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THE IMPACT OF URBAN GROWTH BOUNDARIES ON FUTURE URBANIZATION

INTRODUCTION

The economic development and land use policies pursued in Southern California throughout most of the twentieth century encouraged rapid population growth and urbanization of land. The five counties of Southern California – Los Angeles, Orange, Riverside, San Bernardino, and Ventura – currently support 16 million people, a sevenfold increase since 1900. The growth shows no signs of waning, with the five counties adding 2 million people during the 1990s.

The land conversion pattern is "… spatially organized around the assumptions of the suburban era: that it serves a middle-class suburban population engaged in a middle-class suburban economy; that the supply of buildable land is practically unlimited … that Los Angeles has grown by moving on to the next valley" (Southern California Studies Center 2001). Because this pattern has exerted considerable pressure on the region's resources, including its land supply, policymakers and planners have been forced to reassess traditional development scenarios as they address future urban growth inside their borders.

Although awareness of the regional nature of growth problems has grown (e.g., Lusk Center for Real Estate 2003), little work has been done to forecast the likely future impact of growth on farmland and ecologically sensitive areas. The research in this article provides a starting point for such analysis and as such, was motivated by our desire to learn whether voter approval of SOAR boundaries was likely to alter the course of future development in Ventura County. A two-part methodology was chosen that aimed to answer the following research questions:

How is the spatial pattern of growth likely to vary under different local policy constraints if the population increases by 25% during the next 15-30 years?

How sensitive are farmland and a series of natural vegetation cover types to these urban growth patterns?

Ventura County in 2000

Ventura County is unique in Southern California in terms of its approach to growth. Beginning in the early 1970s, the county and its cities took strong steps to channel urban growth into cities and protect agricultural land in unincorporated areas. By agreeing on the so-called "Guidelines for Orderly Development" and a series of greenbelts between cities, the county and its cities first sought to contain urban development within cities' Spheres of Influence (SOI) boundaries, while permitting these boundaries to expand as new urban development was required. Agricultural zoning was retained in most unincorporated areas, and most agricultural landowners also participated in California's Williamson Act program, which provides lower property taxes in exchange for long-term commitments to retain undeveloped land in agriculture (Ryan, et al., 2003). In 1995, citizen activists throughout the county began to promote a new growth management technique that seeks to create more formal urban growth boundaries that cannot be changed without a vote. In a series of elections between 1995 and 2000, voters approved Save Open Space and Agricultural Resources (SOAR) boundaries to limit growth and thereby preserve farmland in and around eight of ten cities.

The result of all these efforts is a county that is both urban and rural with a distinctive spatial structure (see Figure 1). The northern two-thirds of the county is part of Los Padres National Forest and the bulk of the 756,400 residents in 2000 were spread among ten cities. The county leads the nation in lemon production and produces substantial quantities of other fruits and vegetables. Open space preservation efforts in the eastern part of the county have focused on the Santa Monica Mountains National Recreation Area, which was established in 1978 and today constitutes a large protected zone extending from Point Mugu in the west to the Hollywood Freeway (in Los Angeles County) in the east. The growth management and open space preservation policies implemented prior to SOAR have created a distinctive landscape in which all the cities but one are separated from one another by greenbelts of farmland and natural vegetation.

Table 1 presents statistics on the county's population and land use. Between 1986 and 2000, the population in the county

