

Measuring the Impacts of Natural Amenities and the US-Mexico Border, on Housing Values in the Santa Cruz Watershed, using Spatially-Weighted Hedonic Modeling

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Goals of this Study

- Identify variables affecting the quality of life of the residents of the Santa Cruz Watershed in the Borderlands
- Isolate the effects of the US-Mexico border and known environmental or natural amenities or disamenities on housing prices in the bi-national watershed

Study Agenda

- Find the effects of
 - Current local environmental management on social-vulnerability
 - Environment and border on property values through hedonic studies
- Upload results to the Santa Cruz Watershed Ecosystem Portfolio Model (SCWEPM)
 - online Ecosystem Services tool intended to promote sustainable development in the Borderlands
- Use results from study to determine the benefits of preserving or developing land bi-nationally by local environmental management

Human Well-Being

- **Vulnerability** has been identified as one of the main dimensions of ill-being (the opposite of well-being)
- ...a decision-making process should be judged on specific characteristics, including answering the question “did the process ...pay special attention to equity and to the most **vulnerable** populations?”

Policy and the Environment

- North America Free Trade Agreement (NAFTA) implemented in 1994
- Direct impact in *ambos* Nogales (Both Nogales)
- Problem:
 - Much of the transported goods include toxic waste from the industrial parks and hazardous materials.
- To assess vulnerability: develop boundaries for hazard zones and study
 - Residential populations
 - Land use practices
 - And demographics

1. Lara-Valencia, Francisco, Juan Declet-Barreto and Eric Keys. 2008. Spatial Equity and Transportation Hazard Along Cross-Border Trade Corridor: The Case of *Ambos* Nogales. *Journal of Borderlands Studies*. 23(2).

2. Esparza, Adrian X., Brigitte S. Waldorf, and Javier Chavez. 2004. Localized Effects of Globalization: The Case of Ciudad Juarez, Chihuahua, Mexico. *Urban Geography*. 25(2).

Constructing Deprivation Index

- Map of Arizona and New Mexico colonias from census data showing
 - Areas of greatest housing
 - Social and poverty stress
- Consider broader range of deprivation factors
- Indices applied to census data to develop proper deprivation index with the SCW
 - Can be changed based on scenarios impacting populations

Table 1. Variables Entering Deprivation Indices

Poverty	Variable Description Social	Housing
1] No. persons below 50 % median area income	1] Different residence in past 5 years	1] Median housing value
2] Persons below poverty	2] Household structure	2] Lack of plumbing
3] Median per capita income	3] No vehicle available	3] Age of housing
4] Median family income	4] Dependency ratio	4] Vacant units
5] Ratio of income inequality	5] Occupation	5] Seasonal housing
6] Ratio of middle incomes	6] Linguistic isolation	6] Overcrowding
	7] No high school diploma	
	8] Foreign born population	
	9] Unemployment rate	

(Table 1)

Set of indices summarizes social and economic situation in *colonias*

1. Donelson, Angela and Adrian Esparza. 2007. Undocumented Immigrants and Quality of Life in Arizona and New Mexico Colonias. In Journal of Borderlands Studies. 22(1).
2. Butler, Colin, and Willis Oluoch-Kosura. Human Well-being across Scenarios. Ecosystems and Human Well-Being Vol 2. 2005. Millennium Ecosystem Assessment.

