# Analysis of the Influence of Open Space on Residential Values

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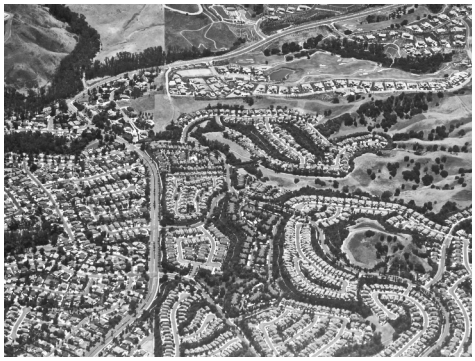
Residential property values decrease with increasing distance from open space in two Southern California counties, regardless of open space preservation policy. Homeowners residing in zones of these counties, with big cities and scarce open space, have a high value for proximity to open space.



Our results also show that there was a statistically significant increase in residential sale price with an increase in lot size for all the zones of San Bernardino and Riverside counties.

Concern over the preservation of open space has been growing in recent years with increasing urban development. Open space provides a range of benefits to residents of a community beyond the benefits that accrue to private landowners. In this study, open space refers to parks, areas with wild habitat, and the area of a residential lot aside from the residential structure itself. Our focus is on the Inland Empire region, which is a large urban area located in southeastern California, including Riverside and San Bernardino counties, indicated by the shaded areas in Figure 1.

To support the conservation of open space, Riverside County implemented the Riverside County Integrated Project (RCIP) in 1999. This analysis measures the impact of open space variables on residential property values in different regions of Riverside County where RCIP is implemented, and different regions of San Bernardino County that do not have any conservation policy.

One objective of this study is to analyze how a policy of conservation and preservation of land influences the housing market. With data on residential property sales and distance measures to open space, it is possible to estimate the value of open space through a hedonic method of valuation. We discuss more about the hedonic method in the methodology section.

## Background of RCIP

RCIP is a comprehensive, integrated program to determine future conservation, transportation, housing and economic needs in Riverside County. One of RCIP's primary aims is to protect the natural environment by conserving habitat and open space through a Multi-Species Habitat Conservation Plan (MSHCP). San Bernardino County is already endowed with abundant open space including wild habitat in the form of national and state forests. Riverside County does not have such an endowment of open space with wild habitat and aims to gain such acreage through the RCIP.

## Study Area

We divided the study region into six zones depicted in Figure 1. Zones 1, 3, and 5 belong to Riverside County, while Zones 2, 4, and 6 belong to San Bernardino County. The study compared the six zones across the two counties in the following three pairs: Zone 1 and Zone 2, Zone 3 and Zone 4, and Zone 5 and Zone 6.

The zones were paired based on similar socioeconomic characteristics and proximity to open space areas in order to compare the value of open space in a zone that has a conservation policy (RCIP) with its value in a zone without the policy. This study also compared the value of open space and other housing market variables in the zones during the years 1996–99 and 2000–04, to compare before and after introduction of the RCIP policy.

## Methodology

We conducted a comparison of the zones using a statistical analysis to study the influence of open space and

