Methods to Assess Co-Benefits of California Climate Investments

Anti-Displacement

Center for Resource Efficient Communities, UC-Berkeley
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I. Background

Under California's cap-and-trade program, the State's portion of the proceeds from cap-and-trade auctions has been deposited in the Greenhouse Gas Reduction Fund (GGRF). The Legislature and Governor enact budget appropriations from the GGRF for State agencies to invest in projects that help achieve the State's climate goals. These investments are collectively called California Climate Investments (CCIs).

Senate Bill 862 requires the California Air Resources Board (CARB) to develop guidance on reporting and quantification methods for all state State agencies that receive appropriations from the GGRF. Guidance includes developing quantification methodologies for greenhouse gas (GHG) emission reductions and other non-GHG outcomes. Non-GHG outcomes are the positive or negative social, economic, and environmental impacts of projects, which are collectively referred to as "co-benefits." Some agencies use a competitive process to select CCI projects and they require applicants to estimate co-benefits when they submit a request for funding.

This document is one of a series that reviews the available methodologies for assessing selected co-benefits for CCIs at two phases: estimating potential project-level co-benefits prior to project implementation (i.e., forecasting of co-benefits), and measuring actual co-benefits after projects have been implemented (i.e. tracking of co-benefits). The assessment methodology at each of these phases may be either quantitative or qualitative. As with CARB's existing GHG reduction methodologies, these co-benefit methodologies will be developed to meet the following standards:

- Apply at the project level
- Align with the project types proposed for funding for each program
- Provide uniform methods to be applied statewide, and be accessible by all applicants
- Use existing and proven tools or methods where available
- Reflect empirical literature

CARB, in consultation with the State agencies and departments that administer CCIs,

has selected ten co-benefits to undergo methodology assessment and development. This document reviews available empirical literature on the ***anti-displacement*** co-benefit and identifies:

- the direction and magnitude of the co-benefit,
- the limitations of existing empirical literature,
- the existing assessment methods and tools,
- knowledge gaps and other issues to consider in developing co-benefit assessment methods
- a proposed assessment method for further development, and
- an estimation of the level of effort and delivery schedule for a fully developed method

II. Description of co-benefits

Previous literature has identified that various types of neighborhood transformation - including physical, demographic and economic – can result from government or market intervention in the built environment. *Displacement* refers to the coerced removal of households from their residents by conditions that affect the dwelling or neighborhood surroundings. According to Grier and Grier (1978), these conditions have the following characteristics:

- They are beyond ability and control of the households;
- They occur despite the household's having met all previously-imposed conditions of occupancy;
- They make continued occupancy impossible, hazardous or unaffordable.

The literature recognizes that displacement is forced upon households, but it does not necessarily involve involuntary actions. Newman and Owen (1982) found that changes of residence driven by economic reasons – such as low-income households "voluntarily" choosing to move because of rent increases – are also a form of displacement, since households under such situations lack reasonable alternatives.

Neighborhood displacement can be attributed to a variety of factors, including transportation investment, urban renewal and redevelopment, and urban greening. Grier and Grier (1978) identified all of the following conditions as ones that could result in neighborhood displacement.

Figure 1. Conditions that lead to neighborhood displacement. Source: Grier and Grier (1978).

Conditions
Abandonment
Accidental fire
Airport construction or expansion
Arson
Code enforcement (incl. overcrowding)
Conversion of rental apartments to condominiums
Demolition to make way for new housing
Demolition for safety/health reasons
Foreclosure
Highway or transit construction/expansion
Historic area designation
Institutional expansion (universities/hospitals, etc.)
Military base expansion
Natural disaster
Partition sales
Planning and zoning decisions
Public building construction
Redlining
Rehabilitation (private market)
Rehabilitation (publicly aided)
Renovation of public housing
Rising market prices and rents
School construction
Urban renewal
Withdrawal of private services from neighborhood or structure

They further categorized displacement based on the above conditions into three types: disinvestment displacement, reinvestment displacement, and displacement caused by enhanced market competition. Disinvestment displacement refers to the decay and abandonment of neighborhoods due to the lack of maintenance. Reinvestment displacement refers to the displacement that results from increased rent costs caused by various kinds of neighborhood reinvestment, both public and private. Displacement by enhanced market competition refers to the displacement brought about by changes in national and regional housing markets.

