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**The Early California Cultural Atlas: Spatial and Digital History and the
Visualization of Colonial California**

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I. Brief Project Summary

The Early California Cultural Atlas (ECCA) explores and visualizes the spatial and temporal aspects of the enormous economic, demographic, and ecological changes that shaped colonial California between 1769-1860. During this time, the peoples and lands of California were remade by political and biological forces that we are only now beginning to understand in their totality. The establishment of Alta California's Mission San Diego in 1769 initiated many of these dramatic changes, including the spread of deadly diseases, the introduction of foreign plants and animals, large waves of Indian migration, and the introduction of new agricultural regimes that undermined indigenous subsistence practices. The ECCA includes a website visualizing these historical trends in the region of Monterey, California.

In 2008, the ECCA received an NEH Digital Humanities Level I Start-Up Grant to construct a basic website of historical change in the region of Monterey, California. In the process we resolved many technical issues and encountered new historical questions, including how to address geographical and spatial-temporal ambiguity. Ultimately, the ECCA will place this data and its associated visualizations alongside data from the Los Angeles Basin—a region with an arid climate, expansive network of Juaneño and Gabrielino/Tongva villages, Spanish missions, Mexican ranchos, and the Pueblo of Los Angeles. By visually and digitally comparing these distinct colonial centers while simultaneously measuring ambiguity through a data characterization and management matrix (see Appendix A), the ECCA will reveal a more comprehensive picture that promotes new ways of understanding California before 1860.

II. Project History

The ECCA emerged out of the Huntington Library's Early California Population Project (ECP), a project that was completed in 2006 with NEH funding. The ECP database contains all the information in the California mission baptism, marriage, and burial records; thus, it holds an extraordinary wealth of unique information on more than 110,000 Indians, soldiers, and settlers in California. Most important for the ECCA, the ECP database lends itself to spatial and temporal analysis. For, each of the more than 200 fields in every record describes a person or event that can be situated in time and place. Beginning in the spring of 2006 Hackel and Jeanette Zerneck began to discuss the advantages of displaying ECP data spatially and temporally through visualizations. They created an interactive map of Indian villages at the time the Spaniards arrived in the Monterey region and linked the ECP data for Indians baptized to a map of the villages from which they came. With this exploratory work complete, in the spring of 2008 Hackel applied for an NEH Digital Humanities Initiative Level I Start-Up Grant to fund a series of discussions about how to incorporate new layers of information into the website and how this information could best be made available to teachers, students, and scholars.

With Level I funding, the ECCA team created a Phase I website (see attached figures) with Google Earth visualizations. The team focused on two missions, San Carlos and San Juan Bautista. Initial mapping for San Carlos relied upon single locations for villages and did not specify exactly how the location of the villages had been determined. In adding San Juan Bautista to the study, Hackel and Zerneck plotted multiple village locations for villages and devised a register that explains the source of information for this mapping as well as the relative certainty of these locations. Furthermore, they created in this new prototype a means by which simply clicking the cursor on an Indian village allows access to basic information on Indians who lived in these villages and moved to San Carlos or San Juan Bautista. An innovative and newly designed time bar function shows the movement of those Indians to the missions in every year until the village has been depopulated. ECCA staff added to the website geo-registrations of historic maps and the boundaries of ranchos created in California during the Spanish and Mexican periods. Thus, with Level I funding the ECCA devised new ways to visualize and understand historical transformations that heretofore had only been represented in ways that did not adequately consider spatial and temporal relationships.

The project director made a significant personnel change at the halfway point in the grant period. We had initially planned to hire a graduate student assistant to work on the project, but we could not find one with adequate background knowledge for the project. Therefore, to coordinate the compilation of historical data for the project we hired Natale Zappia, a recent Ph.D., an expert on the history of early California, and an Assistant Professor of History at Whittier College. Zappia's contributions quickly emerged as crucial for this project's completion.

