J. ENVIRONMENTAL SYSTEMS, Vol. 21(1) 65-84, 1991-92

SOCIAL NETWORKS, SOCIOECONOMIC STATUS, AND ENVIRONMENTAL COLLECTIVE ACTION: RESIDENTIAL CURBSIDE BLOCK LEADER RECYCLING*

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ABSTRACT

This research introduces the notion of environmental collective actions (ECAs) and makes comparisons with collective actions as described by previous researchers. A particular type of ECA is investigated in greater detail; using data from a survey of 269 block leaders, relationships among the effectiveness of block leader curbside recycling, block socioeconomic status, and block social networks are examined. Higher levels of block participation in the recycling program are seen to be associated with higher socioeconomic status, higher "social tie density" (a measure of how well block residents know each other), and higher "social tie centralization" (a measure of how well the block leader knows block residents). The effect of tie density is seen to be more pronounced for high income and education level blocks, but less pronounced for blocks with high levels of resident home ownership. The effect of tie centralization appears more pronounced for low socioeconomic status blocks. Explanations for these results are discussed.

*The authors wish to thank the Staff of SunShares, the block leaders who took the time and effort to fill out the questionnaire, and the National Science Foundation for support of this project. In particular we gratefully acknowledge the Presidential Young Investigator Award Program and Dr. Edward Bryan in NSF's Environmental Engineering Division.

doi: 10.2190/KMEJ-1P0D-6TCB-GG0T
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INTRODUCTION AND OBJECTIVES

M. Olson's "By-Product Theory" and P. Oliver and G. Marwell's (and collaborators) "Theory of Critical Mass" make different assumptions about the effects of free-riders, individual efficacy, and collective good jointness of supply on collective action [1, 2]. We shall describe the assumptions of each theory, and introduce the notion of "environmental collective actions" or ECAs. Our analysis suggests that theories about participation in ECAs employ unique assumptions concerning free-riders, individual effectiveness, and "collective good jointness of supply."

The goal of this article is to increase understanding of ECAs in general, and of recycling programs in particular, by exploring factors affecting the success of block leader curbside recycling programs, such as social networks and socioeconomic status and social networks of participants. Research concerning recycling programs may help answer the many system design questions [3]. Many states are experiencing disposal problems [4], the Environmental Protection Agency (EPA) has announced a goal of 25 percent reduction of solid waste through source reduction or recycling [5], and legislative activity concerning solid waste issues has been very heavy the last few years [6].

We shall review literature on recycling programs, develop hypotheses concerning block leader curbside recycling programs, test these hypotheses using data from a survey of block leaders in the Durham, North Carolina block leader curbside recycling program, and assess the relationships among social networks, socioeconomic status, and program success.

ENVIRONMENTAL COLLECTIVE ACTIONS

Theories of collective action must address two important problems: free-riders and individual efficacy. These problems are important because collective actions provide public goods, defined as any good " . . . such that, if any person X_i in a group $X_i, \ldots, X_i, \ldots, X_n$ consumes it, it cannot be feasibly withheld from others in that group" [1]. Because goods provided by collective actions are nonexcludable, or have nonexcludable components, individuals are encouraged to free-ride. The reduction in collective good caused by one extra free-rider is negligible thus the free-rider sees equal benefits without sharing costs. In large groups, Olson claims that "no single individual's contribution makes a perceptible difference to the group as a whole, or the burden or benefit of any single member of the group" [1, p. 44]. In other words, individual efficacy is assumed to be negligible. Olson and others have emphasized that collective action occurs as a by-product of conventional market behavior [7]. Selective incentives or coercion are regarded as the underlying causes of successful collective action.

Proponents of the Theory of Critical Mass [2, 8, 9] assume that free-riders are not a problem. Public goods often have "jointness of supply", meaning the cost of providing the collective good does not rise as the group consuming it grows larger.