The GGRF programs that may affect displacement risks are shown in Table 1 below.

Table 1: CCI Programs Affected by Co-Benefit

Program	Project	Likely direction of co-benefit (+ = beneficial change)
Sustainable Communities and Clean Transportation		
HSRA	High Speed Rail	-
CalSTA	Transit and Intercity Rail Capital Program (TIRCP)	-
Caltrans	Low Carbon Transit Operations (LCTOP)	-
SGC	Affordable Housing and Sustainable Communities (AHSC)	+
SGC	Transformative Climate Communities (TCC)	+
Natural Resources and Waste Diversion		
CNRA	Urban Greening Program	-
CAL FIRE	Urban Forestry Program	-

III. Directionality of co-benefits

Research indicates that projects that increase property value will generally result in the displacement of low-income households from their vicinity. Thus, CCI projects that create new physical assets for neighborhoods, such as new rail stations, new open spaces, and new street trees, may increase displacement risks – a *negative co-benefit.* However, the Affordable Housing and Sustainable Communities (AHSC) program funds projects that include affordable housing targeted at households that cannot afford market-rate rents in the neighborhoods in question, which can act as a partial counterweight to displacement trends in those neighborhoods. The Transformative Climate Communities program may also possess the capacity to support such projects or take other measures to minimize or reverse displacement from areas of new public investment.

IV. Magnitude of co-benefits

Both private and public sectors play an important role in neighborhood transformation. Previous literature of the influence of the public sector on neighborhood change has primarily focused on the impact of transportation systems. Although few studies explicitly investigate the impact of public investment on neighborhood demographic changes, many studies do look at the impact on property values, which is directly associated with displacement.

Public transit

Proximity to transit is generally considered a net benefit for real estate assets, as it enhances accessibility to jobs and other urban amenities. Researchers have found that the accessibility benefits of living in proximity to transit usually outweigh the potential nuisances that may also be associated with transit, such as noise (Wardrip 2011). Such accessibility benefits are often capitalized into property values in the

form of premiums on real estate prices and rents.

There are two methods in the literature that investigate the effect of transit proximity on housing value. The first method is hedonic price modeling using cross-sectional data, aimed at examining the association between transit proximity and property value. The second method is a “natural experiment” approach that compares the changes in land prices before and after transit construction. Table 2 provides a summary of findings from the literature that used these two methods.

Table 2. Key Findings from the public transit and property value studies

Study	**Type of transit**	**Findings**
Armstrong and Rodriguez, 2006	Commuter rail	10 percent housing value premiums if near rail stations.
Cervero and Duncan, 2002	Light rail and commuter rail	Rents of apartments within 1/4 miles from rail stations are 45% higher.
Chatman et al., 2012	Light rail	The net effect of light rail to owned housing is neutral to slightly negative.
Duncan, 2008	Light rail	For properties within 1/4 miles from rail stations, values of condominiums are 17% higher while values of single family houses are 6% higher.
Goetz et al., 2010	Light rail	Within 1/2 miles from rail stations: sell prices for single family housing are $5,229 higher, sell prices for multi-family housing are $15,755 higher after the opening of rail service.
Immergluck, 2009	Light rail	Single family housing within 1/4 miles from rail stations are sold 15-30% higher than similar housing located elsewhere.
McMillen and McDonald, 2004	Rapid bus line	In the 1980s, single family houses within one mile from transit stations are 4.2% higher in selling prices. From 199s to 1996, the premium increased to 19.4%.
Pollack et al., 2010	Rail	This study investigated 42 stations: median home value around 29 of these station areas increased 20% more compared to other areas.