III. Methodology and Design Process

The ECCA is an integrated investigation of the relationship between historical content and new processes for digital scholarship. There is currently momentum in the development and use of spatially aware technologies for a broad range of applications. And, there is an amazing increase in users' ability and willingness to use spatial technologies. However, in the humanities and especially in the discipline of history, technology and methodologies for dealing with spatial and attribute data with varying degrees of certainty and ambiguity have not been fully developed and adopted. This has created a critical barrier to the widespread adoption of spatial-temporal technologies. The ECCA is developing methodologies to handle these issues and to create spatial-temporal visualizations that support more complex narratives. Each of the sources of data used to map this study area has its own characteristics of ambiguity. Zerneck developed a matrix of methods to analyze the ambiguity by addressing both its source and typology. This information is used to inform appropriate scale, cartography, and associated attributes for the dataset. Several technologies were tested to determine appropriate visualization methods to support users' understanding of the content. These scholarly processes, which have been developed to integrate content and technology, can be adopted with newer technologies as they become available.

The Phase I website was constructed using statistical data from the ECPP, historical maps from online archives, shape files for historical ranchos, and a reference dataset of the North American Spanish missions. The demographic data from the ECPP was linked via the individuals' record of origin to the locations of Indian villages. Considerable work went into the process of determining appropriate locations for the village names mentioned in the historical records. Multiple scholarly sources were consulted and an ontology of village types was developed. The Indian village maps and historic maps were overlaid on current satellite imagery. Then several methods of representing baptism data were tested. The current method shows the probable locations of the villages both before and after active baptisms as static locations. During the period when residents of the village were being baptized at the mission, the number of baptisms is represented by a polygon whose height is determined by the number of baptisms. This allows a quick visualization of the quantity of people who were moving from the village to the mission each year. Further work on the initial demonstration now allows users to interrogate the map to see the exact number of baptisms, and it also includes the baptisms occurring at the mission as a comparison. Expansion of Spanish and Mexican Rancho lands are also overlaid to contribute to the understanding of the change in land use. The most recent version of this dynamic map demo can be viewed in the Internet at: ecai.org/ecca/GoogleEarthDemos.html (see appendix). Google Earth allows complex visualizations with a data-driven timeline, flexible data layering and cartography, links to related resources, and the capability of creating three-dimensional representation of data. Exporting a customized set of data layers with dynamic change over time into an embedded Google Earth, video, or Flash demo allow its incorporation with a narrative explanation into teaching and research materials.

IV. Summary of Project Findings

In our NEH Level I application, we argued that our project would break new ground by embracing ambiguity, an issue that has bedeviled humanists' attempts to use new mapping technologies, especially in studies that involve complicated notions of time and space. At the same time, there has been considerable research in defining geographic uncertainty, developing frameworks for representing geographic uncertainty, and work on methods of visualizing uncertainty. Most of this research focuses on contemporary GIS data for decision-making, visualization of single dimensions of geospatial uncertainty or complex visualization of non-spatial uncertainty. Work in Spatial Information Theory provides examples of modeling complex spatial understanding. In this project, we demonstrated that adding the spatial component to temporal analysis leads not only to a deepening of humanistic inquiry, but to a reformulation of the inquiry itself.

This work addresses the issues of ambiguity and uncertainty holistically as a case study in spatial history. Each of the sources of data and information available to map this study area has its own characteristics of ambiguity. For instance, the representation of the geography of California in Western maps and atlases changed dramatically. The skills of cartography and mapping were improving and there were many voyages of exploration to this region. It also now seems clear that ECCA will force us to fundamentally rethink what we have understood and written about the movements of Indians to missions in California. Most important, the historical questions we are now asking emerged directly out of visualizations we prepared with Level I funding. In our mapping of the movement of Indians to two missions in the Monterey region (San Carlos and San Juan Bautista) we became aware not only that mission recruitment proceeded steadily outward from each mission, but that in the 1820s and 1830s Indians came to the missions from the interior of California, an area previously thought to be far less affected than the coastal region by the growth of mission agriculture and livestock and the creation of Spanish and Mexican ranchos.

Thus, we are now asking new questions: if mission encroachment on native subsistence drove Indian movement to the coastal missions before 1820, what led Indians from the interior of California to the missions after 1820? Furthermore, now that we can see the spatial and temporal patterns of mission recruitment for the Monterey region, how might these patterns differ from those of the Los Angeles Basin, a region of greater aridity, greater Spanish settlement, and greater cultural diversity? Our work in digital history suggests that scholars need to figure out more complicated stories to tell about Indians' movements to the missions and environmental change in early California.