Figure 1. Study Area

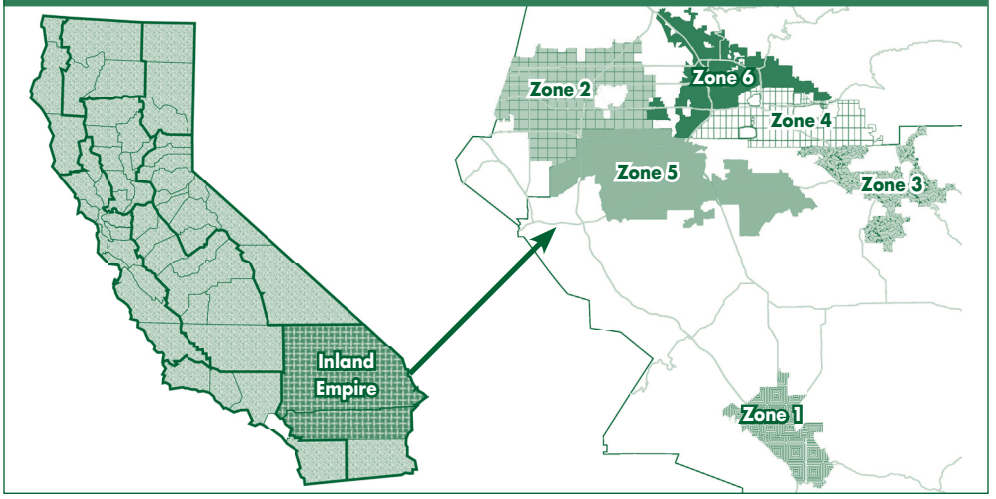


Table 1. Difference in Mean Values for Relevant Variables Pre- and Post-RCIP

| Zones (1996–99) (Pre-Policy) | Sale Value ($) | Distance from a Park (meters) | Distance from Wild Habitat (meters) | Lot Size (square feet) |
|---|---|---|---|---|
| 1 | 186,621 | 819.3 | 2,698.2 | 22,202 |
| 2 | 149,598 | 1,964.8 | 1,664.5 | 9,735 |
| 3 | 111,336 | 689.8 | 2,044.2 | 26,086 |
| 4 | 162,329 | 1,220.4 | 843.9 | 14,447 |
| 5 | 123,275 | 1,844.7 | 2,340.3 | 12,614 |
| 6 | 99,767 | 4,053.1 | 1,511.7 | 10,927 |
| **Zones (2000–04) (Post-Policy)** | **Sale Value ($)** | **Distance from a Park (meters)** | **Distance from Wild Habitat (meters)** | **Lot Size (square feet)** |
| 1 | 309,762 | 821.0 | 2,599.9 | 20,540 |
| 2 | 241,555 | 1,987.2 | 1,739.8 | 9,449 |
| 3 | 156,133 | 729.2 | 2,085.8 | 18,416 |
| 4 | 229,867 | 2,009.0 | 957.4 | 15,646 |
| 5 | 209,233 | 1,747.6 | 2,299.3 | 12,272 |
| 6 | 156,254 | 4,496.7 | 1,577.2 | 10,749 |

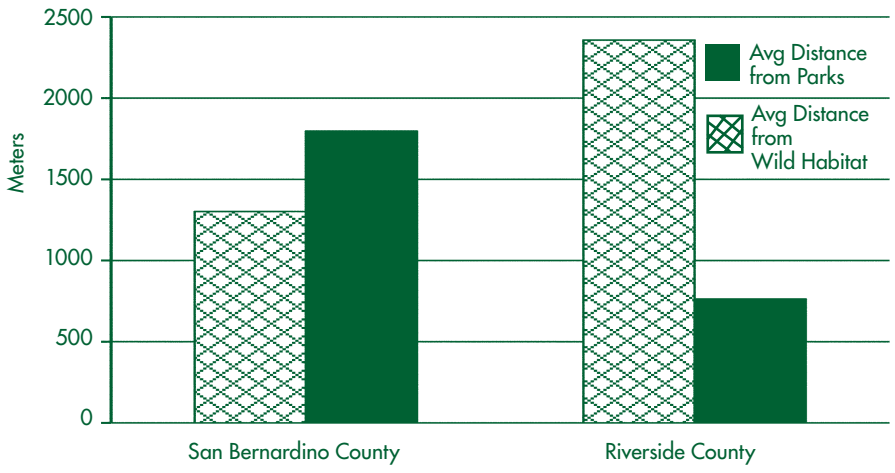
other variables on residential sale value. Our variables included distance from wild habitat, distance from parks, and lot size. The average values for these variables across different zones and two time periods are listed in Table 1.

Lot size is the area of the residential lot measured in square feet. Distance from parks is the straight-line distance from the residential property to the nearest park in meters. Distance from wild habitat is the straight-line distance from the residential property to the nearest wild habitat area in meters.

We use a spatial error hedonic model to estimate the value of open space variables for the zones. Hedonic pricing models express the price of a good (in our case residential property) as a function of its characteristics. When the model is econometrically estimated using data on market prices and characteristics of the residential property, such as structural area of a house or environmental attributes, the resulting estimated coefficients indicate the homebuyers' marginal values of the attributes.

In statistical models involving property value data, there is high chance that property values might be spatially correlated or there might be a high spatial correlation in error terms due to some unobserved factors that can influence the property values. This may produce biased estimates if the spatial correlation is not accounted for in the model. The inclusion of the spatial correlation of house sale prices or error terms in a hedonic pricing model may produce better marginal implicit price estimates of the environmental variables of interest.

Figure 2. Average Distance of Residence from Wild Habitat and Parks, in meters




We compared the estimates of the Spatial Error Model (SEM) with other econometric models like Ordinary Least Squares (OLS) and Spatial Autoregressive (SAR) and find that SEM provides more robust estimates compared to these models. The coefficient for spatial error correlation also turns out to be positive and statistically significant, which validates the need to account for the spatial error correlation in the study.