In general, this previous research has found that housing price premiums related to transit access vary significantly. Most studies in North America focus on the effect of rail access on housing price. A comprehensive review by Cervero and Duncan (2004) found that price premiums by rail access ranged from 6 percent to 45 percent. Another review of several studies (Hess and Almeida 2007) found that although price premiums can be as high as 32 percent, some studies had found that rail access has no effects or even negative effects on housing prices. The variation of results makes identification of a standard premium estimate difficult, as the influence of new rail construction on real estate prices appears to depend heavily on context.

North American studies on the impact of bus transit on housing price have generally found insignificant effects. Cervero and Duncan (2002) studied the housing price impact of the Los Angeles Bus Rapid Transit (BRT) and concluded that its effect on housing prices is marginal. Rodriguez and Targa (2004) found that bus transit in three metropolitan areas in the US had no significant effect on either residential or commercial property value, and suggested that the lack of fixed guideways of bus transit may be the reason why. However, recent studies found that areas in Los Angeles with access to BRT systems that do have fixed guideways (i.e. dedicated roadways for the exclusive use of the BRT) had experienced 25% rent increases over the study period, as opposed to 15% increase in control areas with no BRT access (Brown 2014).

A handful of recent studies have aimed at investigating the demographic changes in neighborhoods that had received new transit investments. Table 3 provides a summary of findings from these literatures. In general, the research concluded that transit development is a catalyst for neighborhood change that may displace current residents by increasing property value. But very few studies have explicitly investigated the changes of income and racial composition following these developments.

Table 2. *Key Findings from the public transit and gentrification studies*

Study	**Study period and location**	**Measure of neighborhood change**	**Findings**
Kahn, 2007	14 cities, 1970-2000	Changes in property value	Walk-and-ride stations have positive effect on housing value, while park-and-ride stations have negative effect on housing value.
Pollack et al., 2010	12 cities, 1990-2000	Population, race, income, rent, auto-ownership, transit ridership	Population, number of housing units, income, rents, home prices, average car ownership all increased in rail station areas; while transit use decreased in station areas.
Dominie, 2012	Los Angeles, 1990-2010	Income composition, racial composition, occupation, and education level.	Areas around transit stations are more likely to gentrify in LA; Car ownership increased in transit station areas, while transit ridership decreased.

Urban greening and forestry

Extensive research has focused on investigating the impact of urban parks, forests, and open space on property values. The majority of these studies used hedonic price analysis of property sales data, concluding that home values increase with proximity to a park or urban greenways, or linear areas of open space along rivers (Bolitzer and Netusil 2000, Achraya and Bennett 2001, Lutzenhiser and Netusil 2001, Troy and Grove 2008). Studies often distinguish broadly between protected open space, such as public parks and land under conservation easement, and developable open space, such as privately owned agricultural land (Irwin 2002, Geoghegan 2002). This difference is relevant because studies have found that preserved open space surrounding a home increases home value, while developable open space has a lesser, insignificant, or negative effect on home value (Anderson and West 2006).

V. Limitations of current studies

The major limitation of current studies is that most studies focus on the relationship between investment and property value, but the step between changing property value and the change in neighborhood demographic composition is incomplete in the literature. There are no rigorous empirical studies that explicitly investigate the *displacement* consequences, as opposed to the property value effects, from transportation improvements. Many hypothetical mechanisms of displacement from rising living cost are still untested. For example, a recent study by Rayle (2015) argued that even if property costs increase as a result of transportation improvement, residents may still choose to stay because of the decrease in transportation cost.

Much research (e.g. Lees 2008, Slater 2008) assumes that displacement always occurs simultaneously with gentrification (in the form of property value increases), but some scholars have argued that gentrification may not always result in displacement (Ellen and O'Regan 2011, Freeman 2005, Freeman and Braconi 2004, McKinnish et al 2010). These studies concluded that under some conditions gentrification can have positive effects on neighborhood without displacement, especially in neighborhoods with large areas of developable vacant land (Butler 2007, Hamnett 2009). As such, some recent studies have argued that gentrification may take many forms depending on the drivers behind it, such as public investment, demographic changes, or macro-economic factors (Davidson 2011, Atkinson 2008).