Figure 1

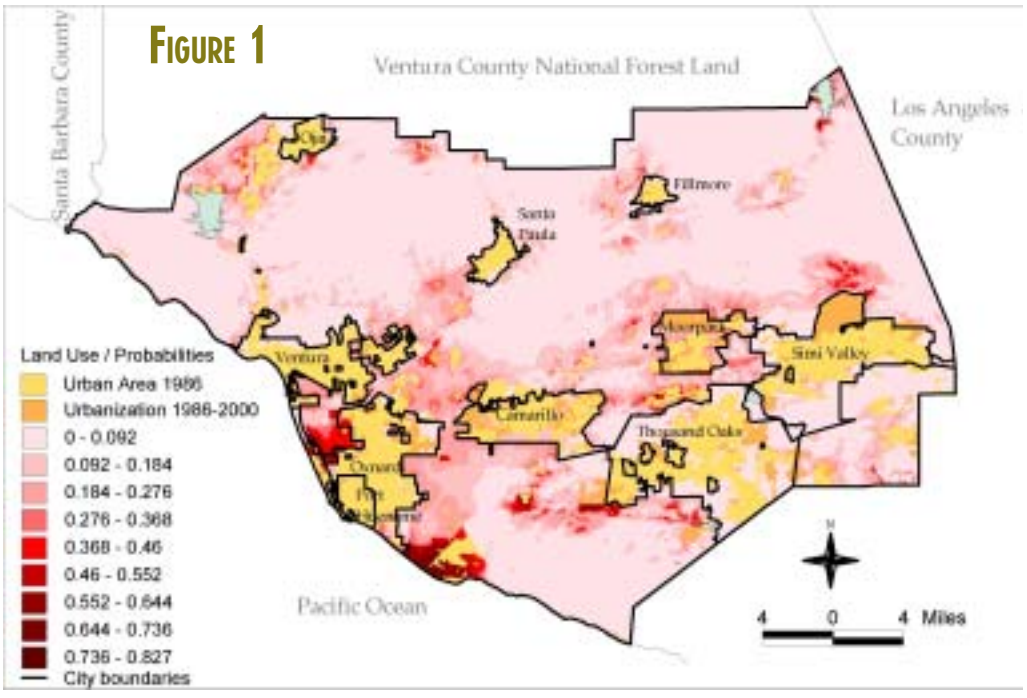


Table One: Ventura County Population and Land Use Metrics in 2000								
	Population			Land Use (acres)				
Political Unit	Residents	Percent Change Since 1986	Density	Urban	Open Space	Farmland	Sensitive Lands	Other Lands
Camarillo	63,300	+37.3	7.1	8,890	0	2,085	350	455
Fillmore	13,250	+20.5	11.6	1,140	0	235	280	120
Moorpark	29,750	+95.1	5.5	5,390	0	85	235	2,280
Ojai	8,250	+10.4	3.8	2,175	0	110	60	255
Oxnard	160,300	+24.1	12.4	12,970	0	2,790	535	850
Port Hueneme	23,500	+19.0	8.6	2,740	0	0	45	5
Santa Paula	27,250	+14.7	11.9	2,290	0	195	385	85
Simi Valley	113,000	+27.7	8.5	13,310	565	30	3,320	4,090
Thousand Oaks	120,700	+25.6	6.9	17,565	8,735	30	1,275	4,160
Ventura	103,500	+19.4	9.4	11,035	205	535	875	350
County	93,600	+16.3	3.3	28,250	36,865	106,490	194,275	77,080
Total (T) / Average (A)	756,400	+25.2	7.2	105,755	46,370	112,585	201,635	89,730
	T	A	A	T	T	T	T	T

grew by 25%, or 150,000 new residents. Cities grew at a slightly faster rate than unincorporated areas: Moorpark nearly doubled in size, and Camarillo, Simi Valley, and Thousand Oaks also recorded large increases. The average population density of 7.2 residents per acre changed little from 1986 to 2000 indicating that new developments supported similar densities to those present in 1986. Densities in 2000 ranged from 3.3 people per acre in unincorporated parts of the county to 12.4 people per acre in Oxnard.

Nearly one-fifth of the county (as defined for this research project), including 70% of the land inside city limits, was developed in 2000. Totals varied considerably from city to city: at least 75% of the land within the city limits of Camarillo, Ojai, Oxnard, Port Hueneme, Santa Paula, and Ventura was urbanized in 2000, in contrast to Moorpark, Simi Valley, and Thousand Oaks, where one-third or more of the land was still undeveloped . Only 6.4% of the unincorporated part of the study area was built up in 2000. The urban area in Moorpark more than doubled during this period, and double-digit percent increases were also recorded in Camarillo, Fillmore, Oxnard, Simi Valley, Thousand Oaks, and unincorporated areas of the county.

Most of the parkland, designated open space, farmland, and environmentally sensitive lands (comprised of steeply sloping lands, floodplains, and wetlands) in 2000 was located in unincorporated areas in the county and in Thousand Oaks, Simi

Valley, Oxnard, Camarillo, and Moorpark. Farmland accounted for 25% of the non-urban portion of the county in 2000 and some farmland occurred inside the city limits of Camarillo, Oxnard, Fillmore, Ojai, Santa Paula, and Ventura. Most of the farmland, as expected, occurred in unincorporated areas. Nearly two-fifths of the non-urban area consists of slopes exceeding 25%, and these steep slopes were especially prevalent in unincorporated areas and in Simi Valley, Thousand Oaks, and Ventura. "Other Lands" are non-urban land in 2000 that was privately owned, gently sloping, located outside floodplains, and used for something other than farming. Thousand Oaks, Simi Valley, and Moorpark have considerably more land of this type within their jurisdictions than other cities. Three cities – Fillmore, Port Hueneme, and Santa Paula – had fewer than 160 acres of these lands, and the largest share (86%) was located in unincorporated areas. These lands are significant because they were subject to conversion to urban land uses under all six of the policy scenarios considered in this research project.

