Results & Discussion

Combining the development prediction models and hydrology analysis produced results for 485 parcels. Each development model provides a unique methodology to predict development pressure (see table). Overall , high development pressure is predicted adjacent to existing urban growth boundaries in the region of interest. A decision guidance database was developed containing project results as well as potentially relevant agricultural and ecological characteristics for each parcel.

SLEUTH Model	Weighted Overlay Analysis
Successful prediction record at regional scales	Ordinal ranking of development pressure
Primarily based on historical development patterns	Utilizes current spatial features and policies
Highly scrutinized, updated, peer reviewed	Expert input and validation of factors and weights

Objective II: Easement Valuation

ACEs will allow for continued agricultural production and limit future development of a property. In general, the value of an ACE is the value of the development right of a property. Because there is no accepted price of ACEs in Ventura County, four methodologies were developed to determine their value.

Method 1: Income Capitalization

The Net Present Value (NPV) of agriculture was subtracted from the fair market value (FMV) of the land. The result was the value of the development right (VDR) of the property.

$$VDR = FMV - NPV\ Agriculture$$

Method 2: Sales Comparison

Fair market land values from our region of interest were compared with land values in counties with similar agricultural values but drastically lower development pressure (DP). The result was the VDR.

$$VDR = FMV_{high\ DP} - FMV_{low\ DP}$$

Method 3: Easement Comparisons

Using the California Farmland Conservancy Program's easement database, appraised values for easements with similar agricultural values and development pressure to Ventura County were calculated.

Method 4: Discounting the Development Right

Used the VDR of a developed parcel to extrapolate the future value of that right on adjacent agricultural properties. Estimates were made for future development scenarios of 25-100 years.

Recommendations

I. Initial easement acquisition efforts should be focused on top priority parcels occurring in both Tier 1 model results. After initial acquisition of top priority parcels, further easement purchases should focus on parcels in Tier 1 of either development/hydrological grouping.

II. The results of the easement valuation methodologies provide a framework for TNC to begin acquiring easements as well as justification for easement value.

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Multi-benefit Floodplain Conservation through Prioritization of Agricultural Conservation Easements

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The Nature Conservancy
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MESM Group Project Brief **Spring 2013**

Introduction

Natural floodplains are unrestricted by flood control structures and provide a multitude of ecosystem services to regions. Constriction of natural floodplains by flood control structures results in the loss of these ecosystem services and requires extensive financial and social resources to replace them.

The Santa Clara River in Ventura County has one of the last remaining natural floodplains left in Southern California. It provides many ecosystem services including high value agriculture, threatened and endangered species habitat, and downstream flood control. In 2011, the Ventura County Watershed Protection District estimated that the Santa Clara River's natural floodplain prevents downstream flood damages of $204 million and $1.05 billion during a 100-year and 500-year flooding event respectively.

Recognizing the value of the natural floodplain of the Santa Clara River and the increasing threats from urbanization, The Floodplain Working Group, led by The Nature Conservancy (TNC), implemented the Natural Floodplain Protection Plan (NFPP) with the goal of conserving critical parcels within the 500-year floodplain of the lower Santa Clara River. TNC approached the Bren School to help accomplish the goals of the NFPP by prioritizing parcels in the floodplain for agricultural conservation easement acquisition. These easements will protect the floodplain's ecosystem services by retaining its high value agriculture and preventing future constriction.