While our project focuses on California, one of our main objectives has been to resolve important issues that have often made it difficult for humanities' scholars to adopt emergent technologies. Thus, the ECCA has at its core a willingness to acknowledge and map ambiguity. Typically, computer programs that historians use to map events spatially and temporally do not have a means to handle ambiguity. Notably, ambiguity is present in at least three of the important layers of information that we are attempting to map. Indian myths, legends, and creation stories describe the California landscape and various places that were part of what we might call a sacred geography. In our Level I grant we focused our studies on the Monterey region, but we found that the region did not lend itself easily to a mapping of indigenous understandings of land and its uses. We are addressing this problem in our Level II Grant application as we endeavor to extend our project to Southern California, a region with a richer ethnographic base. Second, there is lively scholarly debate over the exact location of many of the villages that Indians inhabited before moving to the missions, and much of the information on the location of these villages comes from the records of Franciscan missionaries who had their own understandings of the land and its features. Scholars generally solve this problem by simply mapping a single village site that they consider the most likely. In our project, we will continue to map multiple village locations and document the sources of these variant locations. In this sense, we are not attempting to create a simplified version of the past but one that is full of complexity and open to reinterpretation. Third, we confronted ambiguity in our mapping of the *diseños*, the hand-drawn maps of California ranchos created by grantees and Spanish and Mexican officials. These maps were never drawn to scale and indicate boundaries by trees, streams, or buildings that often no longer exist. Thus, in working with the *diseños* the ECCA is trying to devise new methodologies and best practices for the geo-registration of representational maps. And since issues that surround ambiguity have presented serious impediments to humanists' attempts to map information from different times and places, our efforts have important implications for work on other regions and time periods.

V. Recommendations: The ECCA as a Tool for Interdisciplinary Research and Outreach

A. Interdisciplinary Research

The broader technical questions and challenges the Early California Cultural Atlas is addressing are common to the sub-discipline of Historical GIS or Spatial History, yet to an unusual degree the ECCA is addressing them in an integrated fashion. The project has brought together multiple datasets with different types of ambiguity, subjectivity, and diversity of perspective. Then, using newly available technical tools in experimental ways, it has considered the design of appropriate methods for visualization, navigation, and documentation through complex dynamic maps, which address the differing levels of certainty and scale.

The ECCA project has built on the research and technical experience of the Electronic Cultural Atlas Initiative (ECAI), and it has applied lessons learned in that work in new ways. The ECCA has taken advantage of the technical developments of many ECAI projects including a large-scale collaborative project, the Religious Atlas of China and the Himalaya. Development of the ECCA did not require creation of new large-scale custom software or database systems. Instead, the work leveraged in new ways the Early California Population Project database, historical maps from the David Rumsey and Library of Congress collections, and the tremendous resources of the Online Archive of California, among others. The technical approach chosen for the ECCA also built upon existing technology to create novel and flexible methodologies and tools. Google Earth has been chosen as the primary spatial-temporal interface for multiple reasons. It is relatively easy to use, allows easy creation of complex and multiple visualizations, and enables publication of static and interactive visualizations on the web. Google Earth has a very large global client base, with many programmers contributing open source code for specialized functions. The data can be made available in KML format for others to use as they wish and is human readable for sustainability. A number of digital history projects address digitizing, cataloging and accessing historical maps, including the Cartography of American Colonization Database (CACD) and Digital Mappaemundi. However, unlike the Mappaemundi project, the ECCA uses technologies such as Google Earth that are based on the standardized framework of latitude and longitude and ISO standard dates (year:month:day) and include satellite imagery for context. We can take advantage of this temporal spatial consensus because of the increased adoption of these technologies in widespread applications and the growing community of users familiar with these interfaces. Unlike other projects the ECCA is developing methodologies that use these tools while still representing the appropriate ambiguity for a variety of data types.

ECAI's TimeMap and the Virginia Center for Digital History's HistoryBrowser projects address displaying attributes and multimedia resources within a spatial-temporal interface. The HistoryBrowser, now renamed as VisualEyes, is an Adobe Flash and ActionScript based integrated map and resource interface. It is a powerful but very specialized tool for creating visualizations using multiple types of attribute links and

display. This custom tool creates an easy to use map-based interface. Both of these tools may be useful in creating specific visualizations for the ECCA project, such as for curriculum materials. However, the goals of the ECCA are more complex as not all the resources that are important for the project will be easily importable into a GIS style interface. Converting information into a format usable in a spatial-temporal interface is a complex activity and is even harder in the humanities. Specifically addressing these challenges and determining appropriate methodologies for digital humanities is central to the ECCA project. The results created allow novel complex spatial-temporal visualizations and from these, new simple or advanced user interfaces can be created. This effort is pioneering a rich new approach to analysis for projects in the humanities that was not possible heretofore.