Displacement may also take many different forms, but previous research has primarily focused on increasing economic pressure from rising housing costs. Unlike direct displacement due to economic reasons, Marcuse (1985) proposed a broader kind of displacement, known as exclusionary displacement, to refer not only to the displacement of current residents, but also the exclusion of new residents with certain socio-economic traits. The current displacement literature does not explicitly investigate the magnitude of exclusionary displacement, let alone provide a reliable

tool to assess its magnitude.

VI. Existing quantification methods and tools

Existing methods and tools for the assessment of displacement risks fall into three categories: neighborhood early warning systems, off-model assessment methodologies, and regional modeling.

Neighborhood early warning systems

Neighborhood early warning systems were first developed to analyze crime rates, housing abandonment, housing price appreciation and land use change (Gorr and Lee 2015, Williams et al 2013, Galster and Tatian 2009, Waddell 2002). Later such systems were adopted to predict the likelihood of neighborhoods becoming gentrified. Although such systems were developed with prediction in mind, they can also be suitable for analyzing the past changes in neighborhoods (Chapple 2009). These systems generally synthesize a variety of socio-economic and land use indicators, such as those compiled in Figure 2 by Chapple and Zuk (2016).

One example of a neighborhood warning system is the Chicago gentrification index, which estimates a gentrification score for each neighborhood from 1970 to 2010 based on a composite index that compares the neighborhood to the city as a whole for selected indicators (Natalie Voorhees Center 2015). A neighborhood's gentrification level is determined by whether the neighborhood had higher than average value across the relevant factors. Then the system constructs a map showing the neighborhood change based on these estimated scores.

Figure 2. *Indicators and Data Sources for Analyzing Gentrification and Displacement (From Chapple and Zuk, 2016)*[43]

Indicator Type	Indicators	Data Sources
Change in property values and rents	Sales value, property value	County tax assessor's office, finance departments, data aggregator
	Rent	Data aggregators, apartment operating licenses, Craigslist
	Change in availability of restricted affordable housing	HUD, housing departments
Investment in the neighborhood	Building permits, housing starts, renovation permits, absentee ownership	Jurisdiction's building or planning departments
	Mortgage lending and characteristics	HMDA and assessor data
	Sales (volume and price)	County assessor's office, data aggregators
	Condo conversions	Assessor office, housing department, department of public works
	Change in community and business organizations (#, membership, nature of activities, etc.)	Chamber of commerce, Dun & Bradstreet, neighborhood or local business associations, etc.
	Public investments (transit, streets, parks, etc.)	Public works departments, transit agencies, parks and rec, etc.
Disinvestment	Building conditions, tenant complaints, vacancies, fires, building condemnation	Surveys, Census, maps, building departments, utility shut-offs, fire department
	School quality, crime, employment rates, neighborhood opportunity	Department of Education, Police Departments/crime maps, Census, Bureau of Labor Statistics
	Neighborhood quality	Local surveys
Change in tenure and demographic changes	Tenure type, change in tenancy	Building department, assessor's office, Census
	Evictions	Rent board, superior court
	Foreclosure	HUD, proprietary data sources
	Demographic data on in- vs out-movers (race, ethnicity, age, income, employment, educational achievement, marital status, etc.)	Census, voter registration, real estate directories, surveys, American Housing Survey, Department of Motor Vehicles
Investment potential	Neighborhood and building characteristics (e.g., age and square footage, improvement-to-land ratio)	Tax assessor, Census, deeds, etc.
	Neighborhood perceptions	Surveys of residents, realtors, lenders, neighborhood businesses, newspapers, TV, blogs, etc.
Reasons that people move in/out of 'hood	Reason for move	Surveys of in- and out-movers, state housing discrimination complaints database
Coping strategies/displacement impacts	Crowding/doubling up	Census, utility bills, building footprint
	Increased travel distance and time	Census