Project Objectives

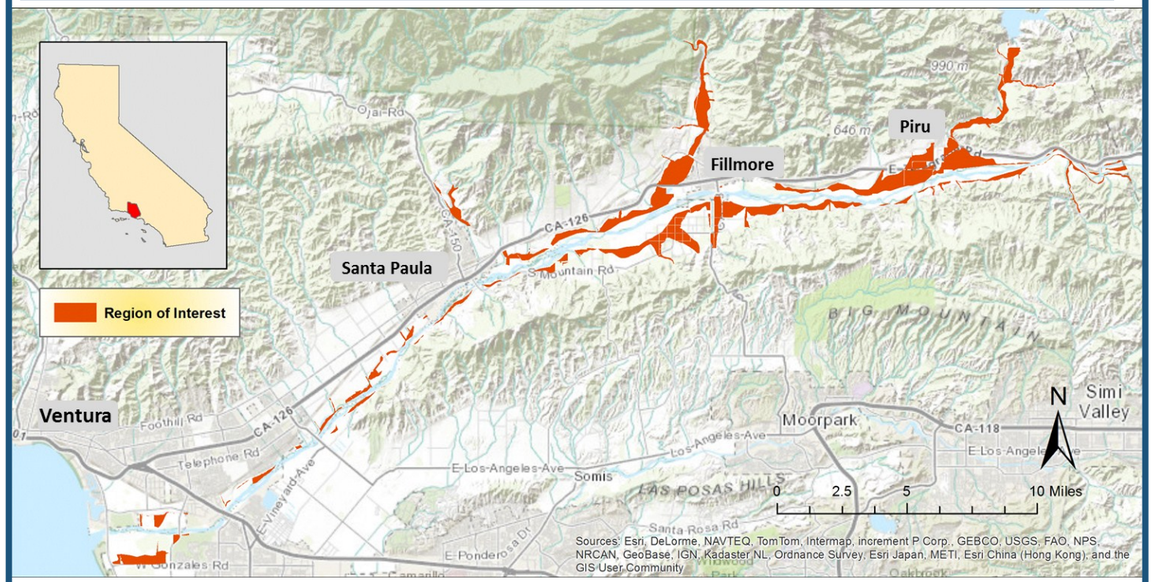
I. Prioritize the acquisition of agricultural conservation easements in the floodplain of the lower Santa Clara River in order to maintain the extent of the natural floodplain by avoiding further structural flood control while preserving its ability to attenuate downstream flooding.

II. Develop methodologies to determine a fair market price for agricultural easements in Ventura County and provide a range of estimates according to these methodologies.

Agricultural Conservation Easements

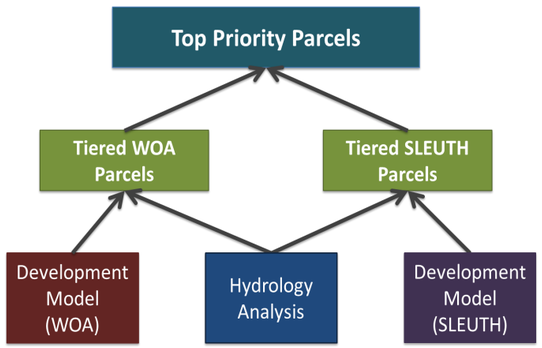
An Agricultural Conservation Easement (ACE) purchases the development rights of a property, which allows farmers to supplement their income while lowering their tax burdens. Beyond their primary objective of farmland preservation, ACE's have also been used to reinforce local land use policies that restrict sprawl by establishing greenbelts around cities while providing open-space and wildlife corridors to satisfy conservation objectives.

Region of Interest



Objective I: Prioritizing Parcels for Easement Acquisition

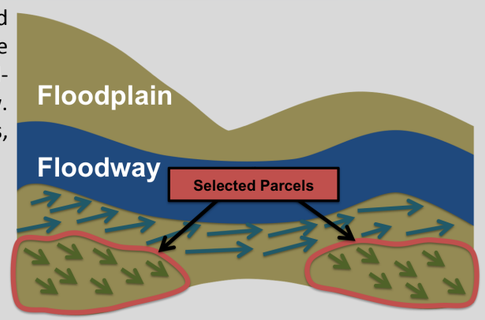
The prioritization of parcels in the region of interest took into account two factors: development pressure and potential downstream flood reduction benefit. Two development prediction models were used to estimate the development pressure for each parcel in the region of interest. The Weighted Overlay Analysis model scored and ordinally ranked parcels based on development pressure. The SLEUTH Model assigned parcels a probability of development in the next 50 years. A hydrological analysis identified parcels that provide potential downstream flood reduction benefits using a divert, slow, and hold methodology developed for this project. Based on the results of these three analyses, parcels along the mainstem of the Santa Clara were placed into tiers in order to prioritize easement acquisition.



