

Multi-benefit floodplain conservation through prioritization of agricultural conservation easements



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Introduction

Natural floodplains are those that are unrestricted by flood control structures, (e.g. levees, dams, river channelization). They provide a multitude of ecosystem services to nature and society, including rich agricultural soils, groundwater recharge, aquatic and riparian habitat, recreational value, and downstream flood control. Constriction of the natural floodplain by flood control structures results in the loss of these ecosystem services and requires extensive financial and social resources in order to replace them.

The Santa Clara River, in Ventura County, has one of the last remaining floodplains in Southern California that remains in a relatively natural state without extensive flood control structures. It provides many of the ecosystem services described above, 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 provides an avoidance of \$204 million and \$1.05 billion in downstream flooding damages during a 100-year and 500-year flood event respectively.



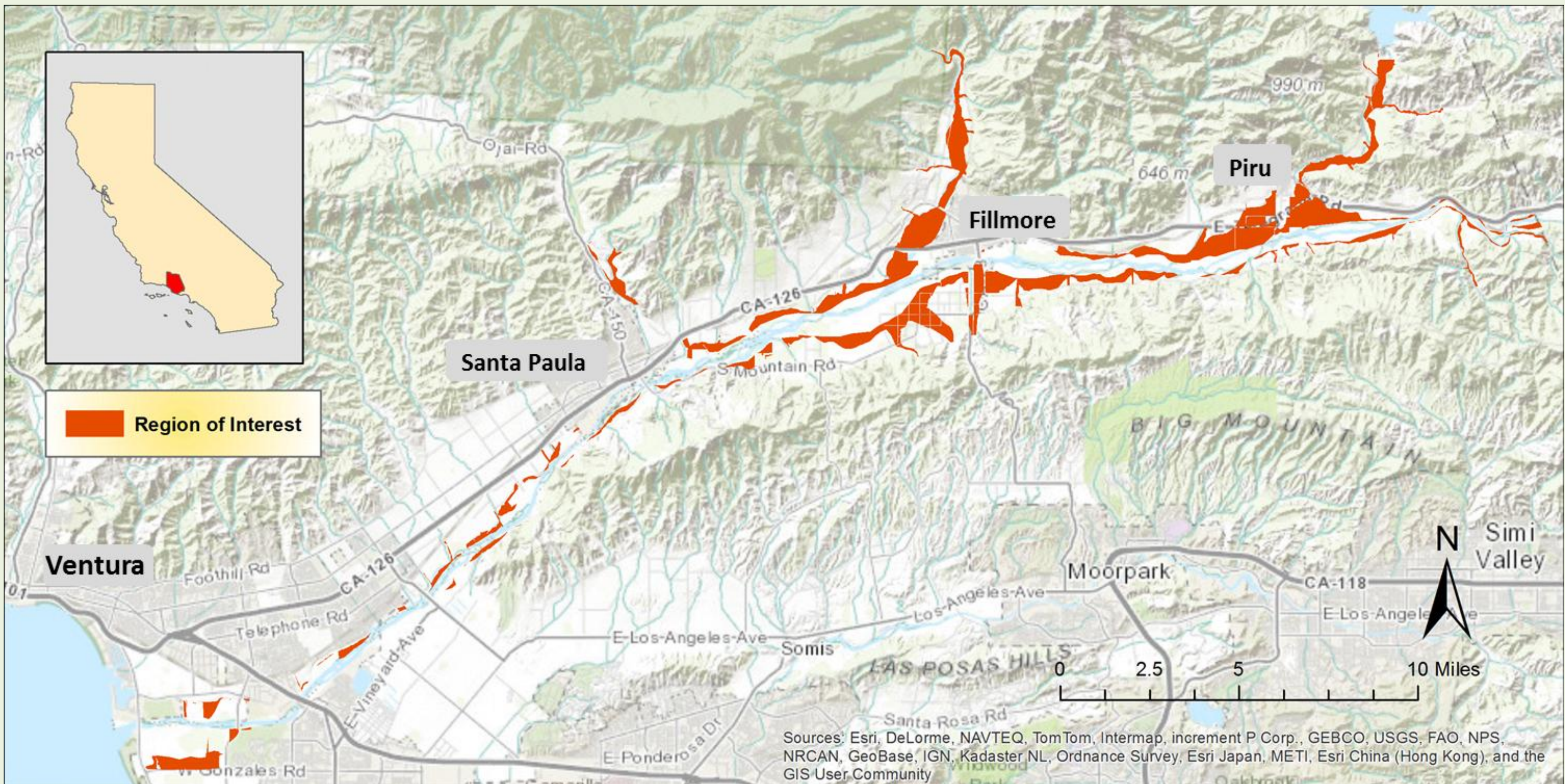
Recognizing the value of the natural floodplain of the Santa Clara River and the increasing threats from urbanization, The Floodplain Working Group, led by The Nature Conservancy, implemented the Natural Floodplain Protection Plan (NFPP) with the goal of conserving critical parcels within the 500-year floodplain of the lower Santa Clara River and protecting the ecosystem services the natural floodplain currently provides. TNC approached the Bren School to help with accomplishing 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 parcels for purchase of agricultural conservation easements in the 500-year floodplain of the lower Santa Clara River that will best achieve the objectives of the Natural Floodplain Protection Plan. These objectives include maintaining the extent of the natural floodplain through avoidance of 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.