Another example of a neighborhood early warning system was developed by Bates (2013) for Portland. This system identified potential gentrified census tracts by assessing the following indicators in 2010: percentage of renters, communities for color, college degree holders, and low-income households. Based on these indicators, this system divided neighborhoods into three typologies of change in order to help planners make decisions:

1. Adjacent tracts (low/moderate 2010 value, low-moderate appreciation, next to high value/appreciation tract);
2. Accelerating tracts (low/moderate in 2010 with high appreciation rates);
3. Appreciated tracts (low or moderate 1990 values, high 2010 value, high 1990-2010 appreciation)

In the state of California, a neighborhood early warning system is used in the San Francisco Bay Area. It is a typology analysis of census tracts based upon a gentrification index that adapts the methodologies of various researchers (Freeman 2005, Bates 2013) to characterize census tracts in which vulnerable populations historically have resided but have since experienced significant demographic shifts as well as real estate investment between 2000 and 2013. The loss of low-income households is used as the indicator for gentrification, and the system assumes that any neighborhood that has experienced a net loss of low-income households while remaining stable (or rising) in overall population has experienced displacement. A typology of displacement, including both gentrification-related displacement and exclusion-related displacement, was also identified using an index built with these relevant factors.

Off-model displacement assessment methodology

Chapple et al (2015) developed an off-model tool for predicting neighborhood gentrification and displacement, which is an extension of the neighborhood early warning systems. This tool first determined whether a neighborhood is currently “eligible” (i.e. at risk) for gentrification based on the criteria summarized in Figure 3.

Figure 3. *Criteria of gentrified neighborhoods. Source: (Chapple et al 2015*[46]*)*

A tract was eligible if it met all of the following criteria:

Tract Indicator	**Year 1**
Population	At least 500 residents
Vulnerable, meeting 3 out of the following 4 indicators:	
% low-income (household income below 80% of the county median)	Above the county 40th percentile
% with Bachelor's degree of Higher	Below county 40th percentile
% renters	Above county median
% nonwhite	Below county median

A tract is said to be gentrified or gentrifying if it meets eligibility and all of the following criteria:

Tract Indicator	**Change between Year 1 and Year 2**
% with Bachelor's degree of Higher	Above county average
Median household income	Above county average
% non-Hispanic white	Above county average
Median gross rent	Above county average

If an area is determined to be "eligible" (at risk) for gentrification, then an additional series of variables are assessed to determine the future risk of gentrification. These variables are summarized in figure 4. Eligible tracts that had only one out of the four risk factors in Figure 4 were given a risk level of "low". Tracts with two or three of the risk factors were assigned a risk level of "moderate", and tracts with all four risk factors were assigned a "high" level of risk.

Figure 4. Criteria for future gentrification.

1. Within ½ mile of a rail transit station
2. % of units in buildings built pre 1950 > regional median
3. Employment Density (# jobs/square mile) > regional median
4. Loss of households living in naturally occurring affordable units > regional median

Regional land use modeling-based assessment methods

Regional land use models can be adapted to model the displacement impacts of investment. Chapple et al (2015) adapted UrbanSim, a large-scale land use model, to address and predict the displacement impact from investment. UrbanSim is a simulation-based model that projects the changes in land use and travel patterns under different future population and economic scenarios. It is a series of disaggregate models that can capture location choices made by individual households (Waddell 2002). The specifications of UrbanSim model are shown in Figure 5.

Figure 5. Specification of UrbanSim model components (Source: Chapple et al., 2015)

Model	Agent	Dependent Variable	Functional Form
Household Location Choice	Household (New or Moving)	Residential Building with Vacant Space	Multinomial Logit
Employment Location Choice	Establishment (New or Moving)	Non-residential Building with Vacant Space	Multinomial Logit
Building Location Choice	Building	Parcel (with Vacant Land)	Multinomial Logit
Real Estate Price	Parcel	Price	Multiple Regression

This disaggregate structure of UrbanSim makes it flexible enough to change model specifications in order to investigate the displacement risk of different policy scenarios. The modifications of UrbanSim for addressing displacement risk include separating renter from owner markets, incorporating income and ethnicity into household specifications, introduction of a choice model for moving out, adding a representation of rent burden in residential location choice, and estimating the feasibility of affordable housing development in the real estate development model.

