

Using GIS, Spatial Analysis and Maps to Improve Urban Places and Spaces

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Outline

- Guiding Principles
- Living on the Edge: Growth Policy Choices for Ventura County
- Green Visions Plan for 21st Century Southern California
- Conclusions / Prospects

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Guiding Principles

- Many digital geospatial data sources
- Vast quantities of online data can be related to these geospatial sources
- Many new analytical methods and models
- Numerous opportunities to advance theory and quantitative science

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GIS Tools

- Elevation (Z)
- Slope gradient (α)
- Slope aspect (ω)
- Curvatures (K)
- Distance to the nearest ridge
- Downslope length
- Upslope area

Slide Courtesy of Bard Romstad

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Spatial Analysis

Slide Courtesy of Zaria Tatalovich

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Environmental Modeling

- Role / value of nature's services
- CITYgreen modeling tools (American Forests)
- Calculate economic benefits of green cover
 - Carbon storage / sequestration
 - Air pollutant removal
 - Stormwater runoff reduction
 - Energy conservation
 - Wildlife habitat provision

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Collaborative Research

- Living on the Edge: Growth Policy Choices for Ventura County
 - Bill Fulton and Jennifer Wolch
 - Christine Ryan and Yan Xu
- Green Visions Plan for 21st Century Southern California
 - Joe Devinny, Travis Longcore, Jennifer Swift, and Jennifer Wolch
 - Jason Byrne, Christine Lam, Alison Linder, Diego Martino, Thao Nguyen, Jaime Sayre, Mona Seymour, and Jingfen Sheng

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Southern California



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Living on the Edge: Ventura Co

- Unique approach to growth
 - "Guidelines for Orderly Development" and Spheres of Influence
 - Williamson Act
 - Save Open Space and Agricultural Resources (SOAR) boundaries enacted from 1995 to 2000
- Most of 756,400 residents in 2000 spread among 10 cities
- 20% of county and 70% of land inside city limits was developed in 2000



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Ventura County (2)

- Northern two-thirds of county part of Los Padres National Forest
- Open space / conservation efforts in south-eastern part of county focus on Santa Monica Mountains National Recreation Area
- County leads nation in lemon production and produces large quantities of other fruits and vegetables



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Research Questions

- How is spatial pattern of growth likely to vary under different local policy constraints if population increases by 25% in next 15-30 years?
- How sensitive are farmland and natural vegetation cover types to these urban growth patterns?



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Methodology

- California Urban and Biodiversity Assessment (CURBA) model developed by John Landis and colleagues at University of California-Berkeley
 - Urban Growth sub-model
 - Policy Simulation and Evaluation sub-model
- ArcView, SAS, and FRAGSTATS



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Urban Growth Sub-Model

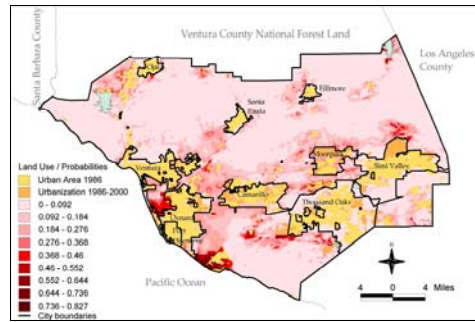
- Utilized multinomial logit regression models to explain past land use change in terms of site-specific variables derived from GIS data layers

$$Y = f(X_1, X_2, X_3, \text{etc.})$$

where Y = land use change from 1986 to 2000 and X1, X2, X3, etc. are explanatory variables derived from ArcView GIS themes

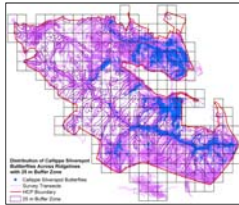
- Site variables included land cover, political status, slope, distance to nearest freeway, percentage of neighboring cells that are urbanized, etc.

Urbanization Probability Grid



Policy Simulation Sub-Model

- Select constraints and modify probability grid accordingly (i.e. set probability to zero in cells to which constraints apply)
- Select population growth increment and density for model run
- Allocate new population to cells using probabilities as guide



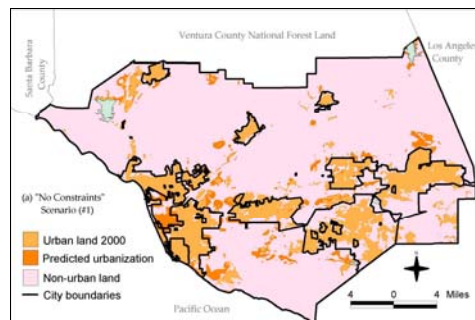
Policy Scenarios

- No Constraints**
 - Growth permitted anywhere except for designated open space & parks
- Environmental / Farmland Protection**
 - Growth prohibited on environmentally sensitive lands (i.e. steep slopes, wetlands, floodplains), farmland, designated open space & parkland
- Compact Growth**
- Compact Growth / Farmland Protection**
- Compact Growth / Environmental Protection**
- Full Constraints**
 - Growth prohibited outside SOAR boundaries and on environmentally sensitive lands, farmland, designated open space & parkland inside these boundaries