B. Outreach

The ECCA has responded to the needs of many constituencies. Presenting visualizations of the transformation of early California has enhanced the study of early California by students, scholars, and Native peoples. Integrating into a single website the materials and resources related to the study of early California and its peoples meets the educational and cultural needs of students, researchers, and Native peoples. At the conclusion of the initial grant period Hackel, Zerneck, and Zappia presented demos of the website and visualizations at academic conferences, to academic colleagues, and to various groups of students and teachers in Southern California. They received enthusiastic support for this work from university faculty and elementary school teachers. It is this broad-based response and overwhelming desire for access to this kind of dynamic visualization that has led to the current proposal for Level II funding.

We will continue these efforts with the website design and curriculum development proposed in our Level II application. In our next grant we will respond directly to the California State Board of Education standards for history and social science. These standards mandate that fourth graders demonstrate an understanding of the physical and human geographic features that define places and regions in California and the social, political, cultural, and economic life and interactions among people of California during the Spanish mission and Mexican rancho periods. Notably, in an average year, there are 400,000 fourth graders in California, and nearly all study the California missions. These students and their 10,000 teachers may be the largest and most important audience for our work, and they are a great way to engage a larger public.

C. Long-term Impact

Once completed the project will have an immediate impact on the how colonial California is taught. We are developing a curriculum for the project and we expect that the website will be used by many of the 400,000 Californian 4th graders each year. Our project will also be of use to historians interested in digital history and those interested in using maps to explore ambiguity and diversity in perspectives of time and space. To date, UCR and the Huntington, the institutions that have sponsored and hosted this project, have received accolades for their involvement in this work.

VI. Appendix A

Data Characterization and Management Matrix

Source of Ambiguity	Examples	Proposed methodology
Data recording/ collection		
Unclear documentation	Village name ambiguity: spelling variations, unclear writing	Choose the most likely village name or drop it from the data set. Document the choice.
Incomplete attribute documentation	Documentation exists but not for all the data of a particular type: Age of Indians at baptism often estimated and sometimes missing	Use best estimates and document Metadata: what are the characteristics of the data set, it's source and history. What percent of data is known, what is not known.
Temporal documentation incomplete or vague	Don't know exactly when, or don't have the same degree of accuracy for all items of a data set – e.g., exact founding dates not available for all Spanish Ranchos	Use dates when available. Round to nearest year. Choose a default date by which all Ranchos were founded. Use the default date if actual date is unknown. Document this choice in Map legend.
Spatial information incomplete or uncertain	Village name is registered in Mission Records. However, the location of some villages is not recorded	We can give them a generalized location or drop them from the visualization. Proposed methodology – drop from spatial visualization.
	Historical Maps don't have standardized representation of location and knowledge of North America was incomplete	Geo-register the historical maps approximately where they would fit in comparison to modern satellite imagery to allow comparison of views over time
Interpretation of data:		
Difference of opinion among scholars about the specific location of a	Often location is based on interpretation of textual descriptions of the site and/or	Choose a site base on ranking of reference data sources. Include lineage data in data

village.

incomplete documentation.
Multiple attempts to decide
where the villages are have
been published

presentation

Data classification:

What was meant by the
Origin of an individual
in the baptism records?
Ambiguity in definition
of home or village

Name may refer to an
inhabited region, a specific
site or multiple sites inhabited
by a group of people

Develop a ontology of village
types


A person's
documentation is
complex

A person may come from
multiple villages/ locations,
perhaps because of
intermarriage

Assign first listed village
only OR count them multiple
times? Document the choice

VII. Figures

Figure 1: ECCA Website



Early California Cultural Atlas

The ECCA is an interactive website that will allow for the integration and management of historical resources, the visual analysis of historical data related to California between 1769 and 1850, the display of research results in the form of maps and other visualizations, and, through various educational tools, the education of students from elementary school to the university classroom. This project is interdisciplinary and collaborative; it draws upon the expertise of research scholars, librarians, archivists, software engineers, technical experts, California Indians, and primary school teachers. Fundamentally, the project represents a new partnership between existing programs. It combines the extensive and unique database of the Early California Population Project (ECP) with the technical expertise of the Electronic Cultural Atlas Initiative (ECAI) to enable new understandings of California and its peoples between the founding of California's first mission in 1769 and the admission of California into the Union in 1850. Our intent is to create an innovative website that will not only improve how we understand a pivotal epoch in California history but one that will demonstrate to humanists how emergent technologies can deepen and foster humanistic inquiry.