Research Design

The California Urban and Biodiversity Assessment (CURBA) model developed by Landis, et al., (1998) for northern California was used with a series of geospatial data layers to simulate spatial patterns of population growth and the impact of this growth on farmland and natural areas in Ventura County. The model runs in an ArcView GIS environment and consists of two parts.

The Urban Growth Sub-Model used one-hectare-square grid cells as the basic unit of analysis and compared observed changes in urbanized land during the period 1986-2000 with a variety of possible explanatory variables. This part of the model process generated a logit regression equation of the form:

$$\text{Prob}(Y) = f\{X1, X2, X3 \ldots Xn\} \qquad (1)$$

where Y = the probability that an undeveloped grid cell was urbanized and $X1, X2, X3 \ldots Xn$ are a series of site variables (land cover, political status, slope, etc.) and neighborhood characteristics (distance to nearest major highway, percentage of neighboring cells that are urbanized, etc.) that can be invoked to explain past growth pattern(s).

The best parsimonious model (i.e. the specification that included the fewest independent variables yet produced the best overall fit with the data) was identified and then used to calculate the future urbanization probabilities reproduced in Figure 1. The final urban growth sub-model in our study incorporated eight variables and correctly predicted the fate of 95% of the non-urbanized cells during the period 1986-2000. This particular sub-model indicated that non-farmland cells close to existing urban areas but far from highways on floodplains and other gently sloping sites were the most likely to be urbanized. The likelihood that cells with these characteristics in Camarillo and Moorpark were urbanized was especially high, which is to be expected given their recent history of rapid urbanization.

These probabilities were then combined with future population growth and density estimates to determine the quantity of land needed to accommodate future growth in the Policy Simulation and Evaluation Sub-Model. This second sub-model uses the ArcView GIS and several user-specified scenarios incorporating different local policy constraints to predict land conversion patterns. Six policy scenarios were developed for Ventura County using SOAR boundaries and constraints that dealt with the loss of farmland and environmentally sensitive lands as follows:

1. "no constraints": permits future growth anywhere in the county except on parkland and designated open space
2. "environmental and farmland protection": prohibits growth on environmentally sensitive lands and farmland in addition to parkland and designated open space
3. "compact growth": prohibits growth outside urban growth boundaries defined as SOAR boundaries for those cities which had them prior to the 2000 election and sphere of influence (SOI) boundaries for the other cities
4. "compact growth and farmland": uses Scenario 3 as a baseline, but prohibits development on farmland and allows it on environmentally sensitive land
5. "compact growth and environmental protection": uses Scenario 3 as a baseline, but prohibits development on environmentally sensitive land and allows it on farmland
6. "all constraints": prohibits development of environmentally sensitive land, farmland, parkland, designated open space, and areas located outside SOI/SOAR boundaries.

These development scenarios were implemented with a population growth increment of 25% and the current density of 7 people per acre. The resulting urban growth patterns (i.e., allocations) were then compared with land use and land cover maps to quantify the impact of growth on farmland and natural vegetation cover types.

Results

Predicted Growth Patterns

The urban land conversion predicted in each political jurisdiction under the six policy scenarios is summarized in Table 2. The following commentary focuses on three scenarios: Scenario 1, "no constraints," which represents the pre-SOAR (i.e. pre-1998) status; Scenario 3, "compact growth" which represents the current status; and Scenario 6, "all constraints."

Scenario 1 was predisposed to favor non-farmland in low-lying areas, close to existing urban land given the final logit regression equation and probability grid (Figure 1). Figure 2(a) shows how development was predicted in or near Oxnard, south of Camarillo and Thousand Oaks, between Moorpark and Thousand Oaks, and immediately north of Moorpark and Simi Valley under this scenario. The relatively large undeveloped areas in Simi Valley and Thousand Oaks were not targeted for growth under this scenario due to the large areas of parkland, designated open space, and steeply sloping lands within these cities.