The classic example is the lighthouse which costs the same no matter how many ships use it as a warning beacon [10]. In this case free riders are no longer a burden as they do not reduce the amount of collective good available to constituents. Thus it is not necessary to organize every group member. An S-shaped production function is often assumed as in Figure 1. After start-up costs are met, collective good production increases quickly with additional contributions or participants until it levels off at or near some maximum level. Large groups with heterogeneous resources are more likely to contain a small subset of members with resources such as money, talent, or political clout sufficient to provide the collective good. Smaller internal groups are easier to organize and collective good provision is often viewed as small group rational choice. Macy [7] modified the critical mass rational choice assumption by assuming that agents learn from past experience and gravitate toward behavior that is more rewarding. Using computer

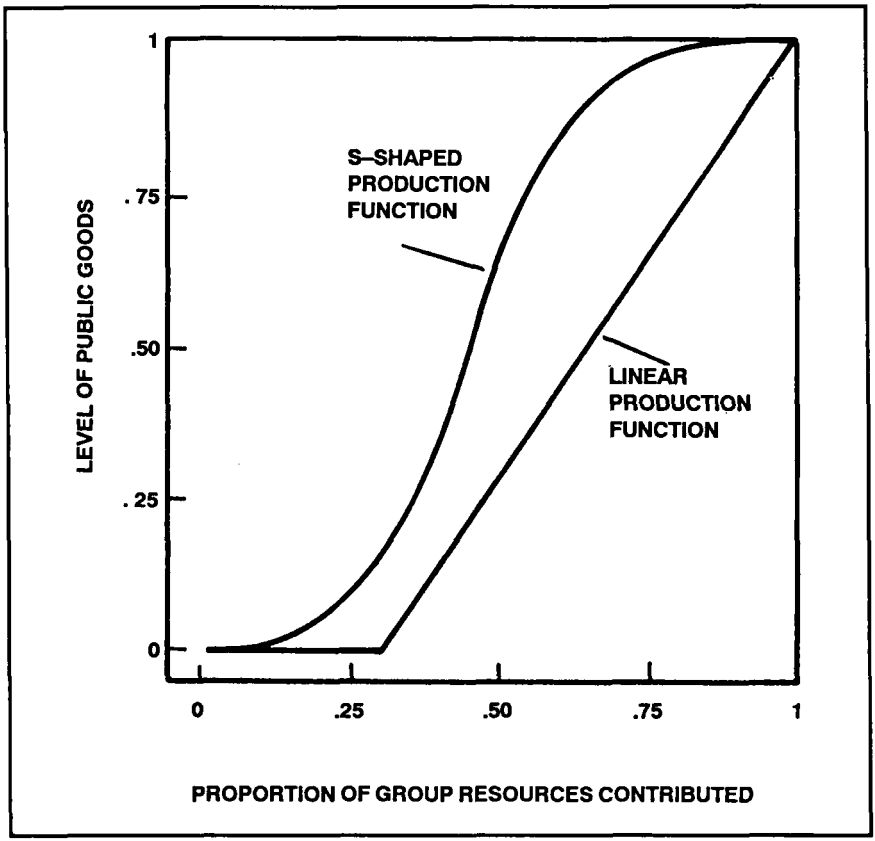


Figure 1. Collective good production functions.

simulations he concluded that although small groups are easier to organize, large groups provide more social leverage, and thus are more likely to provide collective goods.

There is a third type of collective action which, although it produces collective goods with jointness of supply, still has a free-rider problem. Environmental collective actions (ECAs) attempt to motivate individuals to reduce pollution, an internally produced collective bad [11]. Examples include programs for litter prevention, energy conservation, household hazardous waste collection, and recycling. ECAs create the collective good "less pollution" which has jointness of supply. But because this collective good is created in small increments by individual action, i.e., not littering, turning off lights, or recycling, free-riders are important. Litter prevention programs have a very low tolerance for litterers as very few non-participants can create a littered environment. Other ECAs have greater tolerance for free-riders. But for all ECA's, as group size increases, the number of participants required to keep pollution levels constant increases. Potential constituents have approximately the same ability to produce less pollution through proper waste handling, therefore, contrary to the Theory of Critical Mass, there is no resource heterogeneity effect. In other words, there is no small subset of group members with sufficient resources to provide all or nearly all of the potential collective good. The ability of each participant to produce less pollution is very small, but about equal to the ability of all other potential participants. Significantly less pollution can be achieved only with significant participation. In sum, ECAs differ from collective actions typically addressed by critical mass or by-product exponents in three ways: the production function, after start up costs are met, is approximately linear with participation and does not level off as in Figure 1; the collective good is produced from reduction of an internally generated bad; and as group size increases the necessary number of participants also increases. One increasingly important environmental collective action is residential curbside recycling, which is discussed in the next section.