Region of Interest

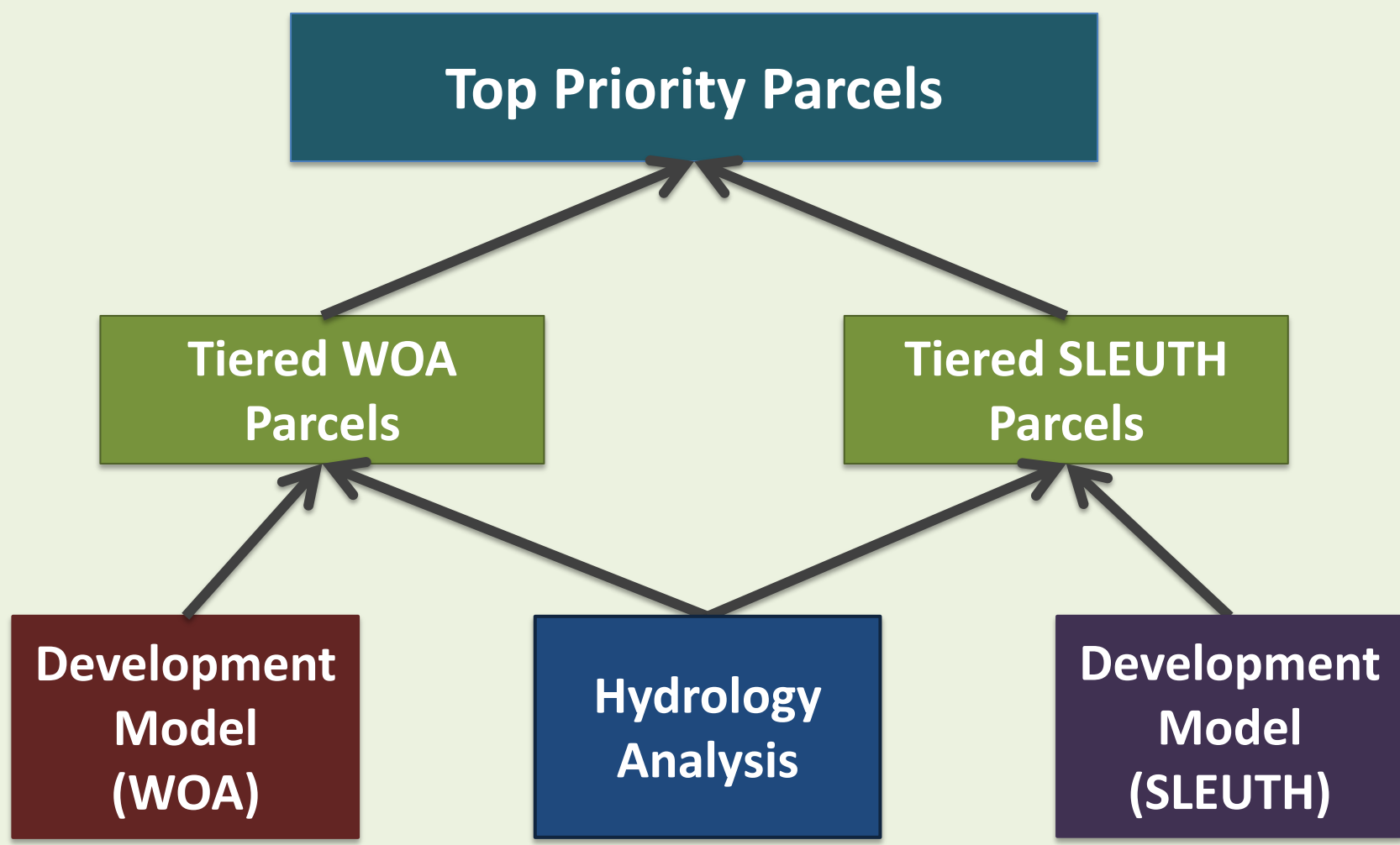
Analysis was completed for the FEMA designated 500-year floodplain of the Santa Clara River in Ventura County. Parcels within the 500-year floodplain and outside of floodway (where development is prohibited) have been prioritized for easement acquisition. Additionally, lands within city urban growth boundaries, behind permanent levees, or already protected, were removed from the analysis.



