

Brownfield Redevelopment and Affordable Housing: A Case Study of New Jersey

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Abstract

A total of 779 New Jersey residents were surveyed to determine the number of people who during the next five years would be willing to move to housing built on brownfield sites that have been remediated to the extent that they pose no plausible brownfield-related health risk to residents.

Fourteen percent of the respondents said they would be willing to move to and live in housing built on cleaned-up brownfields. These respondents were disproportionately relatively poor and young and resided in apartments and cities, especially cities where the city government was actively promoting brownfields. These respondents also did not like their current neighborhoods, did not feel threatened by the idea of living on a cleaned-up brownfield site, and trusted experts to advise them on the health risks involved.

Keywords: Affordability; Development/revitalization; Housing

Introduction

Meeting the housing needs of U.S. cities was not the major reason the U.S. Environmental Protection Agency (EPA) started a program to remediate brownfields. The estimated 100,000 to 500,000 brownfields are former industrial and commercial buildings that are contaminated or perceived to be contaminated by industrial operations, and they are underutilized or abandoned. One goal of the EPA program was to create jobs and new taxable activities (ratables) (Bartsch and Collaton 1997; EPA 1998; Platt 1998; Powers et al. 2000; Simons 1998; U.S. Conference of Mayors 2000). In addition to economic stimulation, a second goal of the EPA and its congressional supporters was to eliminate the risk to people living near contaminated sites, that is, to reduce the possibility of seepage of hazardous substances into nearby water supplies, the threat

of fires and explosions from flammable materials, and the direct exposure of neighbors who might accidentally contact hazards on or close to the surface. Small amounts of contaminants sometimes remain in the soil after cleanup, so an impervious cover is built to prevent exposure. Monitoring is required to make sure that physical barriers do not degrade or become damaged by digging and other on-site activities.

With the dual goals of economic stimulation and health protection in mind, studies have shown that many brownfield sites are suitable for new factories, warehouses, stores, and other commercial activities. The view of brownfield redevelopment as a job-creating activity is supported by reports touting instances where thousands of jobs were created on remediated brownfield sites (Goldshore and Lieberman 2000; Holusha 1999; Powers et al. 2000; Schilling 1999; Van Horn, Dixon, and Lawler 1999).

Yet field investigations show that many brownfield sites are not suitable for commercial activity because they are too small, have shapes that are not conducive to commercial activities, or are not well located. These sites may be appropriate for small shops, parks, other forms of open space, and housing (Miller et al. 2001; Powers et al. 2000). Housing, the last of these, is the focus of this article and has become an option that is being considered more seriously than it was five years ago, when jobs and ratables were the focus of attention (Bartsch and Dorfman 2000; Greenberg and Lewis 2000; Kirkwood 2000; National Association of Realtors 2001; National Governors Association 2000). One reason is evidence that cleaned-up brownfield sites could help fill the need for new housing. For example, New Jersey is expected to grow by 225,000 people during the next five years and will need 80,000 to 100,000 new housing units. Housing that poor and lower-middle-income people can afford is particularly needed. In New Jersey, the Council for Affordable Housing (COAH) of the Department of Community Affairs estimated the need for affordable housing in the state for the 1993–99 period at 86,000 new and rehabilitated housing units, that is, enough for more than 200,000 people. To date, COAH reports that 26,800 units have been built or are under construction, 10,400 have been rehabilitated, and 21,300 more are waiting for a developer to act. In other words, the need for the period was not met, and COAH has not completed its estimates for 2000 to 2005 (Bishop 2001; see also Dolan 1990; League of Women Voters of New Jersey 1988; New Jersey Department of Community Affairs 1991). Assuming that the needs stay the same or increase, it is reasonable to assume that at least 90,000 more housing units, many of them for the relatively poor, will be needed.

Miller et al. (2001) visited over 100 brownfield sites in 12 municipalities in New Jersey. They spoke with city planners and other local officials and then visited each site. About half of the sites had confirmed contamination, mostly low levels of oils, solvents, and metals. Many of the

others had not had environmental surveys, so the extent of contamination was not known. Plot size varied considerably: 28 percent were less than half an acre, and 25 percent were five acres or more. Notably, 80 percent are within a quarter-mile of the nearest residence, and many were in residential neighborhoods. A site-by-site, neighborhood-by-neighborhood review concluded that the most likely use of many of the sites was housing for poor and lower-middle-income populations. When extrapolated to New Jersey as a whole, cleaned-up brownfield sites could absorb 6 to 29 percent of the state's housing needs for 2001 to 2005, much of it for economically disadvantaged populations.

The wide range of these estimates is due to the limited data on brownfields in New Jersey, typical of the United States as a whole. There is no uniformly applied definition of brownfield used by every state and local government. New Jersey illustrates the implications. Briefly, the state has a list of about 10,000 potentially contaminated sites. The state government considers 1,157 of these potentially redevelopable. However, not many have been visited by state officials, and no one knows how many are likely to be developed during the next five years. The state also maintains a smaller list of sites that are more likely to be developed because municipalities have applied for grants to redevelop them. In addition, the municipality had a preferred final use for 73 percent of the sites visited by Miller et al. (2001), but for 27 percent, it did not. Miller used her professional experience as a land use planner with expertise in housing to pick a final use for that 27 percent. The 6 percent estimate for potential housing comes from assuming that only the smaller list of sites for which a final use is known and for which the municipality has applied for cleanup funds will be developed during the next five years. The higher 29 percent figure assumes that all 1,157 sites will be developed within the next five years. The first estimate is probably too conservative, and the second is no doubt too optimistic. However, the quality of data is such that it would be misleading to try to be more precise at this time.