VII. Discussion of knowledge gaps and other issued to consider in development co-benefit quantification methods

There are substantial limitations to each of the available methods for assessing potential displacement risks at the project level. Neighborhood early warning systems, as the name implies, analyze displacement potential at the neighborhood scale (defined for practical purposes as the census tract), rather than at the scale of individual projects. They attempt to identify census tracts that may be vulnerable to gentrification and related displacement, but do not offer a direct means of assessing the role that an individual project might play in turning those vulnerabilities into actual gentrification and displacement.

The off-model assessment method was also designed to operate at the census tract level (not the project level) and shares many of the limitations of the early warning systems. In addition, the models are only calibrated for LA and the Bay Area. Using this methodology for other regions would require the compilation of variables for every census tract in other regions, statistical modeling to estimate coefficients for key variables for each region, and testing of the resulting models to assess how well they predict gentrification/displacement. Additionally, the off-model tools were designed to use historical data to predict likelihood of gentrification/displacement, and were not designed as scenario assessment tools for individual projects. To be able to use the tool in this way would require that applicants be able to predict how the composition of the tract would change in terms of demographics in addition to housing cost/price changes. Finally, these models are likely not useful for assessing impact on gentrification and displacement in the short term, since American Community Survey data, while updated yearly, are unlikely to show changes in displacement indicators for several years.

Among CCI programs, projects funded by the High Speed Rail and Transit and

Intercity Rail Capital programs will likely generate displacement risks due to the likelihood of increases in property values in proximity to new rail stations. These effects are also likely to be significant at the program level, and may be large enough to create significant displacement risks for the GGRF as a whole.

Projects funded under the Low Carbon Transit Operations Program (LCTOP) that support new or expanded rail, bus, or water-borne transit services may also have significant displacement risk impacts, especially if these service expansions include new stops and stations. Other types of LCTOP projects are not likely to have effects on displacement risks, so the program-level significance of potential displacement risks will depend on the proportion of program spending in future years that goes to service expansions, and the character of those service expansions.

Projects funded by the Urban Greening and Urban Forestry programs are likely to result in only minor increases in displacement risks because property value increases attributable to urban open space or trees by themselves are not generally large enough to drive resident displacement. Furthermore, newly planted urban green spaces and urban trees often take several years or more to reach full maturity. Any property value increases resulting from them are likely to unfold gradually until that time, diluting their already small impact on displacement risks. Even at the program level, these effects are likely to be small relative to the more fundamental drivers of displacement risks, such as access to regional job centers.

Projects funded by the Affordable Housing and Sustainable Communities (AHSC) program are often expressly dedicated to building affordable housing for households earning below the area median income, and as such generally will not increase displacement risks. Whether a given AHSC project actually reverses net displacement of low-income people in a given neighborhood depends upon whether the new housing created by the project is affordable to households at income levels below those typical of that neighborhood.

Under certain specific circumstances, an AHSC project could produce housing that meets accepted definitions of affordability yet is actually more expensive than existing rental housing in its neighborhood, creating the possibility that the new AHSC project could be perceived as an indicator of relative gentrification. Even in these instances, however, it is unlikely that any displacement dynamics occurring in such communities are attributable to the AHSC project per se, as opposed to larger factors such as trends in regional housing markets, adjacency to gentrifying neighborhoods, or transit access.

The Transformative Climate Communities (TCC) program may also possess the capacity to stimulate any of the transit or housing project types mentioned above, or to take other measures to minimize or reverse displacement from areas of new public investment, but it remains to be seen whether these will be features of forthcoming TCC plans.