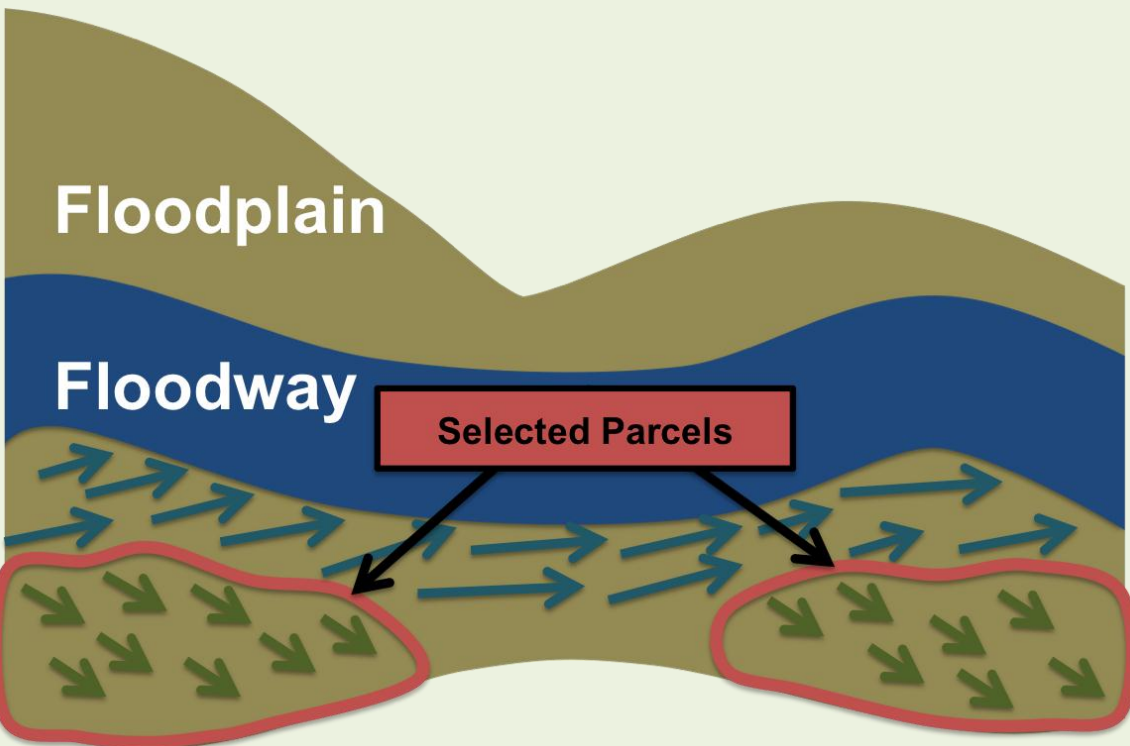
Santa Clara River floodplain in Ventura County with the region of interest in orange

Objective I: Prioritization

With guidance from TNC and the Ventura County Watershed Protection District, two criteria were determined to be most important in prioritizing easements for acquisition: (1) development pressure and (2) downstream flood benefit. Parcels with higher development pressure were assumed to be more likely to contribute to floodplain constriction because of the association of development in the floodplain with structural flood control. Two complementary models were used to quantify development pressure: (A) a Weighted Overlay Analysis, which scored and ranked parcels based on seven input factors and (B) the SLEUTH urban growth model, which used historical development trends to predict the likelihood of development in the next 50 years. Downstream flood reduction benefits were identified using a hydrology analysis that ranked parcels based on their ability to divert, slow, and hold floodwaters. Combining these three analyses, as shown in the adjacent figure, allowed parcels to be tiered for easement prioritization.