Mayors and elected officials want brownfields programs to create jobs and ratables. Yet they have also begun to realize that many sites are not suitable for commercial activity and that there is evidence that people who live near these sites prefer housing, small stores, and community facilities rather than factories and other large commercial properties. For example, a survey done in Perth Amboy, NJ, in a neighborhood with more than a dozen brownfield sites found that 90 percent of the neighbors wanted parks and play areas, and more than 80 percent wanted art and other cultural facilities, theaters, and health care facilities (Greenberg and Lewis 2000). About half wanted housing. Only 25 percent or less preferred factories, stores, and warehouses. Empirical findings of community preferences have helped elected officials and developers modify their plans (Powers et al. 2000).

With regard to housing on brownfields, there are prominent examples of families investing over a million dollars for new housing built on cleaned-up brownfields (Evans 2000; Wells 2000). In fact, a recent survey found no brownfield sites in five small New Jersey cities that overlook the New York City skyline because this valuable land has already been purchased for redevelopment, much of it for housing (Greenberg, Downton, and Mayer 2000). However, evidence exists that some people are leery about occupying a cleaned-up brownfield site. For example, a potential buyer of a \$200,000 townhouse in Union, NJ, recently canceled a purchase contract because of concern about the effects of adjacent manufacturing operations and residual ground water contamination. The customer could not readily get answers from governmental agencies about the health risks (Wells 2000).

Cleanup costs are typically not a major issue. For example, the Council for Urban Economic Development (1999) examined 107 very diverse brownfield projects and found that clean-up costs averaged only 8 percent of total project costs. However, we know of unpublished cases where people purchased land on brownfield sites with the idea of building housing. Unfortunately, contamination was subsequently discovered, and they have faced high unanticipated remediation costs that have jeopardized their investments by doubling or more than doubling project costs and tying the project up in the courts (Michael Hedden, personal communication, December 2000).

Anecdotal information and case studies similar to those just described are interesting but are not a replacement for analyses based on systematic sampling to determine what proportion of the public is willing to buy or rent houses on cleaned-up brownfield sites. This article describes what is, to the best of our knowledge, the first effort to use sample survey methods to determine the public's desire to buy or rent such housing. More specifically, the article answers three questions:

1. What proportion of the New Jersey population is willing to buy or rent on cleaned-up brownfield sites during the next five years?
2. What are the characteristics of those who are willing, and not willing, to consider this option?
3. What incentives might increase the proportion of people willing to consider living on cleaned-up brownfield sites?

Previous research

The answers to these three questions require consulting three bodies of literature. One concerns who moves and why. Every decade, the U.S. government asks people where they lived five years earlier. In addition,

the Census Bureau does annual surveys. From 1975 to 1995, an average of about 45 percent of U.S. residents moved during each of the five-year periods included (1975–80, 1980–85, 1985–90, and 1990–95) (Faber 2000a, 2000b; Schachter 2000). But there is wide variation by age, race/ethnicity, housing tenure, and socioeconomic status. The five-year moving rate from 1990 to 1995 was 44.1 percent. The moving rate for those 25 to 29 was 74.7 percent, compared with 14.7 percent among those aged 75 to 84. Among those aged 20 to 34, over two-thirds moved at least once. The moving rate drops dramatically after age 40. The moving rate among 45- to 54-year-olds was 32 percent; it was 24 percent among those aged 55 to 64, and it dropped to 17 percent among those 65 and older. In other words, we would expect younger people to be far more likely to move than older people.

Race and ethnicity also demonstrate major differences in moving rates. Non-Hispanic whites had a moving rate of 41.5 percent, while all the other groups moved more frequently. The rates for non-Hispanic blacks, Asian and Pacific Islanders, and Latinos between 1990 and 1995 were 47.6, 54.0, and 55.6 percent, respectively. Another major difference is housing tenure. Only 31 percent of housing owners moved, compared with 72 percent of renters. Socioeconomic status also makes a big difference in the propensity to move. Almost half of those earning less than \$10,000 a year moved from 1990 to 1995. The proportion drops as income increases, reaching 36 percent in the \$75,000 and over group. Of course, the poorest tend to be disproportionately unemployed and divorced, so that workforce and family status are part of any expectations grounded in socioeconomics. Overall, relatively young, poor African Americans and Latinos who live in apartments are disproportionately more likely to move than older, more affluent people and European Americans who live in homes they own.

Distance from brownfield sites is another important variable that should influence the results. Intracounty moves are much more frequent than out-of-county ones. From 1990 to 1995, 56.7 percent of moves were within the same county. Consequently, those who live near brownfields are more likely to accept housing built on them than those who do not. Given that brownfields are heavily concentrated in New Jersey's cities and older industrial suburbs, we expected that most of those willing to move would be found in cities and older industrial suburbs that have brownfields and programs to redevelop them.

The second body of literature that must be consulted deals with neighborhood quality and reasons for moving to neighborhoods or leaving them. Clay and Hollister (1983) summarize the essence of what people like and dislike about neighborhoods. People like places that are safe, well groomed, and quiet and that have friendly people, good housing stock, and good schools. They dislike places that are dangerous, physically blighted, and unattractive. These findings are supported by recent

work in more than 40 neighborhoods (Greenberg and Schneider 1996). In essence, research points to crime and physical decay as absolutely destructive of neighborhoods and as the most serious problems (Greenberg 1999; Ross and Mirowsky 1999). An increase in crime and physical decay makes a neighborhood less attractive, so eliminating these problems should make neighborhoods more attractive to residents and investors.

