down-loadable digital files allow the user to input the information into other software packages either for presentation or additional analysis. These are capabilities that are not offered to the user through other atlas projects or most other types of research projects. The potential users of the website and DVD component of the project are limited by internet access and computer equipment. The market sector for the website and DVD has the following continuum of intensity of use-from highest intensity to lowest intensity. The highest intensity use might be academic researchers (historians, demographers, geographers)-tribal groups-educational researchers, college students. Low intensity educational researchers could be elementary school children. Interested citizens-casual browser could be either low users or occasional users.

### **Population and Land Tenure Determinations**

Population records for the different tribal groups are a combination of information extracted from journals of travelers, military records, missionary diaries and government documents. Census materials were recorded sporadically by the different government entities, both foreign and domestic, but they were not as systematic as they were for the general population, which started in 1790. American Indian population's statistics were not collected as part of the regular decennial census until 1860. And even at this late date, it was by state or territory, not by any tribal group or reservation. Schoolcraft published a census of tribal groups in 1852, however, this was taken from a mixture of sources dating from 1845 (Schoolcraft, 1857). There has not been a comprehensive compilation of American Indian populations from the establishment of European settlements in North America until that first census in 1860.

This project employs two techniques for compiling the population of American Indians. The first is the traditional investigation of written documents collected by government agencies and personnel and the records kept by the traders, missionaries, and other American Indian-European contacts. The second method is interpretation from the cartographic record. The map records provide two sets of valuable information; the location of the tribal groups and illustrated documentation of village dwellings, number of warriors or men, and tribal size. The maps of Lewis and Clark are excellent examples of this cartographic/demographic methodology. (38-56) Their maps portray the location of the different tribes that they encountered or were informed about by their contacts. They identified a location or area for the tribal group and listed the number of dwellings, warriors, or village size for a majority of the people depicted.

Land tenure for this project is defined as the system of rights and institutions that govern access to and use of land and other resources (Maxwell and Wiebe, 1998), in particular, the changing institutions that govern access and use of the land and resources. In this case, the location and type of land tenure change due to European colonial power implementation of treaties, agreements, and contracts with the different tribal groups.

Land tenure is investigated according to three criteria: areas and locations of tribal groups before any formal government negotiations; areas and locations identified in any formal government action; and, adjustments to land areas and locations after the formal government actions. The areas and locations of tribal groups' pre-formal negotiations are being extracted from documents and cartographic records available. Land records relating to the formal negotiation contacts between a tribal group and a government are to be mapped according to the negotiated treaty, agreement, or policy. Adjustments after the formal government agreements will be identified and mapped as they relate to case law, additional agreements, land purchases and commissions as the land is accepted in trust status.

Four distinct types of land tenures and Indian-white relationships are examined: 1. the lands occupied and utilized pre-European contact and governed by tribal authorities; 2. land agreements between tribal groups and colonial powers; 3. treaty agreements with the United States government; and, 4. post-treaty agreements and acquisitions. Documented records of land sessions will be interpreted and portrayed cartographically; and the initial land tenure for tribal groups will be cited as their location from pre-formal governmental agreements. This is accomplished by referencing the tribal location as depicted on historic maps. The land tenure agreements with colonial powers (Great Britain, Spain, France, Russia, Netherlands, and Sweden) varies between land cessions, acquisitions and purchases (Prucha, 1994; Jacobs, 1988; Jennings, 1988; Wade, 1988; Horsman, 1988; BIA, 1977). The major source of information for the U.S. negotiated materials is the records and maps of Royce (1899). His publication is a comprehensive listing of treaties, executive orders, and legislative actions, through 1894. The works of Kappler, Cohen, Wilkins, and Prucha complete the record until the 1980s. The adjustments to the negotiated lands will be extracted from a variety of government sources as they relate to court decisions, land purchases, and government commissions. The Bureau of Indian Affairs compiled comprehensive information on land tenure that is current to the present based on data obtained from the different tribal entities. These adjustments are legally binding from direct land purchases to the results of land commissions, and

specific court cases or laws. Land tenure is often more complex than simple cessions, i.e., land grants, patents, sales, court orders, rights, executive orders, etc. As a result, all of the different methods of land transfer are being examined beyond that of the land status as trust lands.

