PART 1

Introduction

1.0

Problems and research questions

The urbanization of the coast presents a serious challenge to those who would preserve the quality of life for coastal dwellers and visitors, protect sensitive coastal habitats, prevent pollution of beaches and ocean, and meet the other objectives of coastal zone management programs. California has had a coastal governance system in place for over thirty years with little systematic review of the effectiveness of the system in achieving legislative goals. This project employed a systematic methodology to evaluate the effectiveness of the California Coastal Zone Management Program (CZMP) in protecting farmland[1] and to compare this regulatory approach for protecting agricultural land to other tools, namely economic incentives and purchase of conservation easements.

The California Coastal Act of 1976 identified retention of important farm- and rangeland as one of the top three priorities for land use in the coastal zone. The legislature must not have regarded the economic incentives of the Williamson Act (adopted in 1965) as sufficient to prevent conversion of valuable agricultural land within the coastal zone, since the 1976 Coastal Act employed regulatory provisions designed to minimize conversion of coastal agricultural lands. California's federally approved coastal zone management plan gave the statewide Coastal Commission significant authority to regulate development in the interest of all the state's citizens while allowing cities and counties to exercise authority in line with state standards.

In 1976, the California legislature declared "that the agricultural lands located within the coastal zone contribute substantially to the state and national food supply and are a vital part of the state's economy,"[2] and these lands "should be protected from intrusion of nonagricultural uses, except where conversion to urban or other uses is in the long-term public interest."[3] The legislature understood that the rate of population growth in coastal communities coupled with the patterns of development that foster sprawl threatened conversion of agricultural land in the coastal zone. In 2007, thirty-one years after enactment of the Coastal Act, California's coastal zone retains important farm- and rangeland. Farms in the coastal zone still make use of unique soil and climate conditions to produce high value crops, provide fresh and healthy produce to local markets, and reduce the pressure of urbanization on coastal and marine ecosystems.

In addition to the Williamson Act incentive system and the Coastal Act's regulatory provisions, the state law assigned responsibility to the Coastal Conservancy for purchasing property rights in order to implement a program of agricultural protection, area restoration, and resource enhancement in the coastal zone.[4] Private agricultural lands are included in the lands of "special significance" that may be selected by the Conservancy as appropriate for land trades.[5] Further, the Conservancy "may acquire fee title, development rights, easements, or other interests in land located in the coastal zone in order to prevent loss of agricultural land to other uses and to assemble agricultural lands into parcels of adequate size permitting continued agricultural production."[6]

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[1] The California CZMP is operated by three lead agencies: the California Coastal Commission, the California Coastal Conservancy, and the San Francisco Bay Conservation and Development Commission (BCDC). Their programs and activities combined compose the state's federal Coastal Zone Management Program (for purposes of the federal Coastal Zone Management Act of 1972). These agencies provide the framework for the California coastal regime, a social institution that sets the rules of California coastal management, defines social practices, assigns roles, and guides interactions among the occupants of these roles.

[2] 21 Public Resources Code, section 31050.

[3] Ca. Pub.Res.Code, Sec. 31051.

[4] Ca. PRC, Sec. 31054.

[5] Ca. PRC, Sec. 31104.3.

[6] Ca. PRC, Sec. 31150.

Current trends in planning aim to protect agricultural land in rural areas but pose threats to agricultural lands within and adjacent to urban boundaries. Under the New Urbanism and Smart Growth planning approaches, the trend in development is away from sprawl and toward higher density cluster housing that will minimize commuter traffic and create communities that provide jobs, shops, and recreation in more concentrated areas. This would require a dramatic shift away from ½ or 1 acre zoning to densities of 40 or more units per acre. While high-density zoning is seen as enhancing opportunities to preserve open space and agricultural land outside of urban boundaries, remaining agricultural parcels in and adjacent to urban areas may become prime candidates for conversion. Current residents who value low-density suburban and rural lifestyles often vehemently resist efforts to create high-density development. Conflicting policies and overlapping state and federal jurisdictions increase the difficulty of shifting to development strategies that limit growth to urban areas. Such conflict poses challenges to the protection of rural and agricultural areas and to upland parts of the watershed, strategies recommended in the Pew Ocean Report.[7]

Planners are also realizing that coastal land management should take place at the watershed level. California's Coastal Commission does not have jurisdiction over upland development and land use outside the coastal zone. Politically defined boundaries can undermine the protection of marine, estuarine, and coastal ecosystems affected by development outside the coastal zone. Statewide coastal policies and regulations influence land use decisions countywide, not only in the coastal zone. We explored the influence of the CZMP on local land use decisions in order to understand the dynamics of land use management in Santa Barbara and Ventura Counties.