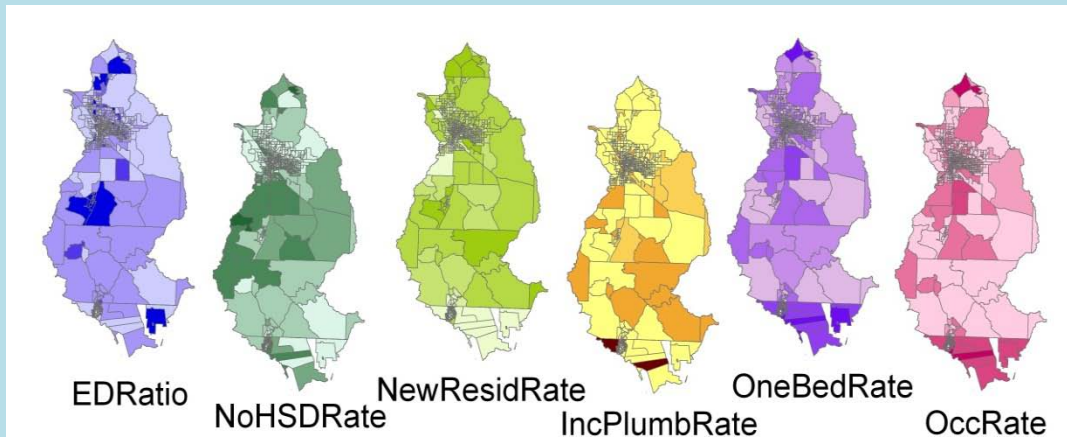
Methodology (1)

- Develop a human well-being index measuring people's socio-environmental vulnerability for the entire SCW
- Based on the comparison of access to infrastructure:
 - Number of bedrooms per house
 - Other social data from the bi-national census and local *colonias* (neighborhoods) database

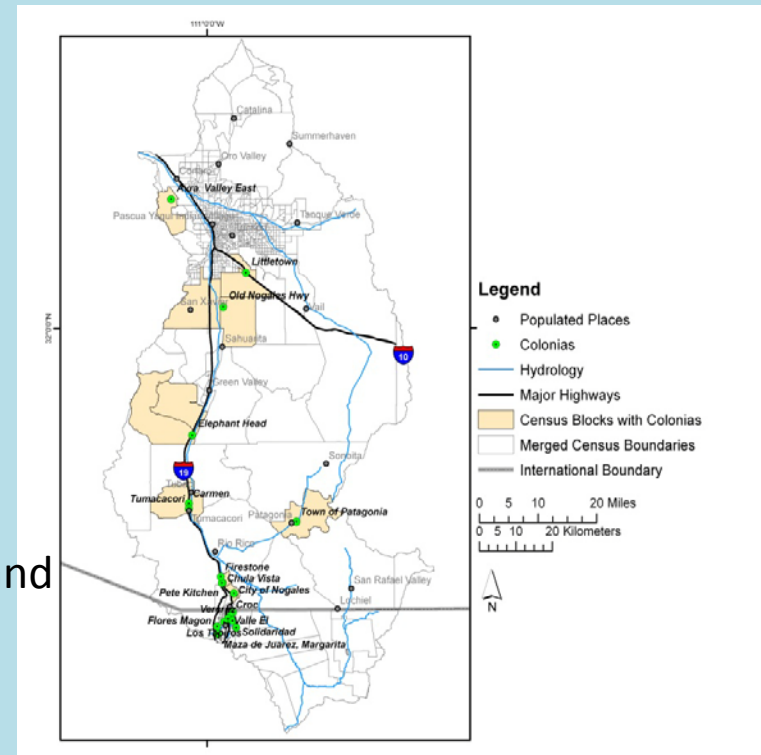
Modified Socio-Environmental Vulnerability

Index (SEVI)

Integration of Mexican Basic Geo-Statistical Areas (AGEBs by their Spanish acronym) with U.S. Census Block groups for the Santa Cruz Watershed, describing population, education, access to urban services, and household assets.



Indicators identified by Lara-Valencia, Declet-Barreto, and Keys (2008) and available to this binational area were adapted and combined with information describing *colonias*.