Hydrology Analysis

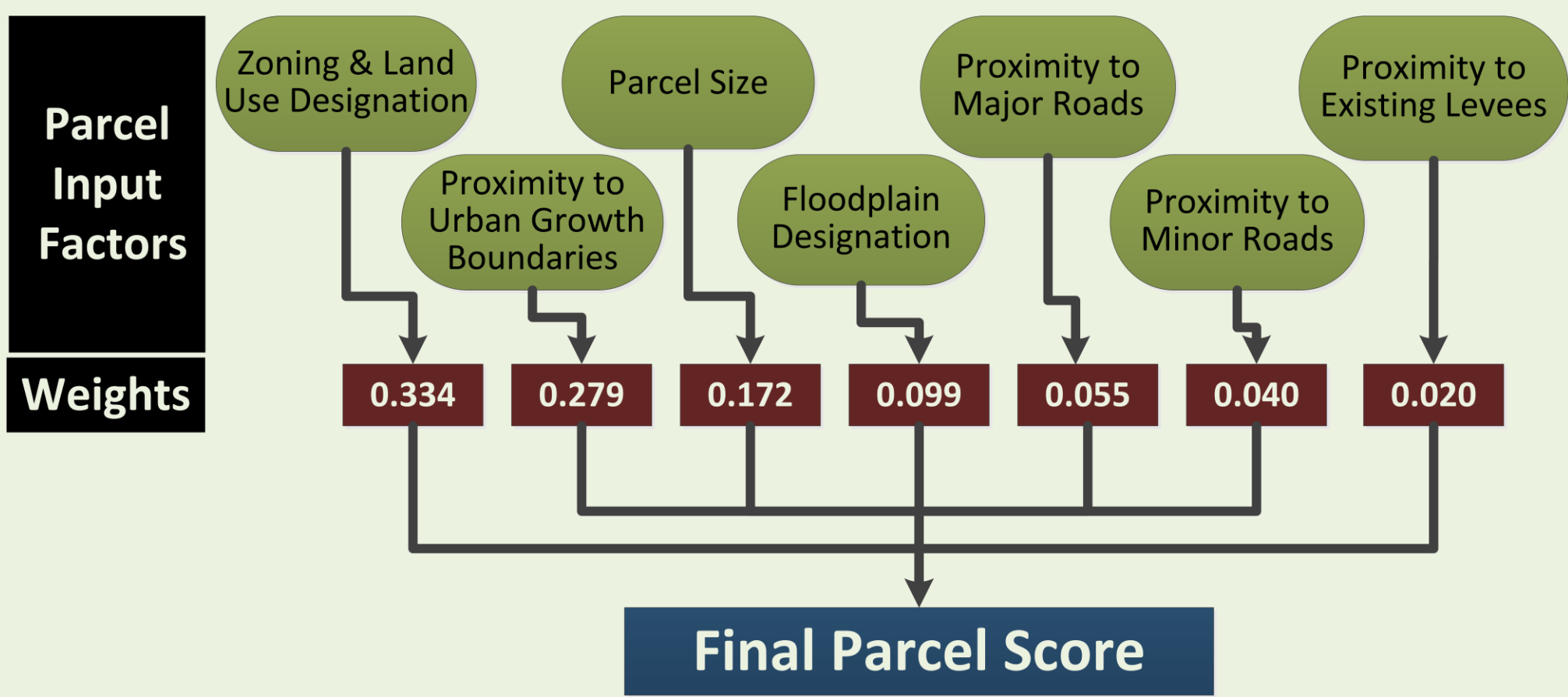


- Parcels that met the following criteria were identified to provide downstream flood reduction benefits:
- 1. **Direction:** diverts floodwaters away from the floodway
 - 2. **Holding:** holds floodwaters for some amount of time in the floodplain fringe
 - 3. **Speed:** slows the speed of diverted waters from the floodway

