Valuing the environment in Metropolitan Phoenix

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How can we value the urban environment?

House prices reflect such things as:

- House size
- Physical condition

But people make purchasing decisions based on other attributes as well, which may also influence the house price:

- Vegetation on the property
- Proximity to work or school
- Locational and environmental characteristics

Two "For Sale" signs in Tempe, AZ

A common method for valuing environmental attributes is hedonic pricing. By analyzing the relationship between house prices and environmental conditions, it is possible to estimate people's willingness to pay for a range of both amenities (such as proximity to parks, amount of vegetation) and dis-amenties (such as proximity to sources of noise or pollution in urban areas). The method is appropriate where there are active, well-functioning property markets. The Phoenix area, one of the most intensively studied urban ecosystems in the US, offers the opportunity to use this method to value many of the environmental changes associated with rapid urbanization in a desert environment.

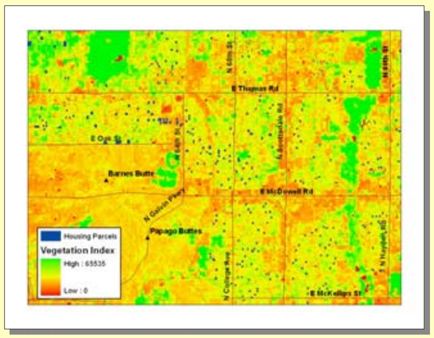

Figure 1: An example of combining environmental data with Assessor's data. Housing parcels sold in 2000 are shown on a map including the Soil Adjusted Vegetation Index (SAVI).

Methods

We combined spatially explicit data from the Maricopa County Assessor's Office on housing sales, environmental data from the Central Arizona-Phoenix Long Term Ecological Research (CAP-LTER) project and other GIS sources to create our hedonic models for the year 2000 (Figure 1). Data were available for 40 variables (see handout).

A random selection of 20 percent of all sales for 2000 were then used to create a model of housing prices, estimated using least-squares regression. The model relates prices to house and environmental attributes, and to distance from both environmental amenities and disamenities.

Results

Preliminary results are reported in Table 1 for sixteen variables. Environmental variables comprise the heat island effect (AUGMIN), particulate pollution (PM10) and vegetation biomass (SAVI). Environmental amenities/disamenities include toxic release sites (LNTRI), water sources (LNWATER) and public parkland including desert remnants (LNPASSOS).

Table 1: Regression model results with mean variable values and marginal prices per unit at mean variable values for the average house price ($154,058). N = 8306, R^2 = 0.773

Effect	Std. Coefficient	t	p-value	Mean	Marginal $/unit at mean values
CONSTANT	0	23.319	<0.000		
AREA	0.155	26.328	<0.000	9210 sq ft	$2.59
R_ROOF_COM	0.2	24.754	<0.000	5	$6,164.08
R_LIV_SQF	0.59	91.441	<0.000	1809 sq ft	$50.26
R_POOL	0.108	18.983	<0.000	121 sq ft	$137.55
R_CONST_YR	0.037	4.229	<0.000	1986	$2.87
AUGMIN	-0.023	-4.369	<0.000	23 °C	$(154.10)
SAVI	0.105	17.742	<0.000	31603	$0.51
LNTRI	-0.072	-10.402	<0.000	17440 ft	$(0.64)
LNGOLF	-0.087	-14.52	<0.000	8071 ft	$(1.66)
LNWATER	-0.044	-7.905	<0.000	9658 ft	$(0.70)
LNSUMMIT	-0.09	-15.261	<0.000	25136 ft	$(0.55)
LNRAIL	0.073	11.907	<0.000	18553 ft	$0.61
LNSCHOOL	0.111	15.207	<0.000	9147 ft	$1.87
LNPASSOS	-0.038	-6.995	<0.000	7942 ft	$(0.74)
LNACTOS	0.01	1.782	0.075	3635 ft	$0.42
PM10	-0.037	-5.218	<0.000	63 conc	$(90.50)

The results show people's willingness to pay (through house prices) to avoid heat islands or pollution pockets, or to be close to amenities like desert remnants, or summits. For example, the marginal willingness to pay to be 1,000 ft. closer to a summit or desert remnant is $552 and $737 respectively. Proximity to the canal does not significantly affect house prices.

Future research

The research supports an SFAz funded project on the role of materials in the sustainability of the built environment. By understanding the linkages between materials use and environmental conditions or amenity, it will be possible to infer the environmental value attaching to materials use.

These estimates are marginal willingness to pay estimates only and do not convey information on the demand curve for environmental amenities. By segmenting the metropolitan area into distinct markets, we expect to construct a demand curve for specific attributes that may be used to project the environmental value of new urban development options.

Analysis of comparable datasets for 1995 and 2005 will make it possible to identify whether (and how) the demand for environmental attributes is changing over time.

Other CAP-LTER research relates vegetation, biodiversity, and pollution exposure with socio-economic indicators. An array of socioeconomic variables will be included in the demand models to enhance their explanatory power.

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