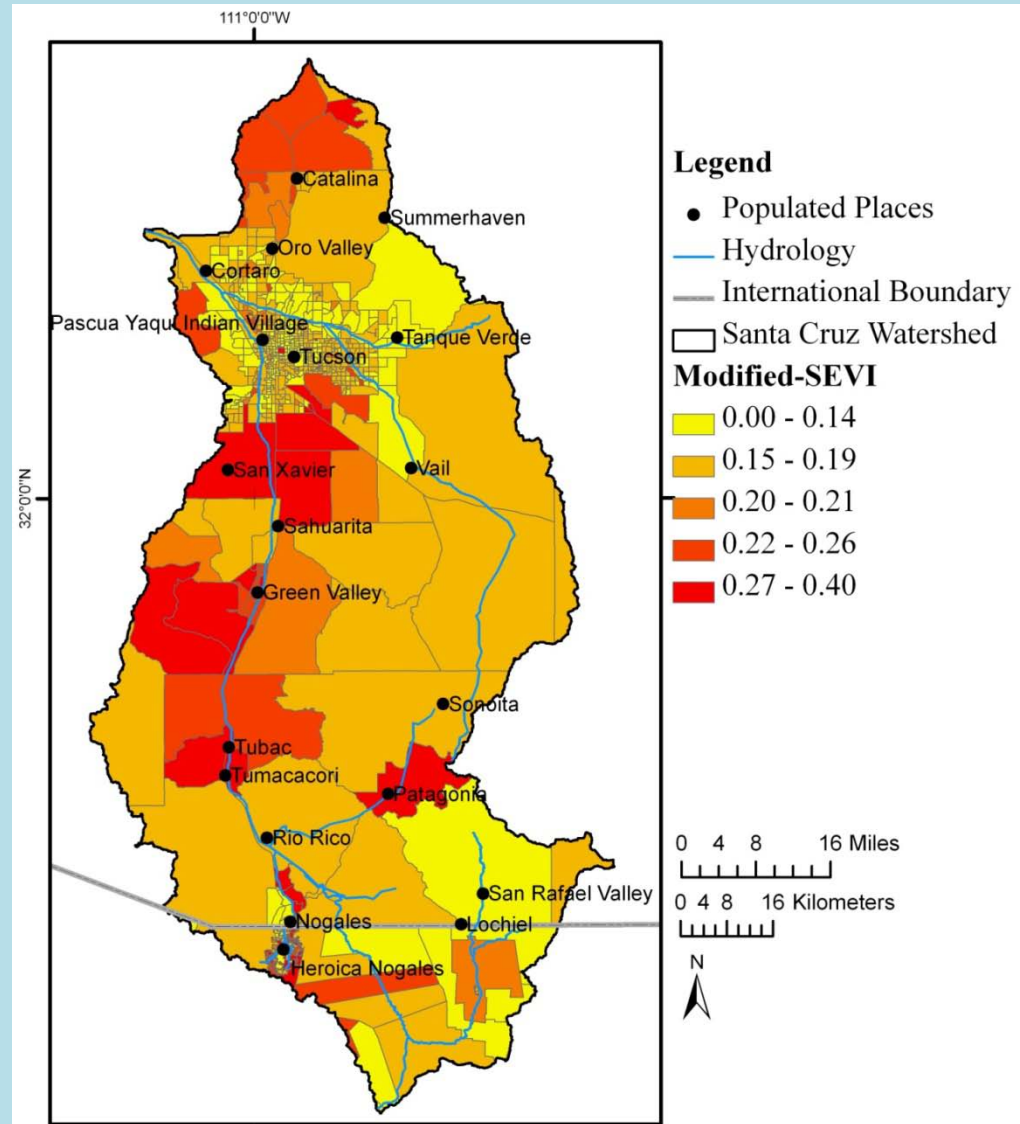


Socio-Environmental Vulnerability Index Formula Adjusted for the Santa Cruz Watershed.