The ECCA began as a pilot project to map the Baptisms of California Indians and the changes in community and land use in early California history. It is based on a database developed for the [Early California Population Project \(ECP\)](#).

The ECP originated in 1998 when Steven W. Hackel, associate professor of history at Oregon State University, envisioned a comprehensive relational database for early California.

This Website and GoogleEarth prototype were developed in collaboration with Jeanette Zerneke, Technical Director of [ECAI](#) (Electronic Cultural Atlas Initiative).

SSHA Panel Presentations November 2009

- [Panel Presentation and Project Overview by Steven Hackel](#)
- [Native Ethnographies by Nat Zappia](#)
- [Power Point demo by Jeanette Zerneke](#)
- [Panel comments by Janet Fireman](#)

This project is partially funded by a grant from

The National Endowment for Humanities

Figure 2: Mission San Carlos Borromeo de Carmelo was established in 1770. Here we see in June of 1770 the estimated location of Native California Villages at the time of initial contact. Baptisms of Indians coming from the village of Tucutnut have been recorded. Figures 2-5 illustrate changes in demographics and settlements between 1770-1849.

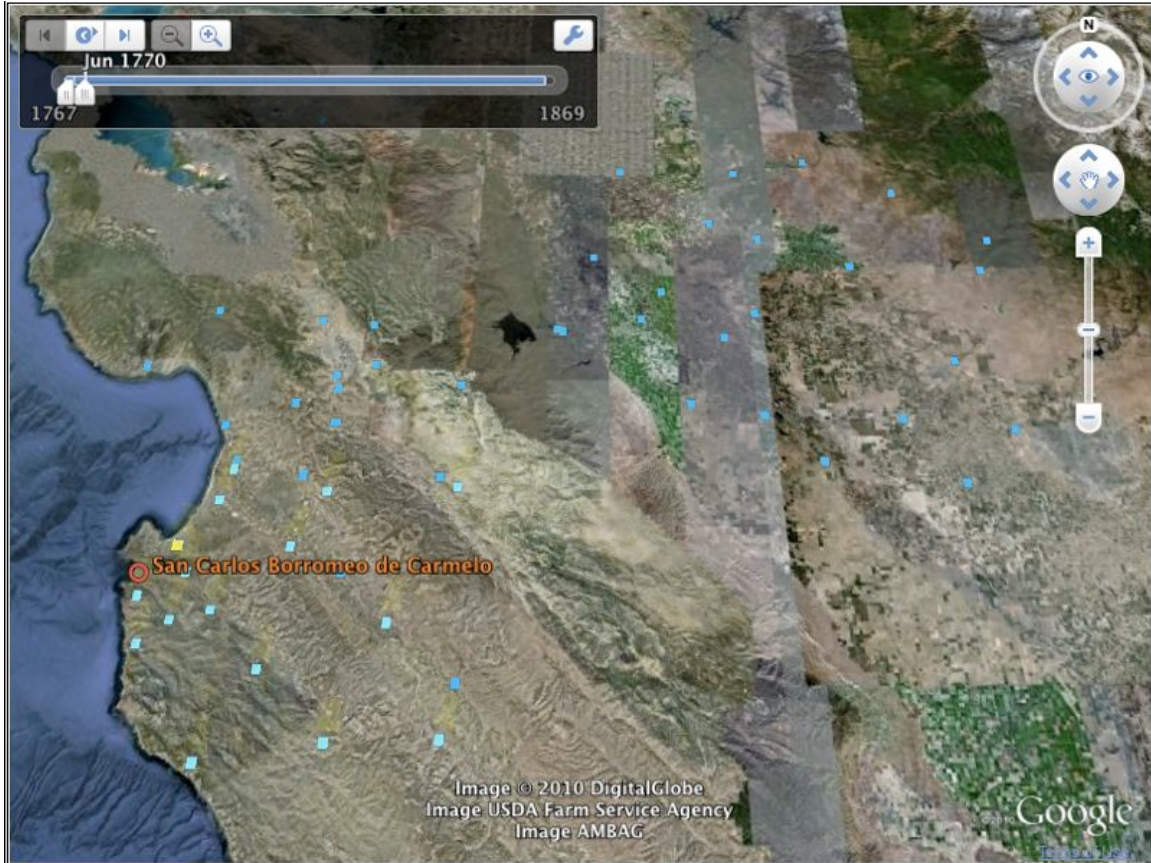


Figure 3: San Carlos Borromeo de Carmelo, 1800.