In fact, however, other neighborhood changes are also noticed by residents (Aitken 1990; Kaplan and Kaplan 1978; Palen 1987). Campbell, Converse, and Rodgers (1976) argue that perceived change in neighborhood quality is powerfully important to people. While some changes are applauded, others produce a grief reaction similar to divorce or even death (Folkman and Lazarus 1988; Gallagher 1993). Clay and Hollister (1983) classified people into mover categories. Three of their types are particularly germane with respect to brownfields redevelopment. "Involuntary out-movers" have the resources to leave, and when the neighborhood changes in ways they dislike, they do. "Unwilling stayers" dislike their neighborhood but cannot move because of a lack of financial resources, family living in the area, their job, or other reasons. "In-movers" take advantage of new housing and other opportunities.

We expected that neighborhoods with brownfields would typically be considered unattractive, but that redevelopment would cut down the propensity to move, might make the unwilling stayers feel better about their neighborhoods, and bring in people from adjacent neighborhoods. A brownfield redevelopment for housing that is part of a neighborhood-wide improvement plan would reverse the perception that the current neighborhood is deteriorating and make people feel that it is going to be made safer and have more recreation opportunities, better schools, theaters and entertainment, and convenient transportation. The literature clearly demonstrates that people want to buy ("Downtown Housing" 1999; Rosenthal 2001). For example, Rosenthal (2001) reports record homeownership rates (67 percent in the year 2000) and substantial increases in homeownership rates among African Americans and Latinos, and he proposes ways of raising these rates. A cleaned-up brownfield site has the potential to offer local high-quality ownership opportunities to poor African Americans and Latinos.

The third body of literature is risk perception and what influences it. Public opinion polls show that the American public is concerned about environmental hazards. For example, a Gallup poll taken just before the 30th Earth Day in 2000 showed that over two-thirds of Americans were "very concerned" about hazardous wastes (Gillespie 1999; Saad and Dunlap 2000). Notably, this is almost the same proportion who were concerned on the first Earth Day, three decades earlier (Baxter 1990). Furthermore, the public has not signaled any desire to weaken the regulations that govern pollution control to create more economic growth. For example, in 2000, 70 percent, the highest proportion in over a de-

cade, would not weaken environmental regulations to increase jobs. Clearly, we should expect a large proportion of Americans to be worried about residual contamination on former industrial sites, especially if the projected use is housing.

The literature on risk perception, however, shows that not everyone is equally risk averse. Gender, age, race/ethnicity, and socioeconomic status are associated with sensitivity to environmental hazards (Blocker and Eckberg 1989; Cutter 1993; Douglas 1985; Hamilton 1985; Van Liere and Dunlap 1980). Women, younger people, and people with young children are usually more worried about environmental hazards than men, older people, and those without families. This literature also shows that more educated and more affluent people are more concerned.

But, in reality, we expected these generalities to be mitigated by two factors. One is local circumstances. For example, a study of male-female differences in risk perception in neighborhoods rated as good or excellent by their residents found that women were more concerned about environmental hazards, although this was not the finding in neighborhoods rated fair or poor quality by their residents. In this set of more environmentally distressed neighborhoods, men were just as concerned about environmental hazards as women (Greenberg and Schneider 1995). In essence, people try to integrate the personal risk and benefit to them (Alhakami and Slovic 1994; Baldassare and Katz 1992; Gregory and Mendelsohn 1993; Sokolowska and Tyszka 1995). With regard to brownfields, people who live near such sites in municipalities where the local government has moved to clean them up should be more aware of the positive side of redevelopment than those who do not have the experience of seeing first-hand the benefits to their neighborhood of cleaning up and redeveloping brownfields.

In New Jersey, six cities (Camden, Elizabeth, Jersey City, Newark, Perth Amboy, and Trenton) have EPA brownfield pilot grants, which have caused considerable community-wide discussion. In Elizabeth, for example, the city has constructed a major new shopping mall on one old brownfield site and a recreation area on a second, and housing is being built on a third. In Elizabeth and in the other five cities, we expected that more people would be favorably disposed to living on cleaned-up brownfields than in New Jersey as a whole.

Personality is a second factor that makes generalizations from the literature about environmental risk problematic in the case of brownfields. For example, the literature reports that white men, dominant in the power structure, have more reason to trust authority than women and African Americans (Flynn, Slovic, and Mertz 1994). This means that white men should be more trusting of state officials and scientists who tell them that it is safe to live on cleaned-up brownfield sites. Since Elizabeth and the five other cities have a much higher proportion of Latinos

and African Americans, the literature implies that relatively fewer people who live in these cities should trust officials who tout the idea of living in housing built on brownfields. But some of these cities have strong mayors who easily win re-election, and so we assume that mistrust would be neutralized by the fact that the message is coming from a mayor and staff they trust.

Those who live in neighborhoods in these six and in other brownfield-rich cities are often surrounded by blight and stressed by vandalism and more serious forms of crime, as well as a lack of amenities and other services. The optimists among them who do not want to move to the suburbs should at a minimum view housing on a cleaned-up brownfield site as an opportunity to live in better housing, and some may view brownfields redevelopment as the first step in improving the quality of the neighborhood, including reducing vandalism, rebuilding physical structures and infrastructures, and providing more services. Those who want to move to older suburbs may find housing opportunities on former brownfield sites.