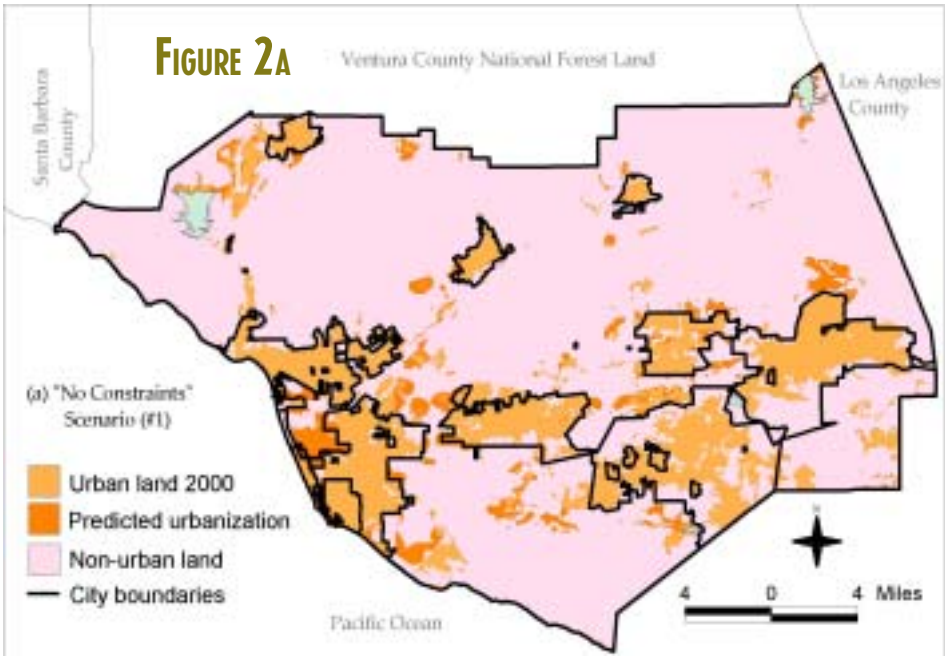
In Scenario 3, when growth was contained inside SOAR boundaries, nearly one-half (48%) of the available land within city limits would be converted (Figure 2b). One-third of the growth was still predicted in unincorporated areas, especially near Simi Valley, Thousand Oaks, Ojai and Oxnard, because SOAR boundaries extend outside the city limits in these instances.

In Scenario 6, a density of 10 people per acre would be required to accommodate a population increase of 190,000. Figure 2(c) shows that the predicted pattern of land conversion is similar to that predicted in Scenario 3, although some growth is diverted from Camarillo and Oxnard to the north side of Simi Valley and to scattered locations in Thousand Oaks. These changes can be explained by the presence of large agricultural areas inside the Camarillo and Oxnard SOAR boundaries and the inclusion of the farmland constraint in this scenario.

Probable Impacts on Natural Vegetation

The Holland land cover classes identified in the California GAP Analysis database (Davis, et al., 1998) were used to identify the habitat losses that are likely to occur under these scenarios. The GAP data show a study area dominated by Venturan coastal sage scrub (187,775 acres; 42% of non-urban area in 2000), six chaparral species (47,325 acres; 10%), and non-native grasses (31,895 acres; 7%). Agriculture remains an important economic activity, occupying 25% of the study area, and the remainder is covered with various coastal and riparian forest and woodland cover types.

The land conversion predicted in Scenario 1 would reduce the spatial extent of 20 of 25 cover classes. This analysis predicts the loss of 12,700 acres of agricultural land and 4,120 acres of Venturan coastal sage scrub,