### **Methodology and Standards**

The multifaceted aspects of this project follow a set pattern of procedures and processes to obtain the needed information, extract the appropriate data, transform the data into a digital format and portray the data on a map. To accomplish these tasks are required a series of steps for population extraction from government records, land tenure from published maps and bibliographic search of published tribal documents. All information will be transformed to a series of integrated relational databases that have set formats and fixed variables. Further, meta-data and data dictionaries will be established to keep records of data types and sources. Critical to this process is the conversion of information depicted on historic maps to the project base map. Established procedure for geo-referencing will focus on key elements of the historic maps that best portray the control points, physical features or cultural entities.

The thrust of this project is twofold: create a digital atlas and provide the relational databases in a format that is easy to retrieve. All tribal land tenure and population materials have some type of geo-referencing which make it possible to map the information. Secondly, all information will be established in a relational database format, adaptable to SQL conventions. The combination of transforming all information into a geo-referenced system and relational databases limits the information included in the project to that information that has a spatial component and is digitally compatible.

Base map scales, map elements, and cartographic representation standards are being identified, coded, and implemented throughout the project. All maps will have a similar base construction with the same basic elements: latitude, longitude lines; major rivers; state boundaries; and appropriate labeling. Cartographic license will nonetheless be employed for the presentation of the data for visualization. After the time sequence, outline, and case studies have been identified, source data for each of the graphics will be researched, examined, and cataloged.

A set reference point density of at least eight geo-reference points will be employed on all conversions of historic maps, along with the use of surveyed or coordinate geometry whenever possible. All of the references will be listed as part of the metadata for the produced map. If specific point data is identified on a map, those coordinates will be part of the relational database and referenced in the metadata. In instances in which no specific point location for a tribal group is identified but only an ambiguous region, a type style change will signify the arbitrary region and, depending on the situation, different techniques for referencing the region will be employed and identified in the metadata. All census and land tenure materials will be recorded and cataloged following the LoC system or some slight modification of this system. This will include all manuscript and scanned maps, documents, graphics and photographs for easy retrieval and integration into the digital system.

Selection of materials to be included into the Atlas project follows three basic criteria. This project will align with the tribal names and conventions identified in the

Smithsonian Institution's **Handbook of North American Indians**. The tribal names, populations and movements will be identified and cataloged over the time period of 1500-present, and segmented through specific time periods. Tribal groups will be limited to those groups that are currently recognized by the federal government, as posted in the Federal Register. This will not only include tribal names and affiliations but also Alaskan villages, communities and cooperatives. And materials for the Atlas project will generally come from the public domain documents. But because case studies are part of the project, the more detailed information may be retrieved from a broader base of source material.

Census materials extracted from public documents can be obtained from the U.S. Census Bureau, the Bureau of Indian Affairs, and other federal agencies or the historic cartographic record. Maps produced from this information will be specific to the framework of the, and referenced in the metadata. Only in rare circumstances will other documents be incorporated into the research. There are too many individual documents, diaries, research articles, books, and other primary sources related to tribal populations and land tenure to extract information from for this project. So the type of source materials will be limited.

Extensive use of maps and other archival materials from the Smithsonian Institution, National Archives, Library of Congress and those available through the Newberry Library are being employed. In some situations materials from state archives, affiliated museums, or tribal archives/museums will be used to present specific case studies. Citations will be incorporated as part of the metadata dictionary for maps.

Land tenure information is limited to legal documentation of land areas and ownership. Direct research into the land holdings of each tribal group will not be part of this project, only land holdings recorded by legal actions will be included in this project, such as: historic map locations and regions; treaties, executive orders, and legislative actions; court and commission decisions; and those lands accepted for trust designation.

Tribal names will be arranged alphabetically and the population information will also follow tribal name and thus will be in chronological order with a graphic illustrating the change over time. Location information will be designed to have either a point location for a specific tribal group or a centroid position for the tribal group that represents the areal extent of the tribe. All location information will be in latitude and longitude coordinates, i.e., decimal degrees. Treaties and legal actions will be cited in several different methods: by its legal reference (Stat.L., XVIII, 685), by its common name (Fort Bridger Treaty), and by its date (July 2, 1863). Court and Commission actions will follow the same procedure. Lands accepted by the Federal government for trust status will be referenced by their acceptance and appearance in the Federal Register. The map reference will follow the LoC-GMD standards for map cataloging and referencing.