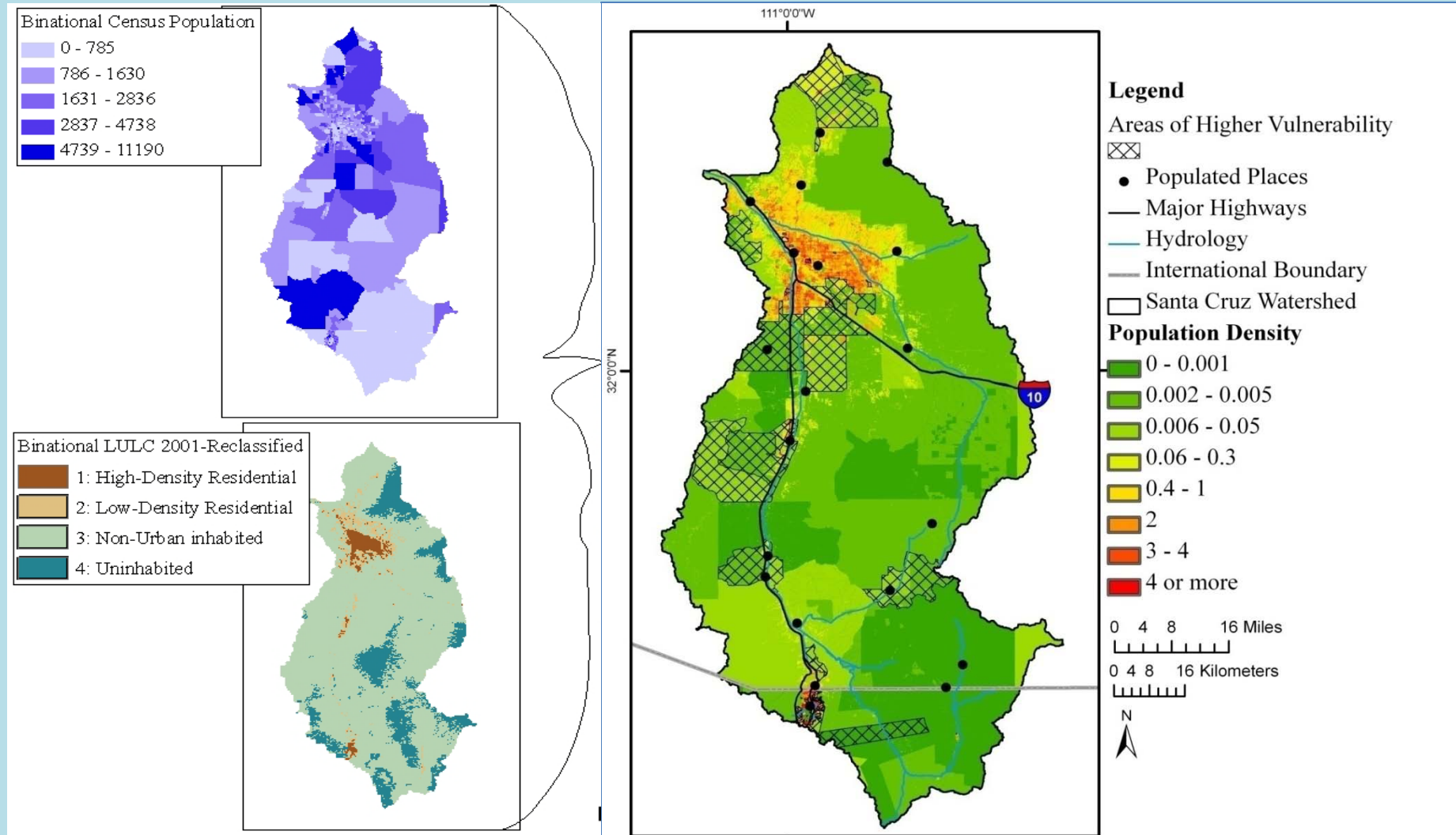
$$\text{SEVI} = (\text{EDRatio} + \text{NoHSDRate} + \text{NewResidRate} + \text{IncPlumbRate} + \text{OneBedRate} + \text{OccRate} + \text{ColoniaRate})/7$$

Range and distribution of SEVI results using geometrical interval classification

Socio-Environmental Vulnerability
Yellow is low → Red is high



Dasymetric Mapping



Norman, Laura M., Lara-Valencia, Francisco, Wilson, Sylvia, Yuan, Yongping, Nie, Wenming, Amaya, Gladys, Villarreal, Miguel, and Sleeter, Rachel, 2011 In Draft, Mapping Vulnerable Populations Equity in Access (and Exposure) to Ecosystem Services at the U.S.-Mexico Borderlands, to be submitted to Ecology and Society.