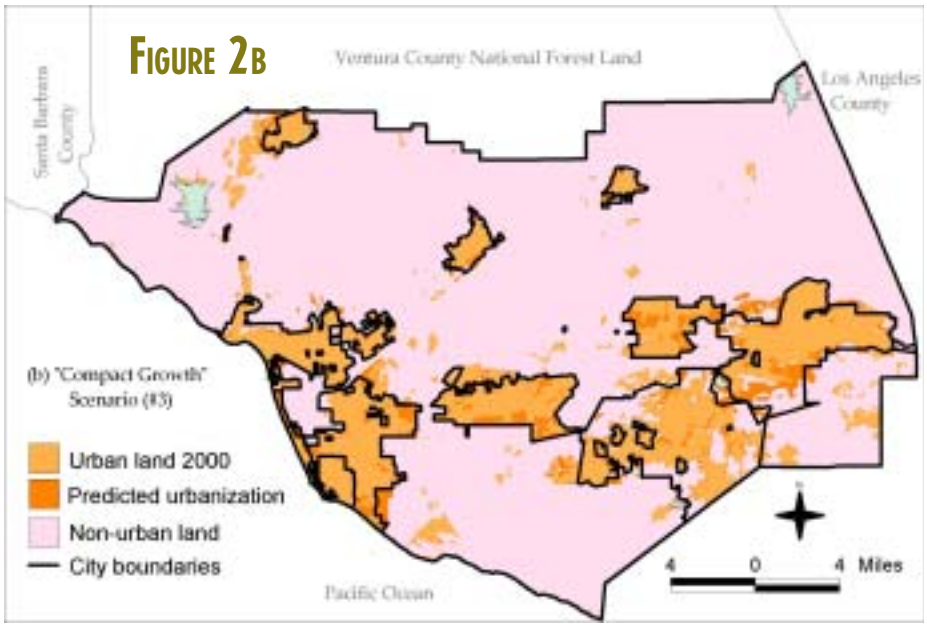


Figure 2b

for example. The largest losses in relative terms would be dealt to farmland (15%), permanently flooded lacustrine habitat (15%), non-native grassland (7%), orchards and vineyards (6%), and Diegan coastal sage scrub (6%).

The land conversion predicted in Scenario 3 would reduce the area of 15 land cover classes. This scenario would transfer growth from unincorporated areas on the Oxnard Plain to Camarillo, Moorpark, Oxnard, Simi Valley, and Thousand Oaks. The adoption of SOAR boundaries would preserve 58% of the farmland, orchards, and vineyards lost under Scenario 1, but large areas of three cover classes – Venturan coastal sage scrub, non-native grassland, and coastal sage-chaparral scrub – would be converted to urban uses. The largest losses in relative terms would be dealt to coastal sage-chaparral scrub (40%), southern willow forest (13%), chamise chaparral (9%), non-native grassland (7%), and sandy areas (6%) under this scenario.

The urban growth predicted in Scenario 6 was similar to Scenario 3 except that population density is higher (due to the shortage of potentially developable land) and lower growth is likely in Camarillo and Oxnard (due to the presence of substantial farmland areas inside the SOAR boundaries). This scenario is noteworthy because it would preserve nearly all of the agricultural land in the study area and convert the largest areas of Venturan coastal sage scrub, big pod chaparral, and horny leaf chaparral to urban uses. Ryan (2001) used the Policy Simulation and Evaluation Sub-Model to calculate several additional landscape metrics that have important consequences for habitat quality.

Will SOAR Make a Difference?

The results, taken as a whole, do suggest that SOAR will help protect agricultural land and open space in Ventura County because the vast majority of farmland and unprotected open space lies outside the voter-approved boundaries. Scenario 3 prohibited development outside the SOAR boundaries and on parkland and designated open space inside the boundaries. Two-thirds of the future growth was predicted inside existing city limits under this scenario, and large areas would be urbanized in Camarillo, Moorpark, Oxnard, Simi Valley, and Thousand Oaks (Table 2). The growth predicted with Scenario 3 would use at least 60% of the potentially available land in six cities – Camarillo, Moorpark, Ojai, Port