The coastal counties of Santa Barbara and Ventura, with land both inside and outside California's coastal zone boundary, provided a unique opportunity to study and evaluate existing legal and economic mechanisms designed to prevent loss of agricultural lands. California employs a complex of economic, regulatory and legal tools to protect agricultural land: regulatory restrictions (command and control mechanisms), tax incentives, and purchase of property rights. Each of these policy instruments helps to preventing the conversion of agricultural land. The research we initiated in 2003 sought to understand the interplay among these three approaches to agricultural land retention. Specifically, we sought answers to the following questions:

1. Have the regulatory mechanisms of California's Coastal Act resulted in increased rates of retention of agricultural land inside the coastal zone?

2. Have the regulatory mechanisms of the Coastal Act affected agricultural land retention in areas outside the coastal zone not subject to the same stringent provisions?

3. Are regulatory mechanisms of the Coastal Act and local ordinances more effective in retaining agricultural land than the Williamson Act's incentive system (voluntary contracts between counties and landowners that provide tax reductions for 10 and 20 year agreements not to convert farm- and agricultural land)?

4. How do the different institutional mechanisms interact? Taken together do they protect agricultural land against the socio-economic drivers of conversion such as rising land values and loss of agricultural infrastructure to support a farm economy?

5. What are the conditions that constrain effectiveness of each of these mechanisms for retaining agricultural land?

6. Using mapping and modeling, what would different future scenarios look like if Coastal Act or Williamson Act provisions were removed?

7. Given what can be learned about the study area and its context, what changes in the coastal institutions (management, policies and practices) would be needed to prevent the loss of remaining agricultural land in coastal counties? Do these local recommendations have regional or statewide utility?

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[7] Dana Beach, Coastal Sprawl: the effects of urban design on aquatic ecosystems in the United States. Report prepared for the Pew Ocean Commission, 2002, available at http://www.pewtrusts.org/our_work_ektid30037.aspx .

To address these issues we studied the dynamics of agricultural land conversion in two of California's coastal counties and examined the role of local (county and city) and state decisions on agricultural land conversion and retention. We sought to determine the relative importance of incentive based institutions, regulatory tools, and purchase of property rights in retaining agricultural land. We created GIS maps showing past changes and used these to model scenarios of possible futures for agricultural land in these two counties. Based on these maps, modeled scenarios for the future, review of relevant literature, in depth interviews and a survey of landowners, we offer recommendations to improve the effectiveness of the institutions that determine land use in California's coastal counties. While important to the coastal areas, the findings are also useful to inform policy decisions for California's Central Valley, an agricultural area where population is expected to triple by 2040 (Bradshaw, et al. 1998).

1.1 Building on past modeling

A team in the Department of Geography at UCSB, headed by Professor Keith Clarke, developed an urban growth and land use change model (SLEUTH) that has been applied in many different parts of the world. Many applications, however, did not analyze the policy drivers of land use change nor study how local and state decisions have affected land use. This application of SLEUTH uses extensive data sets created for the two test counties and links the discernable land use changes over a 30 year period to changes in laws, regulations, land use plans, zoning, and land use decisions of local, state, and federal agencies. Coupling GIS and modeling methods with study of local and state land use decisions, we have calibrated the model to project the future in more meaningful ways. For instance, the Excluded Layer of the SLEUTH model considers certain areas off limits to development. The agricultural lands are considered only by the users choice (i.e., the user decides if they are 50% protected, 100%, etc.). This research enabled us to use the Coastal Zone and the Williamson Act to create a more complex Excluded Layer that integrates the conclusions garnered from this research. The GIS data were previously complete for the Southern part of Santa Barbara County only (with the exception of newer land use data (post-1984) and current Williamson Act data. To this, we added land use data for the Northern part of Santa Barbara County and for Ventura County as well as older Williamson Act histories for both counties.