Hedonic Studies in the Santa Cruz

- Value of property according to inhabitant's perspectives
- Hedonic price models:
 - Hedonic price estimates are affected by an array of open-space amenities and nonresidential land and its addition to the land-use data of the census under block, block group, and tract level.

Homeowners' Preferences

- Pay 20% more to be near a riparian corridor.
- Outweighed structural factors: *swimming pool or extra garage*
- Property values decrease when nearby a low biological quality habitat or a golf course.
- The normalized vegetation index (NDVI) and the soil adjusted and vegetation index (SAVI) can also be used to measure property values by comparing greenness.

1. Bark-Hodgins, Rosalind H., Daniel E. Osgood, Bonnie G. Colby. Do homebuyers care about the 'quality' of natural habitats? American Agricultural Economics Association Annual Meeting. 2005.

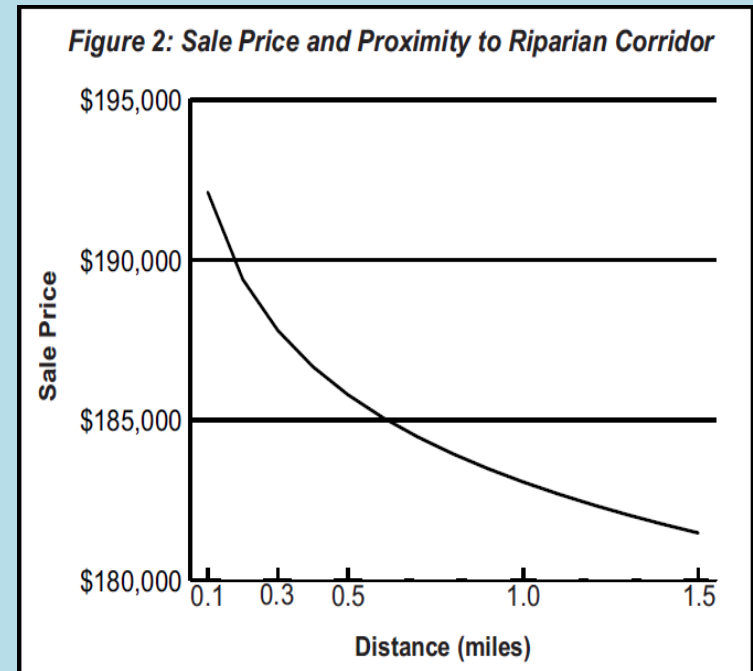
2. Bark-Hodgins, Rosalind H. The Arizona Water Settlement Act and urban water supplies. Department of Agricultural and Resource Economics. 2009.

Example of Property Valuation

- A home valued at \$192,107 when located within 0.10 mile from the riparian corridor
- An identical house located miles from the corridor is given a \$181,466 valuation
- A difference of 6% increase in the property value near the corridor is shown in the \$10,640 price difference.

Riparian Corridor and Property Values

- Premium paid for riparian property in the arid regions of the western United States.
- Properties found 0.5 to 1.5 miles away from the Tucson Riparian Corridor qualified for premiums of over \$103 million dollars for 25,560 residents.