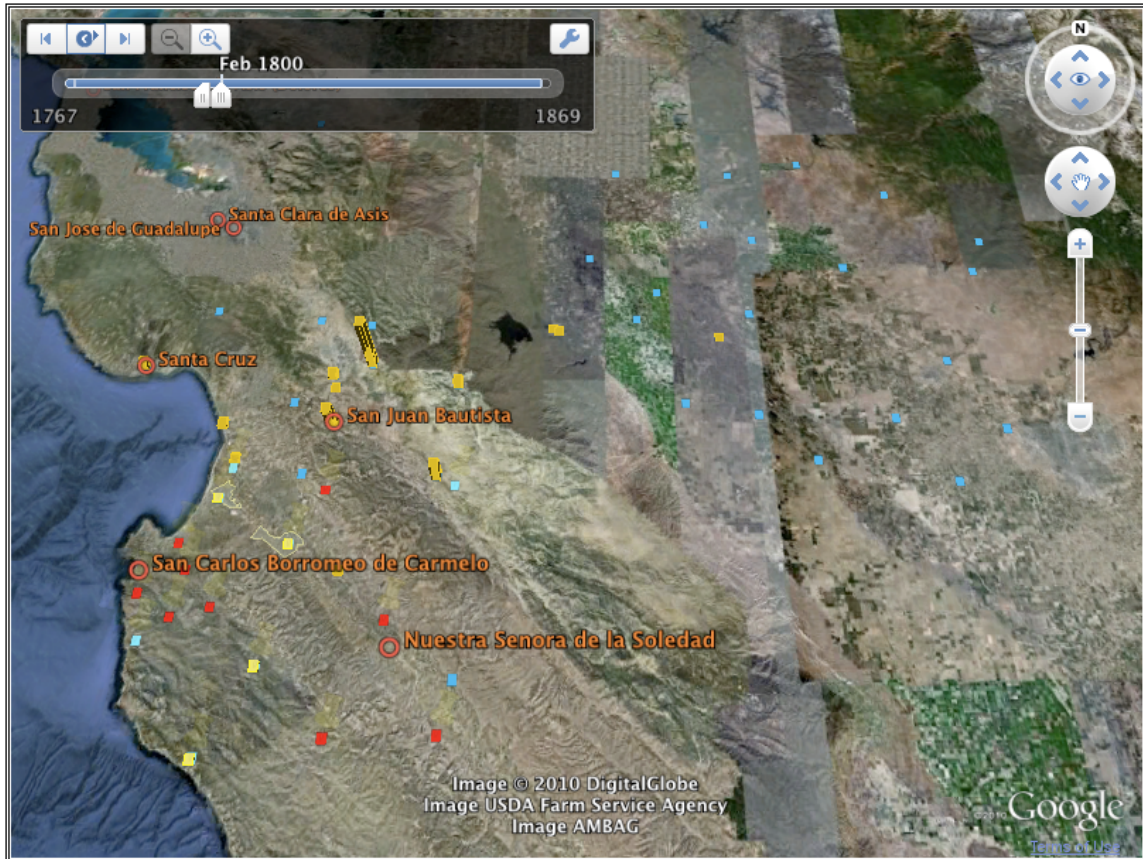


Figure 4: San Carlos Borromeo de Carmelo, 1820.



Figure 5: Monterey region, 1849. In 1849 this area shows a network of secularized mission churches and a large number of land grants owned by Mexican landholders.




Figure 6: Diseño maps from Monterey region.

Historical Land Grant Maps of Monterey Area



Figure 7: ECCA commodity figures. These tables have been embedded into ECCA Google Earth imaging to visualize land use between 1769-1850.




Early California Cultural Atlas

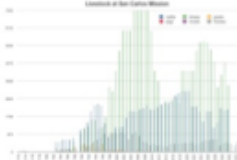
Spanish Mission Commodities

Commodity production practices at the California Missions had a significant impact on environment of California. Spanish livestock began to crowd out California's native fauna, and introduced vegetation pushed aside indigenous plants, greatly undermining the subsistence practices of California Indians.