SLEUTH has already been explored as a means to forecast land use changes and their environmental consequences, for example by the EPA, in Brazil, and in micrometeorology.[8] Other SLEUTH forecasts for Santa Barbara's South Coast are among the most detailed SLEUTH applications to date and at the highest levels of spatial and attribute resolution.[9]

1.2 Methods

This study of land use change employed a collaborative approach that integrates social science with complex spatial analysis techniques and enhances quantitative data with qualitative data. We used existing spatial datasets (e.g. GIS parcel layers, historical aerial photography, remote sensing) to develop an understanding of the land use change history in Santa Barbara and Ventura counties and integrated this with a historical study of coastal and agricultural land use policies, structured interviews, and a survey of agricultural landowners. The overriding challenge of this project has been to find ways to determine how much agricultural land would remain in the absence of the Coastal Zone Management Planrogram and/or the Williamson Act? Would urbanization have spread more extensively beyond the urban/rural boundaries established in current county maps and land use plans?

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[8] C. Gaunt and L. Jackson, "Models for Assessing the Effects of Community Change on Land Use Pattern,". in S. Geertman and J. Stillwell, eds. *Planning Support Systems in Practice*. Berlin: Springer (2002); S. Leao, I. Bishop and D.Evans, "Spatial-temporal model for demand and allocation of waste landfills in growing urban regions," *Computers, Environment and Urban Systems* 28 (2004):353-385; S.T. Arthur,. A Satellite Based Scheme for Predicting the Effects of Land Cover Change on Local Microclimate and Surface Hydrology. Doctorate Thesis, College of Earth and Mineral Sciences, Pennsylvania State University (2001).

[9] The SLEUTH approach of modeling for regional planning in the area may be seen at http://www.geog.ucsb.edu/~kclarke/Landuse/files/v3_document.htm.

We employed three methods to respond to the challenge:

A. Built a GIS database of the study area to conduct an analysis of agricultural land conversion from two decades prior to creation of the CZMP (1945 for Ventura, 1954 for Santa Barbara) to the present.[10] We used this to compare conversion rates prior to establishment of the CZMP, following creation of the Coastal Commission in 1976, after certification of local coastal programs (in the early 1980s). The analysis relied on aerial photography for the pre-1984 land use classifications and the Farmland Monitoring and Mapping Program (FMMP) for the post 1984 land use, as well as other existing datasets (e.g. US Census, FRAP/CDF, DWR land use data, and NOAA). We analyzed patterns, rates and trends of agricultural land use transitions over time and space (e.g. inside and outside the coastal zone), investigating the conversion phenomenon qualitatively (e.g., land transition information) and quantitatively (e.g., area converted). This geographical analysis required deriving quantitative descriptive measures of the observed changes and driving factors (e.g., probabilities derived from observed phenomena regarding likelihoods of parcels converting given their regime as well as proximity to urban areas) of land use change for each one of the time periods. Tools for this step included ArcGIS and analytical packages bundled in ArcToolbox as well as Excel.

B. Simulated different land use scenarios and generated forecasts. Once we assembled the data, we calibrated the SLEUTH model with the historically known Excluded layers existing in Santa Barbara and Ventura Counties. We used the data gathered in our GIS analysis to run the SLEUTH model to simulate land use conversion scenarios with various combinations of policy restrictions controls, and explored the different scenarios.

C. Formulated, disseminated, collected, and interpreted surveys and questionnaires to both landowners and institutions. We hoped to ground our more deterministic modeling in a human framework so that possible important pieces of our modeling could be checked and so that we could flesh out the story of land use change. As will be explained in Part 3 of this report, we were only able to collect a small sampling of completed surveys (13 in all), and thus have used these to further explain landowner motivation and behavior, as well as to enhance information from the literature survey and interviews with landowners, land planners, and others knowledgeable about land use in the study area.