Further driving our expectations about risk perception and brownfields is recent literature demonstrating that a personal sense of efficacy, trust, and other personality measures affects environmental perception and underlies the expectation that some people living in an apartment will take a chance on buying a unit on a cleaned-up brownfield site while their neighbor in the next apartment who is of the same age and ethnic and income group will not (Fritz 1995; Greenberg 1999, 2000; Pew Research Center 1998, 1999). In essence, within these brownfield-rich cities, those who have little feeling of control in their current neighborhood, do not believe that local officials care about them, do not trust their neighbors, do not vote, or do not otherwise engage in neighborhood activities should be more willing to relocate than those who like their neighbors and the local environment and are engaged in trying to improve it. Those who have personalities that are disposed to be more trusting of authority should be more likely to take the chance of moving to houses built on cleaned-up brownfield sites than those who do not. The literature provides interesting options for measuring personality elements, ranging from the obvious, such as degree of optimism versus pessimism and a variety of assessments of trust, to less direct measures of personality, such as measures of community interaction. For example, reports (Chaskin 2001; Greenberg 2000; W. K. Kellogg Foundation 1999; Miller, Rein, and Levitt 1990) show that those who are really connected and want to build neighborhood capacity build a network of personal contacts. They may still get information from the mass media, but personal contacts are essential to the type of personality that engages in neighborhood redevelopment.

To summarize, previous research suggests that the most likely candidates to move to cleaned-up brownfield sites are young men who are

relatively poor, live in apartments in places where a successful brownfields program has been instituted, and do not like their current environment. These likely customers, we expected, would be more trusting of authority and not particularly worried about residual hazards. In fact, the cleaned-up brownfield site should be perceived by them as a personal opportunity to improve their life, rather than as a threat; that is, it represents an opportunity for them to become homeowners, to improve their financial status, and to put down roots in a neighborhood. In the next section, we review the data and methods used to answer our three research questions and determine whether our expectations were met.

Data and methods

The survey was conducted by telephone between November 8 and 15, 2000, with a scientifically selected random sample of 779 New Jersey adults aged 18 and over. All surveys are subject to sampling error, which is the expected probable difference between interviewing everyone in a population versus a scientific sample drawn from that population. The sampling error for 779 New Jersey adults is ± 3.5 percentage points at a 95 percent confidence level.

The total sample of 779 consisted of a cross section of 379 people who were selected through a stratified random sample of all New Jersey households and an oversample of 400 people who were identified as living in “brownfield-active” municipalities. The oversampled brownfield cities are Camden, Elizabeth, Jersey City, Newark, Perth Amboy, and Trenton. These six have received brownfield pilot awards from the EPA and have been actively engaged in promoting the idea of brownfield redevelopment. The reason for oversampling in these six cities was that compared with New Jersey residents as a whole, more residents of large cities were expected to be willing to live in brownfield sites that have been remediated to a point where there is no plausible brownfield-related health risk to residents, especially if they lived in cities that actively promoted brownfields as an opportunity to improve the city and eliminate eyesores.

Households were contacted through random-digit dialing, which gave every residential telephone number an equal chance of being called for an interview. This was a stratified random sample where the known area codes, the exchanges, and the bank of the first two numbers in a possible telephone number were established in accordance with the known population distribution of New Jersey. The last two digits were randomly generated to complete each telephone number to be called. For the oversample of brownfield-active municipalities, the area code and exchange of these cities were randomly called to target these areas. Respondents were selected within each household by first asking for the

youngest male, 18 years or older, who was at home, or if no male was available, asking for the oldest female 18 years of age or older. The completion rate among those who were eligible was 66 percent in the oversample and 73 percent in the cross-section sample.

Because of the oversample, the total sample was weighted in a two-stage process to adjust for the actual population in the oversampled places and then for education levels to ensure accurate proportional representation for the state as a whole. The self-reported ZIP codes of the cross-sectional respondents were examined to determine the actual incidence of brownfield-active communities within the state. Once the correct proportion in the cross-sectional sample was determined, the full sample was weighted by frequency of those self-reported ZIP codes. The second stage of weighting adjusted for known educational levels in New Jersey. In short, the sampling process allowed us to have data that focused on the places we expected the most interest in remediated brownfield sites, as well as results that could be transformed to be representative of the state as a whole.

The survey instrument had 57 questions, many of which had multiple parts, so the actual number of questions exceeded 100. One set of questions formed the dependent variable. One part asked the likelihood of the respondent's moving during the next five years. All those who said they were "very" or "somewhat" likely to move during that period were considered near-term potential customers for residential brownfield sites. Additional questions asked the respondent whether he or she would "consider" buying or renting a house or condominium that was on a cleaned-up brownfield site. These were aggregated into a single trichotomous dependent variable:

1. Likely to move during the next five years and would consider moving to a cleaned-up residential brownfield site, or "brownfield customers"
2. Likely to move during the next five years but would not consider moving to a cleaned-up brownfield site, or "brownfield-not-interested"
3. Unlikely to move anywhere during the next five years, or "not movers"

Four questions addressed expectations that residence in a brownfield-active city would promote brownfield residential customers. One distinguished between those who live in one of the six brownfield-active cities and the remaining 560 New Jersey municipalities. Three inquired about the presence and location of the nearest brownfield sites.

Ten questions explored demographic characteristics, including age, race/ethnicity, gender, education, income, length of residence in the area, and

type of residence. Twenty-three questions addressed local environmental conditions. These included probes about respondents' perceptions of their present neighborhood (large city, suburb near a large city, small city/town, rural area). They were also asked to characterize the quality of their existing neighborhoods and their views of the suitability of cleaned-up brownfield sites for such uses as housing, commercial activities, factories, open space, and others.

Twenty-one questions explored control, efficacy, and trust issues. Six asked respondents whether they would trust assurances about the safety of a cleaned-up brownfield site if those assurances were from state university scientists, business representatives, government officials, and others. Other questions inquired about the sources respondents relied on for information about their community. The expectation was that those who relied on the mass media rather than friends and other local contacts were less connected to the neighborhood and would be less invested in their current neighborhood and more likely to be willing to relocate. Four questions measured respondents' sense of personal efficacy. Three measured their trust of neighbors and local officials and their engagement in local activities. After defining brownfields for the respondents, two questions asked whether they would worry about living near a cleaned-up site and whether they thought living near such a site would pose a threat to their health.