RECYCLING PROGRAMS

Residential curbside recycling programs (RCRP's) mobilize citizens to sort, store, and deliver recyclable materials to reduce waste disposal and produce revenue from the sale of materials. Pollution reduction is by and large linearly related to participation, and the level of pollution is kept constant only by keeping participation commensurate with population (unless source reduction increases significantly). RCRPs also are believed by many to produce the collective good "reduced disposal costs". Weight- or volume-based garbage disposal rates, including pre-bag pricing, can directly channel reduced disposal costs to participants by charging households in proportion to the amount of waste they produce. However, unit pricing is currently not used widely [12, 13]. Most recycling programs in theory transfer any waste reduction saving to the

general population by not raising (or reducing) taxes or disposal rates. Reduced disposal cost is then a collective good without jointness of supply. Recycling programs produce mixed collective goods; the classic free rider problem is applicable to both.

Block leader residential curbside recycling programs are a promising type of recycling program. Such programs use volunteers, usually one per block, to advertise and promote recycling. This takes advantage of social ties between the block leader and block residents. In addition to providing information on the recycling program and making direct appeals to recycle, block leaders serve as opinion leaders, demonstrating socially correct and desirable behavior to other block members [14, 15]. Neilson and Ellington suggest two desirable block leader characteristics: block leaders should be active, well-liked, respected, and considered knowledgeable concerning recycling; and block leaders should be strategically located in social networks [14].

REPORTED FACTORS INFLUENCING RECYCLING PROGRAM SUCCESS

Designing residential curbside recycling programs to maximize material recovery and, by implication, participation involves acting on predispositions and community structures favorable to recycling, increasing recycling program awareness and acceptance, and directly encouraging participation by various devices such as economic inducements, legislation, and elements designed to increase convenience. A wide range of factors have been suggested to influence recycling program success, including prompts, raffles, lotteries, contests, and appeals to commitment [16-25]. The authors have explored mandatory participation requirements, container provision, collection frequency, collection day relative to municipal solid waste collection day, program operator, number of materials collected, co-presence of drop-off recycling, and promotion strategies [26-28]. In the research presented here the effects of social networks and socioeconomic status are examined.

BLOCK CHARACTERISTICS AND SOCIAL TIES

Environmental goods are sometimes called "superior goods" because they appeal to persons of higher socioeconomic backgrounds [10]. Historically, the major social group supporting the environmental movement has been the middle to upper-middle-class [29]. Furthermore, participation in voluntary organizations tends to increase with socioeconomic status [30, 31]. The positive effect of demographic variables such as higher education, higher income, neighborhood stability, type of building, and age group on residential curbside collection success has been noted [21, 32-37]. However, data on the effect of demographic variables are not certain [38]. For example, McGuire [39] found no relationship between

recycling behavior and socioeconomic level. However, the only available recycling program in the study area was a buy-back center. Neilson and Ellington [14] present data for the Boulder Colorado block leader program which suggest that, in areas with block leaders, socioeconomic level has almost no effect on the percent of household recycling. In areas without block leaders socioeconomic level had a small effect; 14.9 percent recycled in high socioeconomic level areas while only 9 percent recycled in low socioeconomic areas. Neighborhood stability had a stronger effect on recycling participation than socioeconomic level. Stable areas had higher percentages of recycling households than transient areas, whether or not block leaders were present.

Social ties have been suggested as an important variable in collective action recruitment. Recruitment depends on becoming aware of the collective action, agreeing with its objectives, and learning how to participate [40, 41]. This may depend on the level of contact, e.g., personal contact, mass advertising [42], social tie density and centralization, and communication cost [5]. Social incentives such as status elevation or avoidance of social sanctions based on participation may also be important [43-48].

Vining et al. proposed that social pressure might encourage recycling behavior [49]. Though results were inconclusive when people were asked directly if social pressure was important, they found that recyclers were more likely than non-recyclers to have heard about recycling from friends. Several studies have determined that recycling participation is increased when public commitments to recycle are made [16, 50-51]. Burn and Oskamp suggest that "[t]he perceived social desirability of an action may conceivably increase the probability of its performance" [16, p. 38]. Block leaders, as opinion leaders, are ready-made to supply a model of what is socially desired behavior.