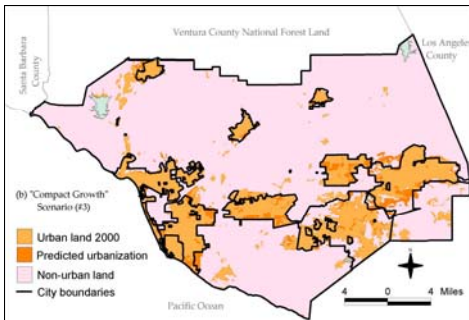
Urban Growth Predictions

Political Units	Available land	Land Conversion Predicted Under Different Scenarios					
		#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

Scenario #1

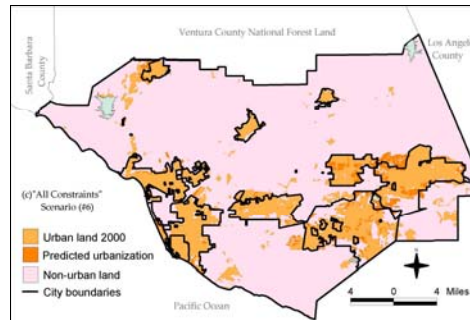


Scenario #3



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Scenario #6



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Implications

- Different urban growth policies would produce different patterns of growth in Ventura County in next 20-30 years
- Different scenarios trade off varying proportions of farmland and natural vegetation cover
- SOAR will consume 67% of potentially developable land and compromise future growth beyond 25% envisaged in this study unless densities are increased



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Green Visions Plan

- Population growth
- Legacy of piecemeal planning
- Regulatory / government context
- Land use / wildlife conflicts
- Public health challenges
- Environmental justice considerations
- Funding opportunities



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Green Visions Plan Area



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Project Goals

- Identify and assess opportunities for:
 - Promotion / restoration of watershed function
 - Habitat conservation / restoration
 - Park / open space acquisition
- Create web-based decision support tools and geospatial data sets




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Multiple Use


- Best sites will simultaneously
 - Treat and infiltrate storm water
 - Restore and conserve ecosystems
 - Provide recreation and open space opportunities



Broadus School, Sun Valley

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Hydrologic Function / NHD



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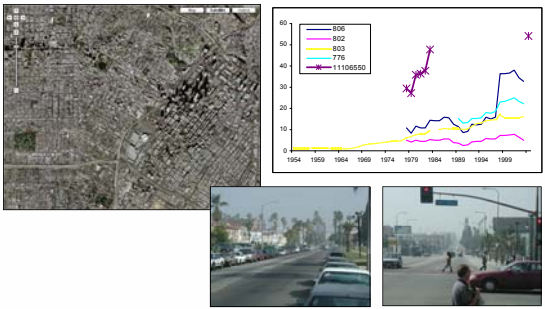
NHD Problems

- Duplicate stream segments
- Flow divergences
- Missing stream segments (reaches)
- Missing or erroneous attributes



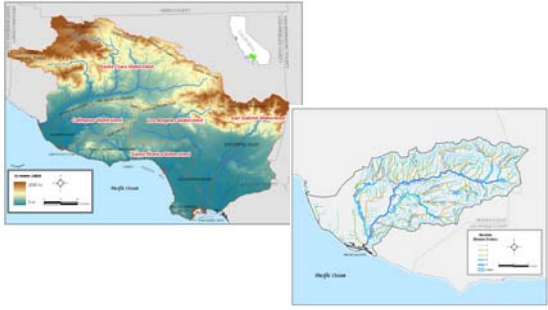
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Mean Annual Daily Discharge



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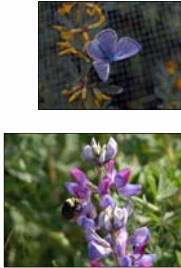
Calleguas Creek



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Habitat Conservation



- Multiple species approach
 - Choose 30-40 focal species
 - Broad taxonomic and life history coverage
 - Includes rare and endangered species
 - Includes indicators of sensitive habitats
- Develop natural history profile and geographic incidence information
- Prioritize restoration and conservation areas based focal species




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Urban Matrix

- Identify opportunities to create local nature parks
 - Target migratory birds and other mobile organisms
 - Build a series of wildlife corridors and linkages across urban landscape
- Urban Twist
 - Delineate connectivity for lower trophic levels
 - **It's the little things that count**


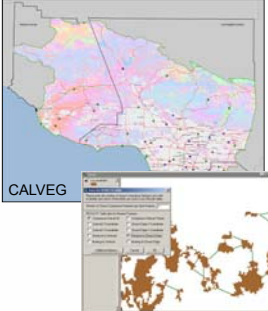






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Missing Linkages


- Suitable habitat (reserves)
- Connectivity (corridors)







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Umbrella Species - Coyote





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Loggerhead Shrike



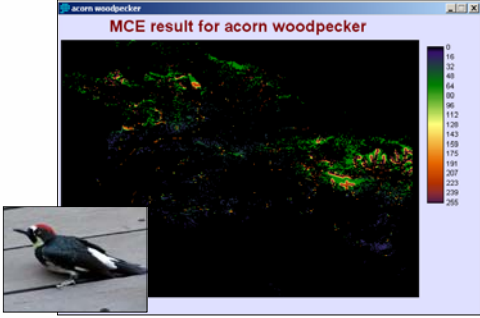



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MCE Analysis

acorn woodpecker

MCE result for acorn woodpecker








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Parks / Open Space

- Compiled polygon layer containing 1,797 parks
 - LA – 1,364 parks
 - Ventura – 231 parks
 - Orange – 202 parks
- Conducted 1,797 web audits (attributes)
- Conducted 250 field audits – sampled 15% of parks using stratified random design



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