Results

The findings are presented in order of the three research questions. The unweighted results are presented in every case, and where appropriate, the weighted results are presented because we are trying to make assertions about the state of New Jersey as a whole.

Brownfield customers

Table 1 presents the weighted and unweighted results from the 779 respondents for the first question. Thirty-six percent said they were likely to move during the next five years, and the remaining 64 percent said they were unlikely or highly unlikely to move during that period. The moving rate of 36 percent is less than national rates, which averaged 45 percent from 1975 to 1995 (Schachter 2000). However, the five-year moving rate for the Northeast from 1990 to 1995 was only 34 percent, compared with 47 percent for the rest of the nation. So the 36 percent rate found by this survey is consistent with the Northeast United States. The unweighted results show that 22 percent said they were likely to move within the next five years and would consider moving to a cleaned-up brownfield site. Most of those potential customers want

Table 1. Willingness to Move to a Cleaned-Up Brownfield Site during the Next Five Years

Category	Unweighted	Percent ^a	Weighted ^b	Percent
Likely to move and willing to move to a cleaned-up brownfield site, or brownfield customers	171	22	107	14
Buy or rent	83	11	42	5
Buy only	63	8	43	5
Rent only	25	3	22	3
Likely to move but unwilling to move to a cleaned-up brownfield site, or brownfield-not-interested	109	14	88	11
Unlikely to move during the next five years, or not movers	499	64	584	75
Total	779	100	779	100

^aNumbers in columns may not add up to totals because of rounding.

^bWeighting is done by location and education. The weighted results are representative of the state of New Jersey as a whole.

to buy, not rent. Fourteen percent said they were likely to move, but not to a cleaned-up brownfield site.

It should be noted that only 10 percent of respondents could at the outset define brownfield in a way that approximated common definitions. We defined brownfields for those who did not know what they were.

The weighted results for this first question are important because they show how those numbers translate to a representative sample for the state of New Jersey. The proportion who said they would be willing to move to a brownfield site during the next five years dropped to 14 percent, compared to 22 percent in the unweighted sample. In other words, as expected, residents of the brownfield-active cities were more likely to say they would be customers.

Characteristics of willingness to move to brownfield sites

The analysis was conducted in two stages. Each of the 60 explanatory variables was separately tested against the following trichotomous brownfield-interest variable: (1) brownfield customers, (2) brownfield-not-interested, and (3) not movers. Chi-square tests were used to find the strongest correlates of interest. A total of 36 of the 60 tests (60 percent) were statistically significant at the $p < 0.05$ level. Only 3 (0.05×60) would have been expected by chance. Table 2 shows some, but not all, of the strongest correlates ($p < 0.001$). We first review an illustrative set of these bivariate results and then present the more comprehensive multivariate results.

Table 2. Illustrative Relationships among Reactions to Brownfield Sites as Residences and Correlates

Variable	Brownfield Customers (N = 171)	Movers but Not Interested in	
		Brownfields (N = 109)	Not Movers (N = 499)
Lives in a brownfield city, %	64.3	54.1	39.7
Lives in an apartment, %	45.0	50.0	12.0
Lives in a large city, %	39.8	33.0	17.6
Average age, years	35.0	37.9	50.2
Annual family income less than \$35,000, %	37.4	22.0	19.6
Perceives health threatened by living near a cleaned-up brownfield site, %	38.6	63.3	54.7
Believes university scientists about safety of cleaned-up brownfield site, %	69.6	50.9	52.7
Feels little control over current neighborhood, %*	62.5	56.0	42.7
Rates present neighborhood as fair or poor quality, %*	42.7	47.7	19.6
Affordable housing is a good or excellent use for a cleaned-up brownfield site, %	77.8	39.4	50.0

Note: All variables are significant at $p < 0.001$.

* The 4 and 5 answers on a five-point scale.

With regard to 6 of the 10 characteristics in table 2, the brownfield customer group is not markedly different from the mover group that is not interested in brownfields. A total of 45 percent of brownfield customers were likely to live in an apartment, compared with 50 percent for movers who are not interested in brownfields. In strong contrast, only 12 percent of the not movers lived in apartments. The mover group that is not interested in brownfields is also more similar to the brownfield customers than to the not movers with respect to living in a brownfield city, living in a large city, feeling little control over their current neighborhood, and tending to rate their neighborhood as only fair or poor quality.

But there are some notable differences between the brownfield customers and the other movers. Much of the customer group (78 percent) supports the idea of building housing on brownfields, compared with only 39 percent of the movers who are not interested in living on cleaned-up brownfields. The customer group is much less likely to be threatened by living near a cleaned-up brownfield site (39 percent feel threatened) than the movers who will not consider brownfields (63 percent feel threatened).

Crucial with regard to affordable housing is the match of brownfield customers and income groups: Over 37 percent of brownfield customers had a family income of less than \$35,000 a year, compared with 22 and 20 percent of the mover-but-not-interested-in-brownfields and not mover groups, respectively.

These illustrative results and nearly all of the other statistically significant results not included in table 2 are consistent with our expectations. Yet bivariate tests can obfuscate interrelationships among the predictor variables, especially in instances where so many variables were statistically significant. Consequently, stepwise discriminant analysis was used to explore multivariate differences among the three-category brownfield interest variable. The method chooses the predictor variables that most strongly discriminate among the three categories of the variable. The ability of a potentially discriminating variable is judged by the F statistic. A high F value means that the between-group variance is greater than the within-group variance, which means that the independent variable discriminates at least one of the three categories from the others.