To create a mechanism for a wider audience to use the information, a website will be constructed to create maps and access to the relational databases. The purpose of the website is twofold. First, to allow internet users access to the basic project maps; and second, to provide a medium through which the more advanced user can either download the maps or create individualized maps based on their own needs,

capabilities, and inquiry. The downloadable maps will be organized using JPEG200 format, while the more advanced user will download the ArcGIS shape files. The website will allow access to the data, but users will not have the ability to modify the information.

All maps produced for the Atlas will have metadata available that provide detailed information about the maps produced. This includes the basic information designated by the FGDC for metadata construction: identification; data quality; spatial data organization; spatial reference; entity and attribute characteristics; distribution; and, metadata referencing ([www.fgdc.gov/metadata/meta\\_standard.html](http://www.fgdc.gov/metadata/meta_standard.html)).

### **Plan of Work**

There are three co-principal investigators on this project, each at their respective institutions (Smithsonian Institution's National Museum of the American Indian, National Museum of Natural History, and the University of Wyoming.). The role of the principal investigators is to insure that the research is conducted in a consistent manner, all procedures for digital conversion are established, and that database construction is accurate and precise. Further, the principal investigators provide the theoretical, technical and practical perspective to the project.

The Smithsonian Institution developed the 15 of 20 volumes of the **Handbook of North American Indians**. The maps for the **Handbook** are done using advanced cartographic techniques to insure clarity, accuracy, consistency, and flexibility. Further, historic maps in the **Handbook** are also being converted to a digital format. The Geographic Information Systems Coordinator for the Smithsonian was also the research cartographer for the **Handbook** and is one of the co-investigators on this project and will follow the rigorous procedures, standards, and quality controls of the Smithsonian into this project. This co-investigator has over 30 years of GIS and database management expertise and 23 years of cartographic expertise working on the **Handbook**. Further, the full resources of SI will be incorporated into this project because it has the potential to complement their efforts in American Indian research. The Smithsonian is providing computing facilities, access to their research documents, availability of their experts, and linkages to other federal agencies and their information on land tenure and population.

### **Dissemination**

This project has many parallels but does not replicate any current works. The Smithsonian Institution's multi-volume **Handbook of Native American Indians** adds significantly to this work. The frameworks and conventions of the HNAI will be followed carefully because there are so many overlapping components. The Handbook has several volumes with a specific theme, e.g., *Indians in Contemporary Society* (2), *Environment, Origins, and Population* (3), *History of Indian-White Relations* (4), and *Languages* (17), but population and land tenure are topics that appear through all of the volumes, in one form or another but not in a comprehensive manner. Also, the HNAI's databases and information are not digitally available; and because of its regional/areal perspective, it does not allow the reader/research to view the overall U.S. cultural or environmental context of the materials and information.

The Library of Congress Geography and Mapping Division and The Alexandria Digital Library – UCSB project provide a means to create a bibliographic reference

system of maps, graphics and published materials in a geographic information systems. The materials produced by the Geography and Mapping Division and in the Alexandria Project are available through the internet and on different digital mediums. The structure, format and search engines of their referencing, cataloging and data capture systems will be incorporated into this project where appropriate and needed. The University of California-Berkeley has created the Electronic Cultural Atlas Initiative project, which is a web-based examination of cultural activities. This project presents a wide range of cultural-historical case studies that provide a background to the study, the data and interpretations. There is no case study in the project that directly relates to American Indians and certainly not to the extent of this project, however, it is an example of how cultural research can be available through the internet. Regardless, some of their techniques and procedures will be incorporated into this project as needed.

There are four main groups of potential users of this project. One group will be those researchers interested in the changes in the demographic characteristics of the American Indian. This group may be interested in following the changes in population size and dimensions. A second group could be interested in the spatial characteristics of the tribal groups. These researchers are concerned with the location of the different tribes at different times during their history and the history of the United States. This could also be viewed as a history of the changes in occupation of a specific location or the “sequence occupancy” of an area. The third group might be those interested in the combination of the two characteristics to examine the process or factors influencing these spatial or demographic changes. Finally, different types of cartographers will be interested in this project because of the unique transformation of historic maps into modern digital maps. Not just the capture of historic maps in a digital form, scanning has done that, but the use of the computer to create new versions of the historic maps that can be of use to others. The main researchers relative to each of the groups could be cultural anthropologists, historical demographers, or cultural-historical geographers. Finally, tribal groups should be able to utilize the results of this project to demonstrate the different environmental or social factors that influenced ancestral changes.

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