Spaccarelli et al. studied the effectiveness of written and verbal prompts in increasing recycling behavior in a non-block leader residential curbside recycling program [52]. They studied blocks of about the same number of houses which varied in two ways: the presence or absence of 1 to 3 recycling households before intervention (pre-recyclers); and the presence or absence of a block club (concerned with maintaining block safety and cleanliness). Recycling increased in all blocks. As expected, prompts were most effective on blocks with block clubs and pre-recyclers. Interestingly, prompts were least effective on blocks without pre-cyclers but with block clubs. They suggest that [52, p. 55]:

> persons confronted by social pressure tend to determine whether or not the behavior being prompted is approved of as endorsed by an appropriate group of peers, and that for a visible behavior such as curbside recycling, one's neighbors would be an appropriate peer group to examine.

The effect of social ties was helpful when recyclers were already present. Where recyclers were not present it was better to have fewer social ties. The presence of

a block leader will facilitate the acceptance of recycling as an approved and appropriate behavior by ensuring that at least one recycler exists on each block. Anecdotal information suggests that peer observation can be effective without written or verbal prompts, block clubs or block leaders. Salimando notes that in a New Jersey program, once a certain number of homes in an area start putting out recyclables suddenly a large proportion of the rest of the neighborhood sees that recycling is popular and starts to recycle [53].

HYPOTHESES TO BE TESTED

Based on this review of the literature, three hypotheses concerning socio-economic variables are tested: higher block participation levels are more likely to occur in blocks with 1) higher average income; 2) higher average education; and 3) higher average percentage of resident-owned homes. Two hypotheses are tested concerning social ties: higher block participation levels are more likely to occur in blocks with 4) higher tie centralization; and 5) higher tie density. Tie centralization is a measure of how well block leaders know block residents, while tie density is a measure of how well block residents know each other.

Spaccarelli et al. have demonstrated an interaction between tie density measured by the presences or absence of block clubs, pre-intervention recyclers, and participation increases subsequent to recycling prompts [52]. In Durham several drop off centers were available before the block leader curbside recycling program started. If higher socioeconomic status blocks are more likely to have pre-block-leader-contact-recyclers, tie density may have a greater positive effect on participation in higher economic status blocks. Thus hypothesis 6) is suggested: higher block participation levels are more likely to be related to higher tie density in higher socioeconomic status blocks. Conversely, if residents in higher socioeconomic status blocks are more likely to recycle given any contact—by friend, acquaintance, or stranger—the effect of tie centralization on block participation will be stronger in lower socioeconomic status blocks. Finally, Hypothesis 7) is suggested: block participation levels are more likely to be related to higher tie centralization in lower socioeconomic status blocks.

METHOD

Setting

Durham is a city of over 100,000 located in the Piedmont of North Carolina. Though the home of Duke University and North Carolina Central University, Durham is not a college town and has a significant working class population. The Durham program, operated by a non-profit organization called SunShares, collects curbside once every other week. "Blue box" storage containers are provided free of charge. Newspaper, glass, and aluminum are collected in the blue box,

glass and aluminum mixed on the bottom, newspaper on top. Separation of the three materials occurs on the collection vehicle. SunShares attempts to recruit volunteers for each block it serves, about one per every twenty-five homes. A significant proportion of its staff is devoted to recruiting and maintaining block leader networks.

Questionnaire

A questionnaire of 269 block leaders in the Durham curbside recycling program was administered in the summer of 1989 following procedures outlined in Dillman [54]. Addresses were obtained from SunShares for block leaders from six separate areas served by the program, ranging from low to high income. None of the service areas include apartments. Of the 269 surveys sent out, 26 were returned incomplete due to deaths, moves, or incorrect address; 196 completed questionnaires were returned for a return rate of 81 percent. Of the block leaders responding to the questionnaire, 55 percent report membership in a neighborhood association, 83 percent live on the block where they are block leader, and 64 percent recycled before becoming a block leader.