Table 3 clearly discriminates among the three categories of the variable. A discriminant analysis produces functions that are linear combinations of the original predictor variables. The method produces one less discriminant function than the number of categories of the dependent variable, in this case, two discriminant functions for the trichotomous brownfield interest variable.

There are two ways of assessing the statistical success of a discriminant analysis. One is the canonical correlations of each function with the dependent variable, that is, the correlation of the function with the trichotomous brownfield interest dependent variable. The correlation with the first function was 0.578 ($p < 0.001$), and 0.344 ($p < 0.001$) with the second function, which is a moderate to strong result. The second way of assessing the strength of the results is to use the discriminant model to predict a category for each respondent and then compare the predicted category with the actual one. The discriminant analysis model accurately classified 68 percent of the respondents into the appropriate category of the dependent variable, including 73 percent of the not movers, 62 percent of the brownfield customers, and 57 percent of the movers who would not move to a brownfield site. In short, the discriminant analysis was moderately effective at isolating key correlates of brownfield interest.

The discriminant model focuses on 17 variables that were selected by the stepwise model and have a correlation of $r > 0.30$ with one of the two functions. The first function, called movers versus not movers, contrasts those who live in apartments ($r = 0.605$) and not in single-family houses ($r = -0.464$). The movers are relatively young ($r = -0.601$ with age), do not rate their neighborhood as good or excellent quality ($r = 0.467$), and do not trust people in their neighborhood ($r = 0.404$). They disproportionately live in a large city ($r = 0.363$) and typically a brownfield-active one ($r = 0.335$). These movers contrast with the not mover population that tends to live in single-family homes, be older, typically

Table 3. Discriminant Analysis of Willingness to Move to a Cleaned-Up Brownfield Site during the Next Five Years

Discriminating Variable	F Value	Function 1: Movers vs. Not Movers	Function 2: Brownfield Customers vs. Unwilling to Move to Brownfield Sites
Lives in an apartment (1 = yes, 0 = no)	61.6	0.605	
Average age, years	60.5	-0.601	
Lives in a single-family house (1 = yes, 0 = no)	49.2	-0.464	
Rate neighborhood quality of present neighborhood (1 = excellent, 2 = good, 3 = fair, 4 = poor)	36.9	0.467	
New park or playground as a choice for a cleaned-up brownfield site (1 = poor..., 4 = excellent)	27.8		0.748
Affordable housing as a choice for a cleaned-up brownfield site (1 = poor..., 4 = excellent)	27.6		0.636
Public school as a choice for a cleaned-up brownfield site (1 = poor..., 4 = excellent)	25.7		0.570
Lives in a large city (1 = yes, 0 = no)	22.5	0.363	
Trusts people in current neighborhood (1 = strongly agree..., 5 = strongly disagree)	22.2	0.404	
Lives in a brownfield-active city (1 = yes, 0 = no)	14.7	0.335	
Mix of housing and small stores as a choice for a cleaned-up brownfield site (1 = poor..., 4 = excellent)	14.2		0.491
Worried about living near a cleaned-up brownfield site (1 = not at all..., 3 a lot)	11.5		-0.379
Concerned with protecting open space in New Jersey (1 = yes, 0 = no)	11.4		0.300
Feels health threatened by living near a cleaned-up brownfield site (1 = yes, 0 = no)	10.9		-0.358
Believes assurances by the mayor or local councilman about the safety of living on a cleaned-up brownfield site (1 = yes, 0 = no)	10.7		0.475
Believes assurances by the New Jersey Department of Environmental Protection about the safety of living on a cleaned-up brownfield site (1 = yes, 0 = no)	9.8		0.322
Believes assurances by a panel of university-based scientists about the safety of living on a cleaned up brownfield site (1 = yes, 0 = no)	9.3		0.302

Note: All the variables in the table have a correlation with one of the two functions of ≥ 0.30 .

rate their neighborhood as excellent or good quality, trust their neighbors, and not live in a large city, particularly a brownfield-active one.

The second function, called brownfield customers, contrasts those who were willing to move to cleaned-up brownfield sites with those who were likely to move, but not to brownfield sites. The former considered brownfield sites as good places to locate parks and playgrounds ($r = 0.748$), new affordable housing ($r = 0.636$), new public schools ($r = 0.570$), and a mixture of houses and small shops ($r = 0.491$). These respondents would believe the mayor and council members of the city that had cleaned up brownfield sites ($r = 0.475$), the New Jersey Department of Environmental Protection ($r = 0.322$), and university-based scientists ($r = 0.302$) if they told them the site was safe to occupy. These respondents also were not worried about the health effects of the sites ($r = -0.379$) and did not feel threatened by the site ($r = -0.358$). By contrast, those who were likely to move but not to brownfield sites did not trust authority and were worried and threatened by the sites. They did not want anything that would expose residents to contaminants put on cleaned-up brownfield sites. Also, brownfield customers were more likely than their counterparts to be concerned about protecting open space ($r = 0.300$). This is an important point because using brownfield sites efficiently conserves more existing greenfield spaces.

Increasing the odds of moving to a cleaned-up brownfield site

The literature addresses the ideas that some middle-class suburbanites will want to return to the inner cities when their children have left and they no longer need so much space and that a new middle class can be built in the inner city and in industrial suburbs from immigrant populations (Danielsen, Lang, and Fulton 1999; "Downtown Housing" 1999; Lang, Hughes, and Danielsen 2000). Table 4 lists attributes that respondents say could increase the chances of their moving to a brownfield site. Assurance that the land is safe was the most important factor. Second was an attractive location with a view of parks and water. Clearly, this attribute has already been realized in the redevelopment of some brownfield sites overlooking New York City's famous skyline and elsewhere.