We transformed the data into its logarithmic form. The logarithmic form produces more accurate estimates that can be compared in terms of relative size. In general, log transformations yielded a better fit of the model to the data than raw scale. In a log-log model the coefficients of the variables represent the percentage change in the dependent variable due to a 10% increase in the independent variable. In this study, the dependent variable is residential sale value and the independent variables are distance from parks, distance from wild habitats and lot size.

The results from estimating the SEM model are presented in Table 2. A negative value represents the percent decrease in the residential sale value and a positive value represents the percent increase in the residential sale value from a 10% increment in the variable. These numbers can also be interpreted as homebuyers' marginal percentage value for these amenities.

The number in parentheses is the t-statistic (t-stat). If the absolute value of the t-stat is greater than 2,

it means that the variable in question has a statistically significant impact on the sale value of housing.

## Results for Riverside County

Table 2 shows that a 10% increase in the distance from the nearest park is associated with a statistically significant decrease in the sale value of the property in all zones of Riverside County, during both time periods, indicating that homebuyers in Riverside County attach value to living in close proximity to parks.

For example, Table 2 shows that an increase of 10% in distance from a park reduced the sale value of a house by 0.43%, 0.70%, and 0.03% in Zones 1, 3 and 5, respectively, during 1996–99. Similarly, a 10% increase in the distance from a park decreased home values decreased by 0.26%, 0.43%, and by 0.02% in Zones 1, 3 and 5, respectively, during 2000–04. For example, if the distance from the nearest park of a home in Zone 1 was 820 meters and the sale value was $248,192, a 10% increase in distance from a park (82 meters) led to a 0.43% decrease in home value—$1,067. Proximity to parks had a positive amenity value in all zones of Riverside County, although the effect was not statistically significant in Zone 5.

Table 2 shows that an increase of 10% in the distance from wild habitat areas reduced sale value of a property by 0.12% in Zone 3 during 1996–99. Home value also decreased by 0.54% during 1996–99, and by 0.21% during 2000– 04, with an increase of 10% in distance from wild habitat areas in Zone 5. The negative impact on home value with an increase in distance from wild habitat areas was statistically significant only in Zone 5 of Riverside County. Zone 5 contains the cities of Riverside and Moreno Valley, which do not have adequate open space areas with wild habitat, causing buyers in that area to attach high value to wild habitat access.

Table 2 shows that the homebuyers' had a higher value for proximity to parks than wild habitat areas in Zones 1 and 3 of Riverside County during both time periods. In Zone 3 home values decreased by 0.70% with a 10% increase in distance from parks, but they were reduced by 0.12% with a 10% increase in distance from wild habitats during 1996–99. Homes in Riverside County are located closer to parks than wild habitat areas on average (Figure 2).

Home values increased with increases in lot size for all the zones of Riverside County during both time periods. Home values increased by 0.35% in Zone 1, 1.47% in Zone 3, and by 0.92% in Zone 5, with a 10% increase in lot size during 1996–99. Similar impacts on home values for lot size were found for 2000–04 for Riverside County.

## Results for San Bernardino County

Table 2 shows that a 10% increase in distance from parks reduced residential sale value in Zone 2 by 0.25% and in Zone 6 by 0.58% during 1996–99. We also found a decrease in home value of 0.08% in Zone 2, 0.53% in Zone 4, and of 0.18% in Zone 6 during 2000–04 with a 10% increase in distance from parks.

City parks have not been designated in San Bernardino County for over 20 years (Bluffstone et al. 2008), and the average distance from residences to parks in San Bernardino County is high relative to Riverside County (Table 1). The scarcity of parks in these zones of San Bernardino County contributes to their high amenity value.

A 10% increase in the distance from wild habitat areas reduced home value in Zone 2 by 0.73% during 1996–99, and by 0.74% during 2000–04. Home value was also reduced in Zone 6 by 0.14%, with a 10% increase in distance from wild habitat during 2000–04. The homebuyer's value for proximity to wild habitat areas was higher than the value of proximity to parks in Zone 2 during both time periods.