Click on images to enlarge




San Carlos Grains Harvested




San Carlos Livestock




San Juan Bautista Grains Harvested



San Juan Bautista Livestock Chart




Soledad Grains Harvested



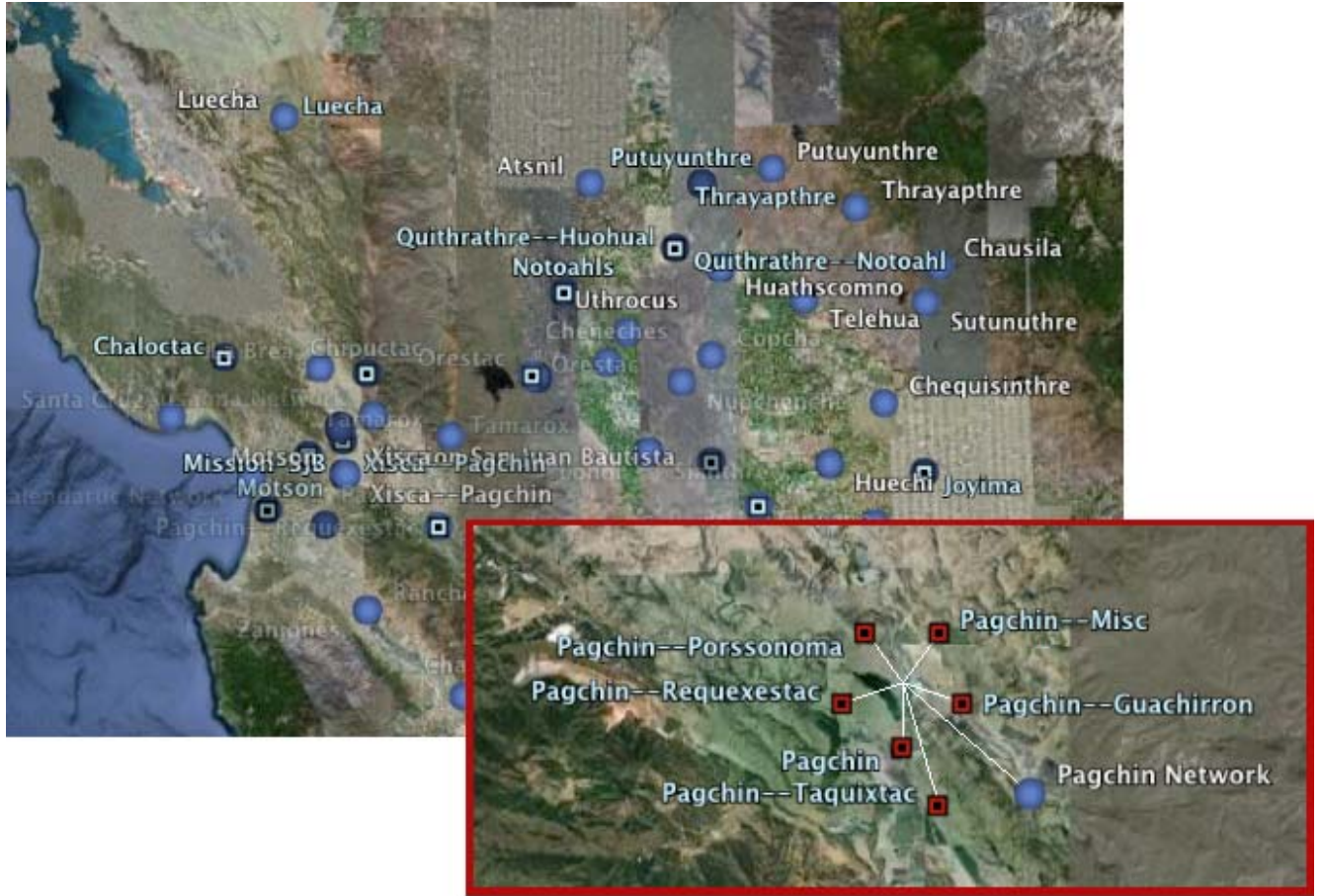
Soledad Livestock

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Figure 8: ECCA website showing village clusters and ambiguous village locations.



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