Beyond these two factors, the odds of changing the willingness of people to move to cleaned-up brownfield sites are small. For example, the third most prominent factor among those who say they are not planning to move during the next five years is a site located near family and friends. This factor was sixth of seven among those who said they would be willing to move to a brownfield site and are likely to move but not there. The order should not, however, obscure the clear message that the two populations that are not customers for brownfield sites are not going to be easily persuaded to consider them.

Table 4. Attributes That Would Increase the Chances of a Respondent's Moving to a Cleaned-up Brownfield Site during the Next Five Years (Percent)

Factor	Brownfield Customers (N = 171)	Movers but Not Interested in Brownfields (N = 109)	Not Movers (N = 499)
Assured that land was safe	59.1	22.0	22.1
Attractive location with views of parks and water	57.9	21.1	16.2
Guaranteed to maintain property values	52.6	12.8	14.1
Located near public transportation	45.0	13.8	14.9
Located near theaters and entertainment	44.4	9.2	7.3
Located near family and friends	43.9	11.0	15.6
Lower cost than other housing in the area	36.8	11.9	9.2

This observation is underscored in data for three groups that are often mentioned as important people to have in the inner cities and older suburbs (table 5). One group of 116 (15 percent of 779) consists of older people (45 or older) who earn at least \$70,000 a year, do not live in a large city, and have no children under 18. This group is our somewhat liberally defined approximation of “empty-nesters” (“Downtown Housing” 1999; Lang, Hughes, and Danielsen 2000). Table 5 shows that only 6 percent of these (7 of 116) are in the brownfields customer group. Another 5 percent are movers, but not to brownfield sites. The vast majority (89 percent) do not intend to move during the next five years. Financial incentives (lower-cost housing, guaranteed property values) persuade only a tiny fraction to strongly consider a brownfield site. In addition to the data in table 5, the three factors of seven that would lead at least 20 percent of this group to strongly consider a brownfield site are location near public transportation, assurance that land is safe, and location near family and friends.

The second group of 45 (6 percent of 779) are young (less than 45), earn at least \$100,000 a year, and have no young children; that is, “young professionals” (“Downtown Housing” 1999; Lang, Hughes, and Danielsen 2000). Twenty-four percent of this small group (11 of 45) said they would live on cleaned-up brownfield sites, a higher proportion of the population than the population as a whole. Furthermore, while the group is small, the incentives that disproportionately attracted them compared with the rest of the population were assurance that the site was safe and guaranteed property values.

The third group consists of Asian Americans and Latinos, the two most rapidly growing populations in the study region and elsewhere in the United States. We examined the data for the 84 (11 percent of 779) who had family incomes of at least \$35,000. This population consists disproportionately of brownfield customers. In addition, the factors that attract

Table 5. Interest of Selected Populations in Housing on Brownfield Sites

Group	Older, No Children, Upper Middle Income, Not Currently City Residents ^a		Younger, No Children, High Income ^b		Asian American and/or Latino with Middle Income ^c	
	Number	%	Number	%	Number	%
Brownfield customers	7	6	11	24	21	25
Movers but not to brownfield sites	6	5	4	9	14	17
Not movers	103	89	30	67	49	58
Total	116	100	45	100	84	100

^aPopulation is 45 or older, earns at least \$70,000 a year, does not currently live in a large city, and has no children under 18 years old.

^bPopulation is less than 45, earns at least \$100,000 a year, and has no young children.

^cPopulation is Asian American and Latino and earns at least \$35,000 a year.

them are family and friends, physically attractive locations, and public transportation.

We can reflect on these group-specific findings using data from the American Housing Survey and neighborhood studies done in New Jersey and its environs. Greenberg and Schneider (1996) and Greenberg (1999) found that problems are much more important drivers of public perception than attractions. That is, crime and physical decay are neighborhood killers, repelling existing residents and any investors. Hence, fear of contamination and loss of property values because of stigma are predictably at the top of the list of what brownfield customers would need addressed before considering a move to a cleaned-up site. If there is no fear of health threats or loss of property value, then attractions take over. In previous studies, neighborhood appearance is the most important attraction, followed (in order) by convenience to leisure activities and good schools. Convenience to jobs, friends and relatives, and public transportation is important to a smaller number of people. However, the fact that these are important to Asian-American populations is consistent with one previous study of Asian Americans in New Jersey (Greenberg, Schneider, Singh 1998).

Discussion

Before exploring the policy implications of this research, we emphasize the fact that to the best of our knowledge, this is the first study of its kind, so we cannot compare these findings with others. Clearly, replicates are required. In particular, New Jersey has no city larger than 300,000 people. We need studies of more populous American cities to determine whether the findings hold in larger cities, such as New York, Chicago, San Francisco, and others. In particular, we suspect, but can-

not be sure, that the small number of empty-nesters who were willing to move to housing on cleaned-up brownfield sites may be so inclined because the cities in this research cannot offer the kinds of amenities that larger cities do, with the exception of Weehawken, Hoboken, Jersey City, and a few others that are located across the Hudson River from New York City and are directly accessible to it by mass transportation. Theaters and other forms of entertainment were not among the most important incentives for this group in New Jersey. As reported earlier, they were more attracted by the idea of being close to family and friends than by being close to cultural facilities. In short, this research supports the findings of Kasarda et al. (1997), who did not find a major trend toward changing central-city and suburban migration patterns. It also underscores the possibility, and the difficulty, of using housing to control sprawl in states that do not have the downtown attractions of a major city (Danielsen, Lang, and Fulton 1999).