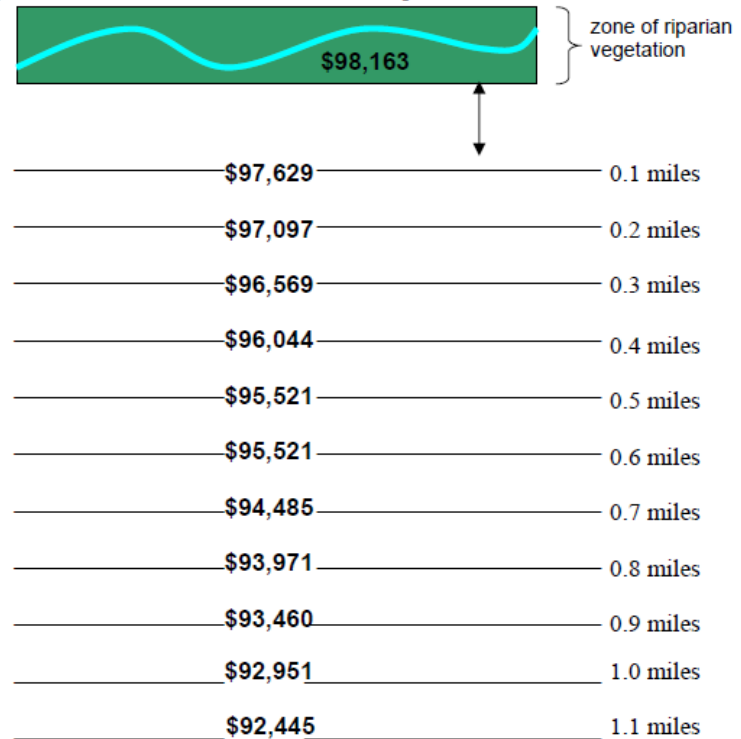


1. Colby, Bonnie, and Steven Wishart. Riparian Areas Generate Property Value Premium for Landowners. Agricultural and Resource Economics. 2002.
2. Bark-Hodgins, Rosalind H., Daniel E. Osgood, Bonnie G. Colby. The Value of Riparian Corridors in Desert Cities. Office of Arid Land Studies, The University of Arizona. 2011
3. Weber, Matthew A., and Robert P. Berrens. 2006. Value of Instream Recreation in the Sonoran Desert. Journal of Water Resources Planning and Management.

Distance Effect

Property values in
Rio Rico change with
distance from
Riparian Corridor

Figure 5.4: Distance to Santa Cruz River Riparian Corridor, Rio Rico (von Liebig)*



*One story house, 6 years old, parcel size 36,363 square feet, 6 bathroom fixtures, 1638 square feet of living area, 2 car garage, distance to nearest golf course is greater than 0.5 miles (0.5 used in calculation),