Measures

Success is measured as the percentage of households on a block recycling regularly as reported by the block leader. This is called the block participation rate. Participation was not measured directly, as this would have required monitoring more than 3200 homes over 4 or more collection days spread over at least 2 months. Instead, block leaders are asked how many occupied residences their block has and how many of those residences recycle regularly. It is assumed that block leaders are aware of participation on their block from talking to residents and observing containers on collection day. Participation rates are categorized as high (greater than or equal to 85%), medium (between 60 and 85%) and low (less than 60%). Ranges rather then the exact percentages are used because block leader are not expected to have exact knowledge of block participation rate. One reason this is so is because definitions of regular recycling may vary. What is regular recycling? Ideally it is recycling most or all of one's recyclable materials. Few block leaders have this information for their entire block. Regular recycling could also be defined as putting out recyclables on more than a certain proportion of collection days. The definition used in this research is that regular recycling is putting out recyclables on average more than once per two month period (four collection days). However, it is unlikely that many block leaders know this for their block.

Block leader accuracy was indirectly verified in the Watts neighborhood of Durham. Sunshares regularly records collection day participation levels. However, this information does not translate directly into participation rates because many householders do not participate every collection day. In order to calculate a

factor which when multiplied by the collection day participation rate estimates the regular recycler participation rate SunShares recorded every household's participation in Watts for four consecutive collections, two months. This information is used to check the block participation rates estimated by the Watts block leaders responding to the questionnaire. To get an upper limit on the participation rate of regular recyclers a rate was calculated for each block for residences recycling at least once during the four collections. A lower limit was determined by including only those residences recycling at least twice over the four collections. The upper and lower values were then classified as high, medium, and low as defined above. If the participation rate determined from block leader responses is accurate it should lie within the upper and lower bounds calculated from the SunShares study. This was the case for eighteen of the twenty-four block leaders from Watts returning surveyed. The six cases lying outside of the upper and lower bounds showed no bias as three were above and three were below. We conclude that block participation levels low, medium, and high as reported by block leaders are a reasonable measure of block participation rate.

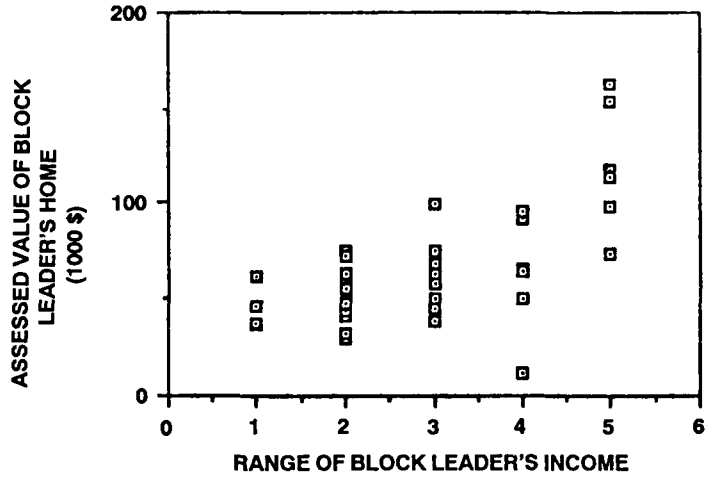
Three socio-economic variables were measured, block income block education, and block home ownership, all determined by block leader response. Census data could not be used as recycling blocks do not correspond to census tracts or blocks. Thus, income was compared to Durham property assessments. Figure 2 plots (a) block leader income versus block leader's Durham property assessment and (b) block income versus average Durham property assessment of four randomly selected homes for 44 randomly selected blocks. The plots are similar, in fact assessments in (b) shows less spread than those in (a). It does not appear that the block leaders assessment of block income is unreasonable.

Income and education are used as general measures of socioeconomic status. Home ownership, the percent of resident owned homes per block, is moderately highly correlated with income and education, though not as nearly as high income and education are correlated to each other. Home ownership also indicates block stability. Neighborhoods with high levels of resident home ownership tend to be more stable than neighborhoods composed mainly of renters.