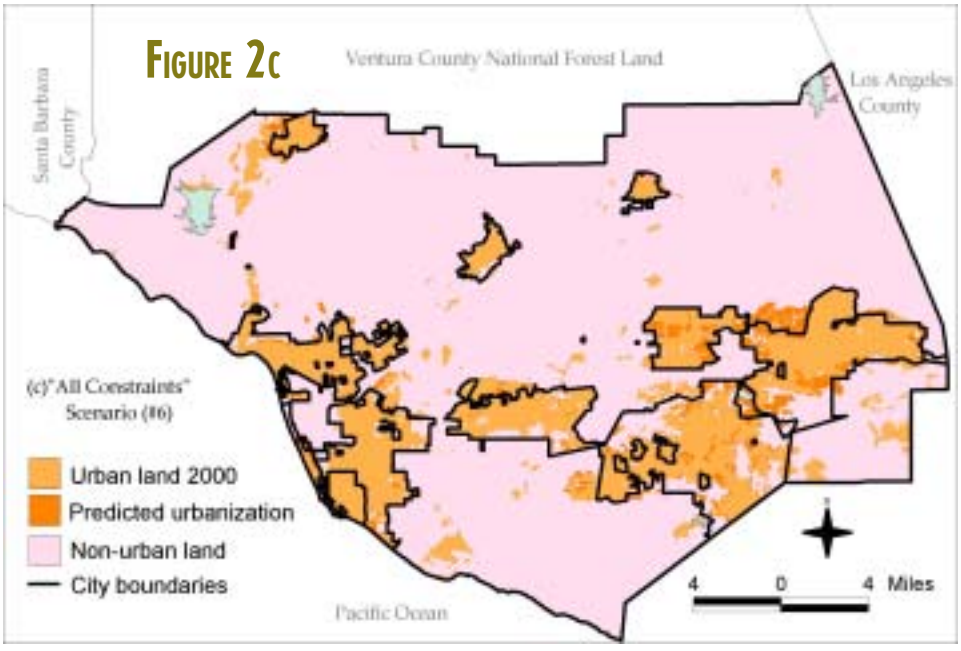


Figure 2c

Political Units	Available Land (acres)	Land Conversion Predicted Under Different Scenarios (acres)					
		#1	#2	#3	#4	#5	#6
Camarillo	2,890	240	195	2,565	700	2,065	420
Fillmore	635	20	20	220	185	235	125
Moorpark	2,600	700	1,730	2,405	2,330	2,175	2,095
Ojai	425	15	0	270	295	320	240
Oxnard	4,175	795	290	2,455	565	2,385	495
Port Hueneme	55	5	5	55	55	5	5
Santa Paula	660	10	5	310	410	170	60
Simi Valley	8,010	5	130	4,455	6,385	4,195	4,145
Thousand Oaks	14,205	60	215	3,965	5,515	4,695	4,695
Ventura	1,965	90	10	735	790	550	270
County	414,710	23,275	23,380	8,245	8,660	9,225	6,355
Totals	450,330	25,215	25,980	25,680	25,890	26,020	18,905

Hueneme, Simi Valley, and Thousand Oaks – and this result will make for numerous new challenges if the pressure for growth continues beyond the 25% growth increment. In contrast, 92% of the growth would occur in unincorporated areas immediately outside existing city limits under Scenario 1.

Two sets of additional comments are warranted. The first concerns agricultural land. Although nearly 60% of the agricultural land, orchards, and vineyards lost under Scenario 1 would be preserved under Scenario 3, the predicted losses under Scenario 3 would still exceed 5% of the total agricultural land base in 2000 because there are substantial areas still used for agriculture inside the SOAR boundaries of Camarillo, Oxnard, and several other cities. The three scenarios that prohibited growth on farmland explicitly (2, 4, and 6) would all be more effective at protecting farmland land than the SOAR boundaries in Scenario 3.

The second set of comments starts with the observation that the growth patterns predicted in Scenario 3 assume that the current SOAR boundaries will be sustained indefinitely. It is hard to predict whether voters will "hold the line" on these boundaries in future elections. On the one hand, in the first three "SOAR override" elections in 1999 and 2000 (two in Ventura and one in unincorporated county territory near Ojai), voters approved converting agricultural land to development. On the other hand, all three projects involved community and institutional uses – a church, a park/sports complex, and the expansion of a convalescent home – and none of the three projects was more than 100 acres in size. A sterner test came in 2002, when ballot initiatives appeared in both Santa Paula and Simi Valley to alter the SOAR boundaries (expanding them in Santa Paula, shrinking them in Simi Valley). Both were stimulated by the prospect of more housing developments, but, as it turned out, both measures were defeated – so the original boundary lines

held. Furthermore, SOAR proponents have indicated their desire to propose new ballot measures removing farmland from inside the current boundaries in both Camarillo and Oxnard. Because the original SOAR measures passed overwhelmingly, it is not clear that voters would okay large private development projects, especially those proposing substantial housing or commercial construction.

Conclusions

The CURBA model was used with a series of GIS layers in this research project to predict future urban growth patterns and their impact on agricultural land use and a number of ecologically significant natural vegetation communities in Ventura County. Two GIS layers were used to depict past growth, and logit regression was used with eight independent variables to explain these growth patterns. The final regression model correctly predicted the fate of 95% of the non-urbanized cells in 1986 and produced a probability grid indicating the likelihood of non-urbanized cells being urbanized in the future. These probabilities were then used with six local policy scenarios that offered varying levels of protection for farmland and natural vegetation to predict future growth patterns and their impacts on farmland and natural vegetation. A growth increment of 25% and the average density in 2000 were used for the six model runs. The results showed that: (1) the county will be able to accommodate this growth under five of the six scenarios examined; (2) the adoption and enforcement of SOAR boundaries as urban growth limits would consume nearly two-thirds of the potentially developable land and compromise future growth beyond the 25% envisaged here unless densities are increased; and (3) different land use and urban growth policies would produce very different spatial patterns of growth in Ventura County in the next two or three decades.

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