Bourne's Data

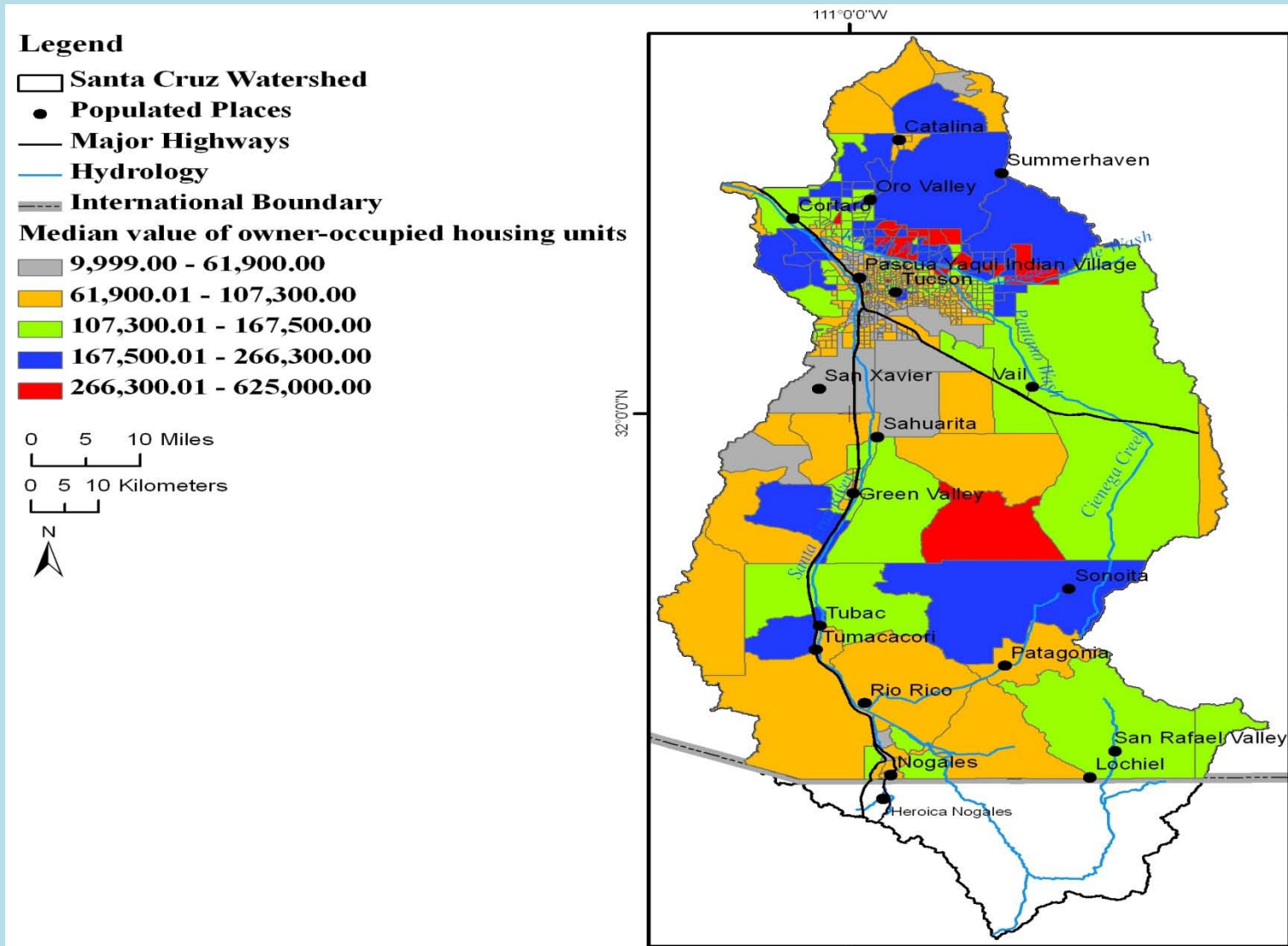
Time Period: 2001-2005		Amenity	Distance (miles)	SFR Property Value	%Change from 1.1 Mile	Difference (\$)
	SANTA CRUZ COUNTY-TUBAC/RIO RICO	Riparian Corridor				
			Within 1.1		3.1-5.8%	
			outside 1.1		0%	
Colby and Wishart (2002)			1.5	\$181,466	6%	\$10,640
		Stream	1	\$125,570		
			0.19	\$125,829		\$258.81
Mahan, Polasky, and Adams	*Type of wetland does not affect price	Wetland	1	\$125,570		
Multnomah County, Oregon.			0.19	\$126,006		\$436.17
			0.1	\$192,107		
Netusil 1999-2001		Stream	0.5			
		Amenity	Distance (miles)	SFR Property Value	%Change	Difference (\$)
Mooney and Eisgruber 2001	MOHAWK WATERSHED, WESTERN OREGON	Stream Frontage			7.00%	
Doss and Taff (1996)	RAMSEY COUNTY, MINNESOTA (Wetlands)					
	within 0.738636 mi	Forested	0.621371192			\$145
		Forested				
		Scrub-shrub	0.621371192			-\$145
		emergent	0.621371192			-\$136
		open-water	0.621371192			-\$99
Bin (2005)	PORTLAND, OREGON	open-water	1.04166			
			0.473484			\$18,007
		Lake View				\$46,000
	OREGON	Rivers	0.568181			
			0.378787			\$3,720
	RIO RICO	Golf Course	0.5			
			0.4		11.40%	\$3,720

Bourne, Kimberly L. The Effect of The Santa Cruz Riparian Corridor on Single Family Home Prices Using the Hedonic Pricing Method. Department of Agricultural and Natural Resource. Master's Thesis. 2007.

Methodology (2)

- Represent local housing stock through the mean house values within census blocks
- Control for housing stock characteristics and social-environmental vulnerability
- The hedonic pricing method will be applied to statistically estimate a function that relates property values to the variables described.