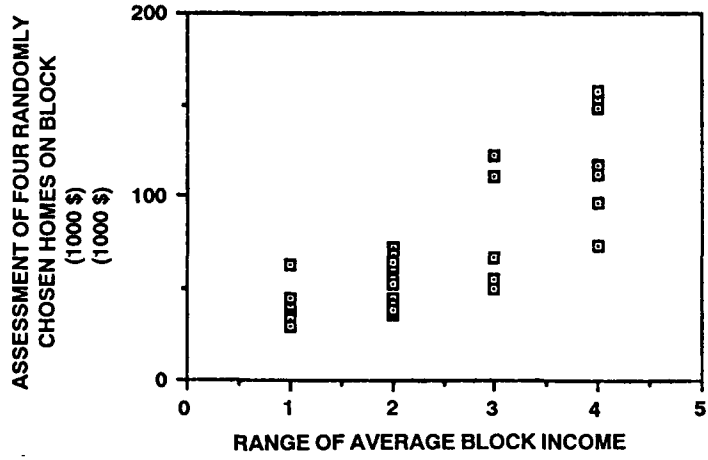
Block leader ties to the block (tie centralization) is measured as the percentage of homes on the block leader's block at which the block leader knows at least one adult as a friend or close friend. Ties within the block (tie density) is a measure of how well block residents know each other, as reported by the block leader, and is an ordinal variable.

RESULTS

Data from the questionnaire are used to produce contingency tables of block participation level versus social networks and socioeconomic status. The contingency tables are tested for nonrandom relationships using chi-squared (χ^2) tests of significance. Socioeconomic variables are discussed first, then social networks.



(a) Assessed Value of Block Leader Home Versus Block Leader Income
1 = Less than 20,000 $
2 = Between 20 and 40,000 $
3 = Between 40 and 60,000 $
4 = Between 60 and 80,000 $
5 = Above 80,000 $



(b) Average Assessed Value of Four Homes on Block Versus Block Leader Estimate of Average Block Income
1 = Less than 20,000 $
2 = Between 20 and 40,000 $
3 = Between 40 and 60,000 $
4 = Above 60,000 $

Figure 2. Comparison of income and home assessment.

Finally the differential effect on participation of social networks for low and high socioeconomic groups is investigated.

Table 1 shows a contingency table of block participation rate versus block income level. Low income blocks are more likely to have low block participation rates, medium income blocks are more likely to have low or medium block participation rates, and high income blocks are more likely to have medium or high block participation rates. Contingency tables of block participation rate versus education and home ownership level are similar: $\chi^2 = 8.1$, $p = 0.017$ and $\chi^2 = 22.7$, $p = 0.001$ respectively. Participation rates appear to be higher in higher socioeconomic status blocks. This supports the proposition that environmental goods are "superior goods", that is, of more value to the middle and upper-middle class.

Tables 2 and 3 present contingency tables for block participation rate versus tie density and tie centralization respectively. Table 2 indicates that blocks with medium tie density are more likely to have medium participation rates while high tie density blocks most often have high participation rates. Low tie density blocks show a very small tendency toward low participation rates. Table 3 indicates that blocks with low tie centralization are more likely to have low or medium participation rates while those with high tie centralization are more likely to have medium or high participation levels. Higher block participation rates are associated with higher tie centralization and density. Friendship ties between block leader and block residents appear to be instrumental in encouraging block residents to recycle. Ties within the block also appear to positively affect recruitment by the block leader. Ties within the block may also effect recycling after the program begins. As blue boxes start appearing on collection day non-recyclers on high tie density blocks may be less willing to stand out as a non-recycler whereas this may not concern non-recyclers on low tie density blocks.

Table 1. Number/Percent of Blocks with Low, Medium, and High Recycling Participation Rates by Block Income Level

	Number/Percent of Blocks with Income Level[b]		
Participation[a] (1)	Low (2)	Medium (3)	High (4)
Low	10/67	29/41	7/13
Medium	2/13	34/49	27/49
High	3/20	17/20	21/38
Total	15/100	80/100	55/100

$\chi^2 = 20.3$; $p < 0.0001$

[a]Low is ≤ 60 percent participation; Medium is between 60 and 85 percent; High is > 85 percent.

[b]Low is < 20,000 $.yr; Medium is between 20 and 40; High is > 40.

Table 2. Number/Percent of Blocks with Low, Medium, and High Recycling Participation Rates by Block Tie Density Level

	Number/Percent of Blocks with Tie Density Level[a]		
Participation (1)	Low (2)	Medium (3)	High (4)
Low	21/38	15/24	7/17
Medium	17/30	33/52	13/32
High	18/32	15/24	21/51
Total	56/100	63/100	41/100

$\chi^2 = 19.6$; $p < 0.001$

[a]Low is "less than half of the block residents know each other"; Medium is "about half know each other"; High is "most or all know each other."