Zone 6 consists of big cities like San Bernardino, and this area does not have adequate parks. The average distance from a residence to a park was largest in Zone 6 compared to all other zones (Table 1). An increase in the distance from parks reduced home values by a greater percentage

Table 2. Spatial Error Model Regressions (SEM)

| Zones (1996–99) | Distance from Park (meters) | Distance from Wild Habitat (meters) | Lot Size (square feet) |
|---|---|---|---|
| 1 | -0.43 (-13.49) | 0.44 (7.11) | 0.35 (6.51) |
| 2 | -0.25 (-5.45) | -0.73 (-16.89) | 1.68 (33.59) |
| 3 | -0.70 (-6.83) | -0.12 (-0.82) | 1.47 (10.49) |
| 4 | 0.057 (0.62) | 0.13 (1.26) | 1.64 (19.71) |
| 5 | -0.03 (-0.77) | -0.54 (-10.09) | 0.92 (19.90) |
| 6 | -0.5 (-13.04) | 0.06 (1.01) | 0.36 (10.86) |
| **Zones (2000–04)** | **Distance from Park (meters)** | **Distance from Wild Habitat (meters)** | **Lot Size (square feet)** |
| 1 | -0.26 (-12.02) | 0.10 (2.94) | 1.43 (38.72) |
| 2 | -0.08 (-2.53 ) | -0.74 (-24.71) | 1.29 (37.79) |
| 3 | -0.43 (-8.38) | 0.61 (7.21) | 1.15 (16.47) |
| 4 | -0.53 (-11.19) | 0.48 (8.26) | 1.24 (31.81) |
| 5 | -0.02 (-1.09) | -0.21 (-7.50) | 1.29 (43.61) |
| 6 | -0.18 (-5.64) | -0.14 (-3.67) | 1.09 (24.53) |

than an increase in the distance from wild habitats in Zone 6 during both time periods. Home values decreased by 0.18% with a 10% increase in the distance from parks, and by 0.14% with a 10% increase in the distance from wild habitat during 2000–04.

The average distance to wild habitat areas from residential properties in Zone 4 was approximately 900 meters, the lowest of any zones. Table 2 shows a negative amenity value for proximity to wild habitat areas in Zone 4 during both time periods. There was a 0.48% increase in home value with a 10% increase in distance from wild habitat in Zone 4 during 2000–04.

Zone 4 is relatively rural, with residents more isolated from immediate access to shopping, schools, etc. This can be a reason for the results presented above.

Our results also show that there was a statistically significant increase in residential sale price with an increase in lot size for all the zones of San Bernardino County during both time periods. Home value increased by 1.68% in Zone 2, 1.64% in Zone 4, and by 0.363% in Zone 6, with a 10% increase in lot size during 1996–99. Comparable results for the effect of lot size on home values in San Bernardino County were found for the 2000-04 period.

## County Comparison

In some zones of both Riverside and San Bernardino County, we find that homeowners' value for lot size was higher than their value for proximity to open space areas. Home value decreased by 0.26% with a 10% increase in distance from parks, whereas they increased by 1.43% with a 10% increase in lot size in Zone 1 during 1996–99. In Zone 2 there was a 0.73% decrease in home value with a 10% increase in distance from wild habitat, whereas home value increased by 1.68% with a 10% increase in lot size during 1996–99.

Average residential property values increased for both the counties in 2000–04 compared to 1996–99. As Table 1 shows, this increase was higher for Zone 1 than Zone 2, and for Zone 4 than Zone 3, and for Zone 5 than Zone 6. Thus, Riverside County experienced greater appreciation of home values in two of the three study comparisons. Through its conservation plans, the RCIP could have played a key role in pushing up residential property values in the zones of Riverside County.

## Conclusion

Our results show that residential sale value decreased with increases in distance from open space, regardless of the presence of an open-space policy such as RCIP. Our results also show that scarcity of open space in zones with big cities (Zones 5 and 6) can lead to homeowners having a high value for proximity to open space. Higher value for lot size compared to proximity to parks and wild habitat areas for some of our zones suggest that private lot size can sometimes be a substitute for proximity to public open space.

Another important observation, from the methodological standpoint, is that the spatial error hedonic model used in this study provides more robust estimates compared to other econometric models. With more accurate and efficient estimates of value of open space and other variables, the spatial error hedonic model can be used in the decision-making process associated with open space conservation policy and urban land-use planning.

The amenity values generated in this study can help in estimating the benefit of conservation of open space, which can be used as a tool by policy makers to set the conservation fees, e.g., development impact fees that help finance conservation. Additionally, this study can prove significant for land-use planning and conservation decisions, not only in the Inland Empire region but for any other region with similar geographical characteristics and residential markets.

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### For additional information, the authors recommend:

Riverside County Integrated Project (www.rcip.org)

Bluffstone, R., M. Braman, L. Fernandez, T. Scott and P.-Y. Lee. 2008. "Housing, Sprawl, and the Use of Development Impact Fees: The Case of Inland Empire." *Contemporary Economic Policy*, 26(03) 433–447.