VIII. Proposed method/tool for use or further development

Overall, existing methods are inadequate to assess resident displacement risk co-benefits of CCI investments at the project level. Development of an assessment framework based upon the off-model assessment methods would require statistical analysis of several California housing markets in order to determine the most suitable variables for identifying gentrification and displacement risk, and would still be of limited applicability because they function at the census tract scale rather than the individual project scale. UC-Berkeley therefore recommends that no assessment method be developed at this time.

IX. Bibliography

Acharya, G. & Bennett, L. L. 2001. Valuing open space and land-use patterns in urban watersheds. *Journal of Real Estate Finance and Economics* 22: 221–237.

Anderson, S. T. & West, S. E. 2006. Open space, residential property values, and spatial context. *Regional Science and Urban Economics* 36: 773–789.

Armstrong, R. J. & Rodríguez, D. A. 2006. An evaluation of the accessibility benefits of commuter rail in eastern Massachusetts using spatial hedonic price functions. *Transportation* 33: 21–43.

Atkinson, R. 2008. Commentary: Gentrification, segregation and the vocabulary of affluent residential choice. *Urban Studies* 45: 2626–2636.

Bates, L. 2013. *Gentrification and Displacement Study: Implementing an Equitable Inclusive Development Strategy in the Context of Gentrification*. Portland, OR: Portland State University.

Bolitzer, B. & Netusil, N. R. 2000. The impact of open spaces on property values in Portland, Oregon. *Journal of Environmental Management* 59: 185–193.

Brown, A. 2014. *Neighborhood Change Along the Orange Line (BRT) Applied Planning Research Project*.

Butler, T. 2007. For gentrification? *Environmental Planning A* 39: 162–181.

Cervero, R. & Duncan, M. 2004. Neighbourhood composition and residential land prices: Does exclusion raise or lower values? *Urban Studies* 41: 299–315.

Cervero, R. & Duncan, M. 2002. *Land Value Impacts of Rail Transit Services in Los*

Angeles County. Report for the National Association of Realtors and Urban Land Institute.

Chapple, K. 2009. *Mapping Susceptibility to Gentrification: The Early Warning Toolkit*. Berkeley, CA: Center for Community Innovation.

Chapple, K. & Zuk, M. 2016. Forewarned: The use of neighborhood early warning systems for gentrification and displacement. *Cityscape: A Journal of Policy Development and Research* 18: 109–130.

Chapple, K., P. Waddell, D. Chatman, A. Loukaitou-Sideris and P. Ong. 2016. *Developing a New Methodology for Analyzing Displacement*. Report to the California Air Resources Board under Agreement 13-310.

Chatman, D. G., Tulach, N. K. & Kim, K. 2012. Evaluating the economic impacts of light rail by measuring home appreciation: A first look at New Jersey's River Line. *Urban Studies* 49: 467–487.

Davidson, M. 2011. Gentrification in crisis: Towards consensus or disagreement. *Urban Studies* 48: 1987–1996.

Dominie, W. 2012. *Is Just Growth Smarter Growth? The Effects of Gentrification on Transit Ridership and Driving in Los Angeles' Transit Station Area Neighborhoods.* Los Angeles: UCLA.

Duncan, M. 2008. Comparing rail transit capitalization benefits for single-family and condominium units in San Diego, California. *Transportation Research Record* 2067: 120–130.

Ellen, I. G. & O'Regan, K. M. 2011. How low income neighborhoods change: Entry, exit, and enhancement. *Regional Science and Urban Economics* 41: 89–97.

Freeman, L. 2005. Displacement or succession?: Residential mobility in gentrifying neighborhoods. *Urban Affairs Review* 40: 463–491.

Freeman, L. & Braconi, F. 2004. Gentrification and displacement New York City in the 1990s. *Journal of the American Planning Association* 70: 39–52.

Galster, G. & Tatian, P. 2009. Modeling housing appreciation dynamics in disadvantaged neighborhoods. *Journal of Planning Education and Research* 29: 7–22.