Table 3. Number/Percent of Blocks with Low, Medium, and High Recycling Participation Rates by Block Tie Centralization Level

	Number/Percent of Blocks with Tie Centralization Level[a]	
Participation (1)	Low (2)	High (3)
Low	30/40	14/19
Medium	32/42	32/43
High	14/18	28/38
Total	76/100	74/100

$\chi^2 = 10.5$; $p < 0.005$

[a]Low is block leader "knows at least one adult as a friend at" ≤ 12 percent of homes on block; High is > 12 percent.

In Table 4 the effect of tie density on participation is examined with blocks split into low and high income groups. High income high tie density blocks show a strong tendency for high participation while high income medium tie density blocks show a strong tendency for medium participation. Few high income low tie density blocks are observed in the Durham data set. The five high income low tie density blocks are split almost evenly between low and high participation. Low income blocks show no significant relationship. This is repeated when the same relationships are investigated splitting blocks into low and high education groups:

Table 4. Number/Percent of Blocks with Low, Medium, and High Recycling Participation Rates by Block Tie Density and Income Levels[a]

	Number/Percent of Blocks with Tie Density Level		
Participation (1)	Low (2)	Medium (3)	High (4)
	(a) Low Income Blocks; $\chi^2 = 3.9$; ————		
Low	17/47	12/33	5/25
Medium	14/39	17/47	9/45
High	5/14	7/20	6/30
Total	36/100	36/100	20/100
	(b) High Income Blocks; $\chi^2 = 14.6$; $p = 0.006$		
Low	3/60	4/16	3/14
Medium	0/0	15/60	5/24
High	2/40	6/24	13/62
Total	5/100	25/100	21/100

[a]Block Income Level: Low is < 40,000 $/yr; High is > 40,000 $/yr.

$\chi^2 = 6.4$, $p > 0.05$ and $\chi^2 = 10.2$, $p = 0.037$ respectively. Tie density is more important in high socioeconomic status blocks, as measured by income or education. If high socioeconomic status blocks are more likely to have pre-block-leader-program-recyclers, then high tie density increases the likelihood that residents receive confirmation of the block leader's pro-recycling message from other pro-recycling neighbors. If lower socioeconomic blocks are less likely to have pre-block-leader-program-recyclers, then in high tie density low socioeconomic status blocks the block leader's message may be diluted by negative or neutral discussions with other non-recyclers.

A different result is obtained when blocks are split into low and high home ownership groups, as seen in Table 5. Low home ownership blocks with low or medium tie density are more likely to have low or medium participation. Low home ownership blocks with high tie density are more likely to have medium or high participation. High home ownership blocks show no significant relationship. If home ownership indicates block stability, this result suggests that tie density is more important in low stability blocks than in high stability blocks. Perhaps transient blocks that have a sense of community are far more likely to recycle than transient blocks without; hence the significant relationship. This result was unexpected and requires further study.

Table 5. Number/Percent of Blocks with Low, Medium, and High Recycling Participation Rates by Block Tie Density and Home Ownership Levels[a]

	Number/Percent of Blocks with Tie Density Level		
Participation (1)	Low (2)	Medium (3)	High (4)
(a) Low Home Ownership Blocks; $\chi^2 = 12.7$; $p = 0.013$			
Low	17/53	11/35	0/0
Medium	11/34	16/52	3/43
High	4/13	4/13	4/57
Total	32/100	31/100	7/100
(b) High Home Ownership Blocks; $\chi^2 = 6.1$; ————			
Low	4/28.5	4/13	6/18
Medium	6/43	17/57	10/30
High	4/28.5	9/30	17/52
Total	14/100	30/100	33/100

[a]Home Ownership Level: Low is < 88 percent of Homes Owned by Resident; High is ≥ 88 percent.