Median Housing Unit Value



Property Value Function

$$V=f(H,E,S,B)$$

- *Home structure
- *Environmental amenities
- *Societal factors
- *Proximity to Border

Legend

• Populated Places

— Major Highways

— Hydrology

— International Boundary

□ Santa Cruz Watershed

Areas of Higher Vulnerability

Median value: Owner-occupied houses

9,999.00 - 61,900.00

61,900.01 - 107,300.00

107,300.01 - 167,500.00

167,500.01 - 266,300.00

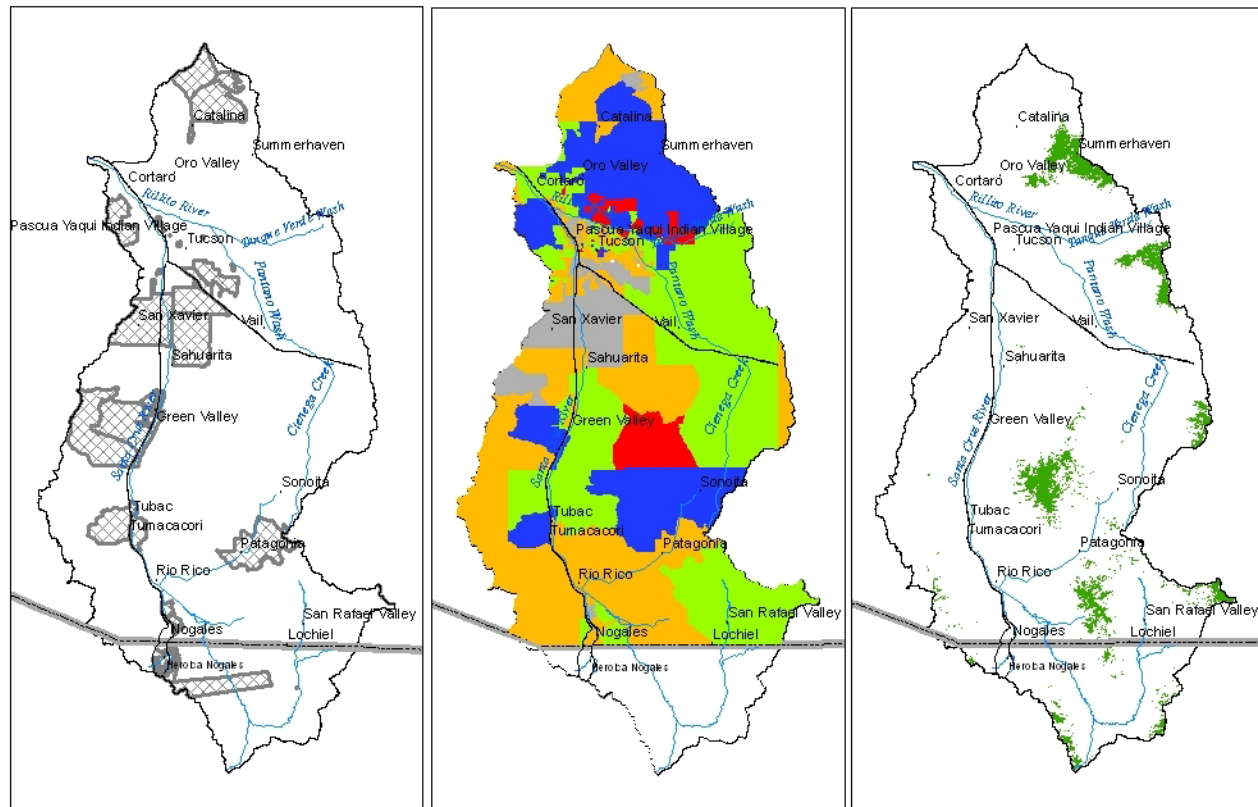
266,300.01 - 625,000.00

Forested areas

■

0 5 10 Miles

0 5 10 Kilometers



Summary

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Future Studies

- Apply methodology to develop housing values across the border esp. in Nogales, Sonora, Mexico.
- Contact:

Oficina del Catastro
Ayuntamiento Nogales Sonora
(*Cadastre Officer*)

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Thank you

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