Development Models

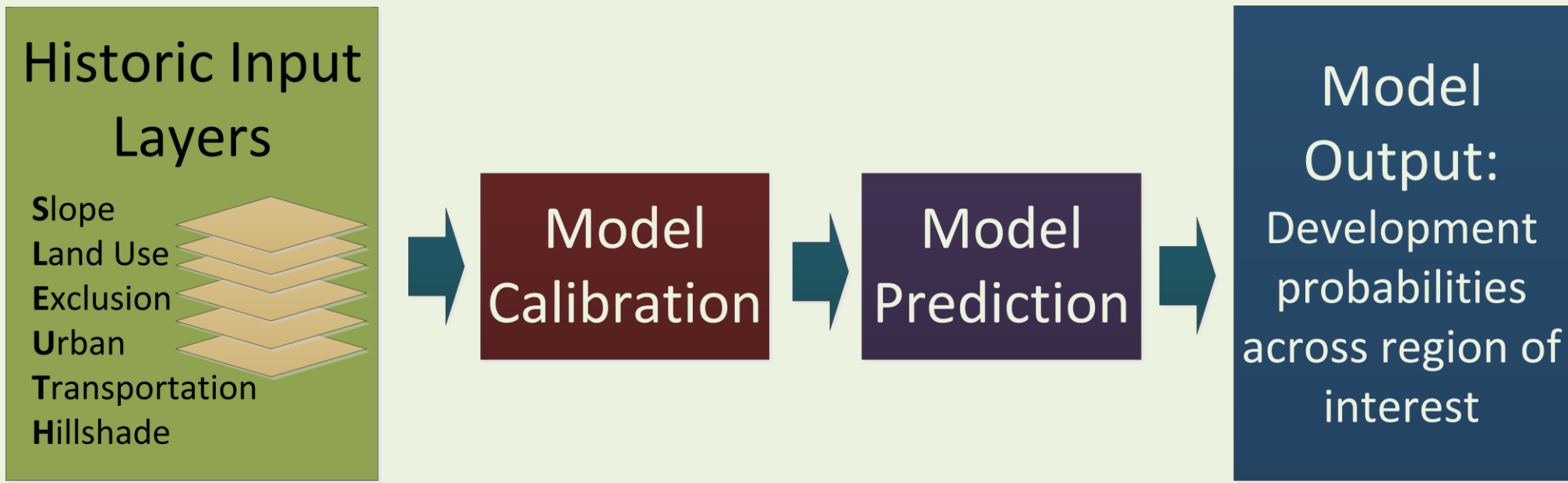
Weighted Overlay Analysis

Weighted Overlay Analysis models use multiple spatial layers to produce a comparable metric for multi-criteria problems such as site selection and suitability. Seven input factors were used to determine development pressure in the region of interest (see adjacent figure). Each of these factors was assigned a weight using the Analytical Hierarchy Process with guidance from TNC and local government agencies. The input factor scores were combined for each parcel to develop a final parcel score identifying areas with the highest development pressure.



SLEUTH

The SLEUTH Urban Growth Model uses historical land use change patterns to develop model parameters that are used to predict urban development (see adjacent figure). 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.



Results

Each parcel in the region of interest was ranked based on the combination of the hydrology analysis and development models. 18 parcels occur in both tier one outcomes and are recommended as top priorities for easement acquisition.

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

Objective II: Easement Valuation

Agricultural Conservation Easements (ACE) 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 for 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.

$$VDR = FMV - NPV \text{ Agricultural Rents}$$

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: Discounted Value of 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.

Conclusion & Recommendations

- I. The results of this analysis will guide TNC’s agricultural conservation easement acquisitions in the lower Santa Clara River Floodplain. Eighteen top priority parcels were identified for initial acquisition that both contribute to downstream flood reduction and have the highest development pressure. Acquisition efforts beyond these 18 parcels should focus on those parcels in the tier one categories. Further, recognizing that TNC may consider other factors beyond those included in the prioritization model in their easement acquisition strategy, a decision guidance tool was developed containing project results as well as agricultural and ecological characteristics for each parcel in the region of interest. This tool will guide acquisition into the future as priorities change.
- II. The results of the easement valuation methodologies provide a framework for TNC to begin acquiring easements as well as justification for easement value.

Overall, the framework of this analysis could and should be used in other river systems to protect natural floodplains and the many benefits they provide into the future. Additionally, further work could be focused on incorporating more rigorous hydrology methodology as well as climate change projections into the prioritization model.

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Photos courtesy of The Nature Conservancy



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