Geoghegan, J. 2002. The value of open spaces in residential land use. *Land Use Policy* 19, 91–98.

Goetz, E. G., Ko, K., Hagar, A., Ton, H. & Matson, J. 2010. The Hiawatha Line: Impacts on land use and residential housing value.

Gorr, W. L. & Lee, Y. 2015. Early warning system for temporary crime hot spots. *Journal of Quantitative Criminology* 31: 25–47.

Grier, G. W. & Grier, E. S. *Memo Report: Urban Displacement: a Reconnaissance.* Bethesda, Maryland: The Grier Partnership.

Hamnett, C. 2009. The new Mikado? Tom Slater, gentrification and displacement. *City* 13: 476–482.

Hess, D. B. & Almeida, T. M. 2007. Impact of proximity to light rail rapid transit on station-area property values in Buffalo, New York. *Urban Studies* 44: 1041–1068.

Immergluck, D. 2009. Large redevelopment initiatives, housing values and gentrification: The case of the Atlanta Beltline. *Urban Studies* 46: 1723–1745.

Irwin, E. G. 2002. The Eefects of open space on residential property values. *Land Economics* 78: 465–480.

Kahn, M. E. 2007. Gentrification trends in new transit-oriented communities: Evidence from 14 cities that expanded and built rail transit systems. *Real Estate Economics* 35: 155–182.

Lees, L. 2008. Gentrification and social mixing: Towards an inclusive urban renaissance? *Urban Studies* 45: 2449–2470.

Lutzenhiser, M. & Netusil, N. R. 2001. The effect of open spaces on a home's sale price. *Contemporary Economic Policy* 19: 291–298.

Marcuse, P. 1985. Gentrification, abandonment, and displacement: Connections, causes, and policy responses in New York City. *Journal of Urban and Contemporary Law* 28: 195–240.

McKinnish, T., Walsh, R. & Kirk White, T. 2010. Who gentrifies low-income neighborhoods? *Journal of Urban Economics* 67: 180–193.

McMillen, D. P. & McDonald, J. 1982. Reaction of house prices to a new rapid transit line: Chicago's Midway Line, 1983–1999. *Real Estate Economics* 32: 463–486.

Newman, S. J. & Owen, M. S. 1982. Residential displacement: Extent, nature, and effects. *Journal of Social Issues* 38: 135–148.

Nathalie P. Voorhees Center. 2015. *Gentrification and Neighborhood Change: Helpful Tools for Communities*. Chicago, IL: University of Illinois, Chicago.

Pollack, S., Bluestone, B. & Billingham, C. 2010. *Maintaining Diversity In America's Transit-Rich Neighborhoods: Tools for Equitable Neighborhood Change.* Dukakis Center for Urban and Regional Policy.

Rayle, L. 2015. Investigating the connection between transit-oriented development and displacement: Four hypotheses. *Housing Policy Debate* 25: 531–548.

Rodriguez, D. & Targa, F. 2004. Value of accessibility to Bogotá's bus rapid transit system. *Transportation Review* 24: 587–610.

Slater, T. 2008. 'A literal necessity to be re-placed': A rejoinder to the gentrification debate. *International Journal of Urban Regional Researcy* 32: 212–223.

Troy, A. & Grove, J. M. 2008. Property values, parks, and crime: A hedonic analysis in Baltimore, MD. *Landscape and Urban Planning* 87: 233–245.

Waddell, P. 2002. UrbanSim: Modeling urban development for land use, transportation, and environmental planning. *Journal of the American Planning Association* 68: 297–314.

Wardrip, K. 2011. *Public Transit's Impact on Housing Costs: A Review of the Literature*.

Williams, S., Galster, G. & Verma, N. 2013. Home foreclosures as early warning indicator of neighborhood decline. *Journal of the American Planning Association* 79: 201–210.

Wyly, E., Newman, K., Schafran, A. & Lee, E. 2010. Displacing New York. *Environmental Planning A* 42: 2602–2623.