Hydrology Analysis

Flood reduction benefits are defined as areas that redirect flood waters away from the main river channel, thus diverting some quantity of water out of the floodway and reducing the total volume of water traveling down the system during times of high flow. In order to identify parcels that provide flood reduction benefits, parcels were selected that met the following criteria:

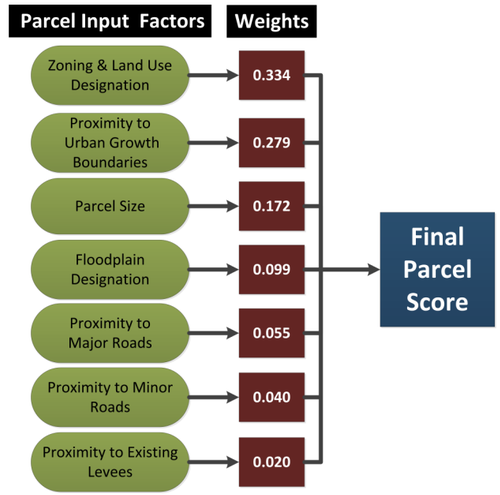
1) Direction: parcel diverts floodwaters away from the floodway
2) Holding: parcel holds floodwaters for some amount of time in the floodplain fringe, measured as an average volume
3) Speed: parcel slows the speed of diverted waters from the floodway



Development Prediction Models

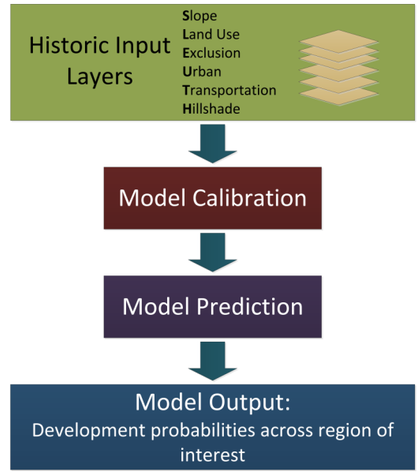
Weighted Overlay Analysis

Weighted Overlay Analysis models use a combination of multiple weighted spatial layers to produce a comparable metric for analysis. They are used to solve multi-criteria problems such as site selection and suitability. This Weighted Overlay Analysis used seven input factors. These factors were weighted with consultation from TNC and local government agencies using the Analytical Hierarchy Process to best identify development pressure in the region of interest. Each input factor's attributes were assigned scores based on its contribution to development pressure. The seven input factor scores were combined for each parcel in the model to develop a final Weighted Overlay Analysis score used to prioritize parcels for acquisition.



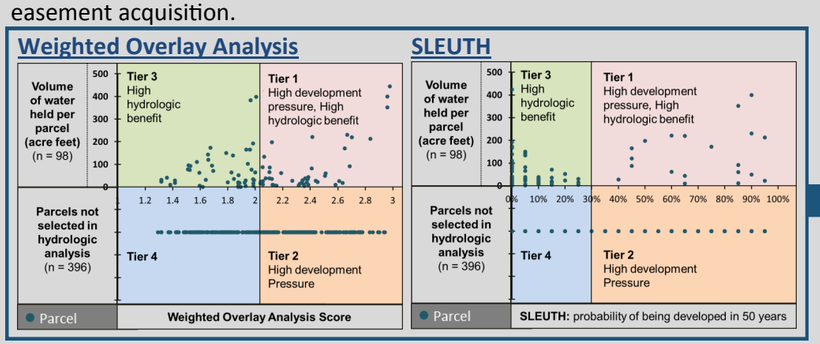
SLEUTH

The SLEUTH Urban Growth Model is a cellular automaton model that uses historical land use change patterns to inform model parameters that are used to predict urban development. SLEUTH (Slope, Land use, Exclusion, Urban, Transportation, Hillshade) was developed by Keith Clarke of the UCSB Geography Department and has been used throughout the world to predict regional urban growth. Three development scenarios were run using different exclusion layers. The primary scenario uses the allowable uses and restrictions associated with zoning designations as a basis for various levels of development exclusion. The final results of the SLEUTH model provide a probability of development for the next 50 years for each parcel in the region of interest.



Combination of Hydrology and Development Models on a Parcel Scale

The results of the development models were combined with the hydrology analysis to divide the parcels into four tiers. Parcels in tier one were identified as those with highest development pressure and as having a contribution to downstream flood reduction. Parcels present in both tier one groups are top priority for easement acquisition.



Tiers	Number of Parcels	
	Weighted Overlay Analysis	SLEUTH
One *High Development Pressure + High Flood Benefit*	44	22
Two *High Development Pressure*	199	131
Three *High Flood Benefit*	52	74
Four *Low Development Pressure + Low Flood Benefit*	190	258