1.3 Related research

Past evaluations and reports have provided considerable time-sequenced data and information on the evolution of the California coastal regime, but they have not provided the systematic and independent evaluation of the coastal regime. The state and federal authorities have conducted these periodic evaluations of the CZMP and related acts at roughly 5-year intervals.[11] Mandated by law, they provide summaries of activities over relatively short spans between evaluations, highlight issues relevant at the time, and recommend specific amendments to the legal framework, changes in implementation or enforcement, and allocation of funding. In the 1990s, those concerned with the decline in quality and quantity of ocean resources focused renewed attention on the need to understand the interaction of land and ocean and the impact of pollution and land use decisions (made both in the coastal zone and areas further inland) on marine life. California issued a substantial report in 1997 entitled California's Ocean Resources: An Agenda for the Future that summarized a number of statutes and agency roles, analyzed major ocean resource management issues, and provided policy relevant recommendations. That report did not examine in any depth the impacts of the California coastal regime. It does, however, include useful data, and it highlights critical issues.

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[10] The GIS data is available on the internet through the Alexandria Digital Library at UCSB and the ESRI Geography Network.

[11] NOAA's Office of Ocean and Coastal Resource Management evaluates the performance of the CZMP periodically, as required by Section 312 of the federal Coastal Zone Management Act. The most recent evaluation covered the period from December 1996 through May 2001, http://www.coastal.ca.gov/ocrm-eval-california.pdf . To mark the 20th anniversary of the Coastal Act, the journal *California Coast & Ocean* devoted several articles in its winter 1996-97 issue to assessment of the Act and its operation noting major accomplishments and future directions.

The Coastal Commission has completed three studies of cumulative impact in the coastal zone under the Regional Cumulative Assessment Project (ReCAP); one of these overlaps a small portion of our study area in Ventura but does not focus on agricultural land conversion.[12] These contain useful information showing changes over time.

The use of Remote Sensing (RS) and GIS for coastal applications and management dates from the 1960s and constitutes an increasing trend that is gaining wider acceptance among scientists and stakeholders.[13] Decision-makers have recognized the value of these technologies to scientifically ground their decisions and are adopting them to increase the efficiency of coastal area management.[14] Coastal GIS-RS research includes a wide range of applications (e.g., water quality assessments, oil spill remediation, coastal hazards, and open space conservation). Literature regarding integrated coastal agricultural lands monitoring, specifically in relation to coastal management policies, is limited and focuses on non-agricultural objectives of coastal protection such as protection of estuaries and wetlands.[15]

Several land use and land cover change programs such as NASA's Land Cover Land Use Change Program (LCLUC) and the NOAA Coastal Change Analysis Program (C-CAP) are currently in place. The C-CAP uses satellite imagery, aerial photography, and fieldwork to track land cover change along the nation's coastal zone. Also, extensive research in understanding urban dynamics has culminated in the development of land use change models[16] such as the Keith Clarke's SLEUTH model, which covers our study area.

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[12] Regional Cumulative Assessment Project (ReCAP), http://www.coastal.ca.gov/recap/rctop.html . The assessment for the Santa Monica Mountains/Malibu includes part of Ventura County.

[13] Dawn J. Wright and Darium J. Bartlett, Eds., Marine and Coastal Geographic Information Systems. Research Monographs in GIS Series (Taylor & Francis, 2000).

[14] R. Welch, M. Remillard and J. Alberts, 1992. Integration of GPS, remote sensing and GIS techniques for coastal resource management. *Photogrammetric* Engineering and Remote Sensing, 58(11):1571-1578. (NOAA Center, 2001).

[15] Hershman, M.J., Good, J.W., Bernd-Cohen, T., Goodwin, R.F., and Lee Pan Pogue, V. 1999. The Effectiveness of Coastal Zone Management in the United States. *Coastal Management*, 2: 113-138.

[16] C.Agarwal, G.M. Green, J.M Grove, T.P.Evans, and C.M. Schweik. A Review and Assessment of Land-Use Change Models. Dynamics of Space, Time, and Human Choice. CIPEC Collaborative Report No.1. USFS Publication GTR-NE-297(Bloomington, IN: *Center for Study of Institutions, Population and Environmental Change*, 2002) available at: http://www.srs.fs.usda.gov/pubs/viewpub.jsp?index=5027.