Readers who are concerned about providing affordable housing for disadvantaged people and upgrading the quality of distressed neighborhoods will be pleased by the results of this survey. They show that the overwhelming majority of those who are both likely to move during the next five years and are willing to live on a cleaned-up brownfield site are relatively young and economically disadvantaged people interested in buying affordable housing. Perhaps they sense that this housing is their only realistic opportunity in the near term. They view housing on a safe brownfield site as a way of upgrading the quality of their lives. Also encouraging is the fact that affluent young and childless families and middle-class Latino and Asian-American families are disproportionately interested in living on cleaned-up brownfield sites. Further, this research shows that with incentives, their interest could grow. Given that most of the brownfield customers were interested in buying, the findings are consistent with previous research showing that Latinos and Asians could attain the homeownership rates of Caucasians (Painter, Gabriel, and Myers 2000).

On the supply side of the housing equation, the results are also good. The proportion of respondents who are likely brownfield customers (14 percent of state residents and higher in cities where there is a strong brownfields program) is in the range of the plausible redevelopment of brownfields into housing units during the next five years in New Jersey.

If the interest is in using brownfield redevelopment to lure empty-nester suburban residents back to cities and to stop sprawl, then the results are not encouraging. Relatively few people who fall into the middle- and upper-middle classes are likely to move or willing to consider moving to a cleaned-up brownfield site. This is particularly true of older middle-class people with no children in residence. Of course, if they could be assured that the sites were clean and safe and if the sites were associated with lovely views of open space and were near family and friends,

the likelihood would increase. But it is hard to expect much of an increase in willingness among current middle-class suburban residents in the near future.

The results present a clear challenge to policy makers. Unless the sites are physically attractive, they need to be marketed as affordable housing for people who mostly already live in large cities or industrial suburbs. In terms of affordable housing, a major challenge is related to timing and opportunity. We reiterate the point that serious consideration given to building housing on brownfields is quite new. Listokin and Wylie (2000) point out that the mortgage market is so unpredictable that their observations, which generally favor support of ethnic and racial minorities for mortgages, might not be the case in five years. So the opportunity that now exists to get the land and provide mortgages might have disappeared in a few years.

A critical challenge is to interest developers in building housing on brownfields. In New Jersey, developers have historically made large profits by building in the suburbs and are clearly going to need incentives to build in stressed inner-city neighborhoods. Incentives might include processes to speed up permitting, an opportunity to change from single-unit to multiple-unit zoning, and the option to cluster housing on those sections of parcels where there is no contamination while covering contaminated areas with parking and other impervious covers. However, we need more data about what is needed to help developers.

Even if developers build, the challenge to government and developers is to think hard about how they are going to assure potential customers that the sites are clean and safe. Through detailed face-to-face interviews, we need to learn precisely how much of the decision to move to a brownfield is caused by a desire to own a house or live in a newer unit and how much the health risk weighs in the decision. We need to know how much potential customers can afford, compared with likely rental and ownership prices. If health risk and stigma are concerns, developers and governments may need to determine creative ways of assuring customers that the value of their investments will be protected. Those supporting putting housing on brownfields need to get this information and get help from those the public will believe, primarily from universities and state environmental scientists, as this study shows.

An additional part of this policy challenge is that a consensus for affordable housing has been difficult to build (Field 1997). Local government and community groups in neighborhoods with many brownfields need to be able to build a consensus around the future of the neighborhoods, to include removing brownfield eyesores and converting them into housing. The only published study we know of that explores brownfields and neighborhood planning, done in a Puerto Rican and Dominican American neighborhood, suggests that such a consensus can be built

if open space and community facilities are part of a redevelopment plan (Greenberg and Lewis 2000). In short, if brownfields redevelopment is part of a formula for building an inner-city middle class, then this study suggests that developing one around ethnic/racial populations in existing city neighborhoods is a more viable option than bringing back older, middle-class suburban residents.

Arguably, a disproportionate environmental burden has been placed on the residents of inner-city and older suburban neighborhoods (Been 1994; Hofrichter 1993; Sexton 1999). Consequently, building affordable housing on cleaned-up brownfields has environmental and social justice implications that need to be considered. It may be interpreted as once again providing poorer people with lesser opportunities on formerly polluted sites, that is, lower-quality housing than is available to more affluent people. Yet using brownfield sites to enhance the housing, employment, shopping, and recreational opportunities of poorer populations and raising the quality of life overall in their neighborhoods and political jurisdictions by cleaning up eyesores and replacing them with new housing appear to us to be consistent with the aims of providing desirable land uses that address environmental concerns and social justice.

Conclusion

Can turning brownfields into new housing be part of the package of attractions that will persuade those who live in sprawled developments or will live in them in the near future to live in inner cities or in old industrial neighborhoods? The effort to redirect growth to cleaned-up brownfield sites is obviously only part of the larger effort to manage growth so that some of the remaining open space in large metropolitan areas is preserved and infrastructure dollars are spent as effectively as possible (Burchell, Listokin, and Galley 2000; Miller et al. 2001). But those who want to control sprawl by redeveloping cities are in for a struggle with the realities of over half a century of American metropolitan population out-migration trends. But even if building housing on brownfields does not substantially help control sprawl, building affordable housing for the existing residents of cities and new migrants and attracting the atypical middle- and upper-class resident who wants to return to the city with high-quality housing in attractive neighborhoods are clearly much needed improvements over thousands of dilapidated brownfield eyesores. Federal, state, and local governments, and allies in the nonprofit and for-profit sectors need to focus on facilitating this important cleanup and housing and neighborhood redevelopment opportunity.

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