Another explanation concerns block leader recycling experience. Contingency tables of whether block leaders had recycled since or before becoming a block leader show a significant relationship versus home ownership, $\chi^2 = 4.0$, $p = 0.046$, but insignificant relationships versus education and income. 60 percent of the block leaders on high income home ownership blocks recycled before becoming a block leader versus 74 percent for low home ownership blocks. Perhaps block leaders volunteering for low stability blocks are more likely to be actively interested in recycling and more likely to overcome low tie centrality or create high centrality, in high tie density blocks, and thus are more effective encouraging recycling.

Table 6 shows the effect of tie centralization on participation when blocks are split into low and high income groups. Low income low tie centrality blocks show a strong tendency for low participation while low income high tie centrality blocks are more likely to have medium participation. High income blocks show no significant relationship. This is repeated when the same relationships are investigated splitting blocks by low and high education, $\chi^2 = 10.6$,

Table 6. Number/Percent of Blocks with Low, Medium, and High Recycling Participation Rates by Block Tie Centralization and Income Levels[a]

Participation (1)	Number/Percent of Blocks with Tie Centralization Level: Low (2)	High (3)
(a) Low Income Blocks; $\chi^2 = 11.7$; $p = 0.003$		
Low	29/55	7/19
Medium	16/30	19/51
High	8/15	11/30
Total	53/100	37/100
(b) High Income Blocks; $\chi^2 = 4.2$; ————		
Low	1/5	5/15
Medium	13/69	13/39
High	5/26	15/46
Total	19/100	33/100

[a]Block Income Level: Low is < 40,000 $/yr; High is > 40,000 $/yr.

$p = 0.031$ and $\chi^2 = 4.5$, $p > 0.05$ respectively, and low and high home ownership, $\chi^2 = 12.7$, $p = 0.013$ and $\chi^2 = 6.1$, $p > 0.05$ respectively. Tie centralization is more important in low income blocks. If high socioeconomic blocks are more likely to recycle regardless of how information on recycling opportunities is disseminated, then it is reasonable that tie centralization will be less important on such blocks. It appears reasonable that tie centralization is more important on low socioeconomic status blocks, where there may be less pre-block-leader-program-recyclers and where people may be less predisposed to recycle. In this situation a block leader strategically located in the social network is better able to motivate recycling.

CONCLUSIONS

1. Block participation in block leader curbside collection recycling programs is higher with higher average block income, education, and home ownership. As noted earlier, environmental collective goods are sometimes called "superior goods" because they have greater appeal for higher socioeconomic groups. This is supported by the findings of this research.

2. Block participation is higher for blocks with higher block tie density and centralization. Higher tie density appears to encourage recycling by facilitating the exertion of social pressure and by consolidating block leader appeals through supportive communication with other block residents. Tie centralization seems to be effective because block leaders are better able to exert social pressure or communicate the benefits of recycling to friends.

3. The effect of tie density is more pronounced for high income and education level groups. Blocks with higher socioeconomic status may be more likely to have pre-block-leader-program-recyclers—people who used the available drop off centers. The presence of pre-recyclers and high tie density would then result in the spread of positive accounts of recycling as neighbors consult with each other after a block leader visit or after the block leader and the pre-recyclers put out recyclables on collection days. In blocks with few or no pre-recyclers tie density will have less effect as their will be few or no neighbors with recycling experience. This suggests that block leader recycling programs should attempt to create recycling ties in low socioeconomic status blocks, perhaps through fairs, block parties, or contests.

4. The effect of tie density is different for blocks segregated into low and high home ownership groups. The effect of tie density is more pronounced for low home ownership blocks. This was not anticipated, as similar results were hypothesized for income, education, and home ownership. Further study will be required to understand it fully. This result may be related to block leader characteristics as low—compared to high—home ownership blocks are more likely to have a block leader who recycled before becoming a block leader. This was not found when blocks were segregated by income or education levels.

5. The effect of tie centralization is more pronounced for low income, education, and home ownership groups. High socioeconomic group are more likely to recycle, therefore the relationship between block leader and resident may not be as important. In low socioeconomic status blocks residents are less likely to recycle. In this situation a close relationship between block leader and resident appears to be more effective in encouraging participation. This suggests that block leader recycling programs should exert extra effort to find block leaders for lower socioeconomic status block who are strategically located in block social networks.

6. The results of this analysis can be used to informatively develop recruitment strategies for curbside recycling programs specifically and ECAs in general. Extra effort should be expended on lower socioeconomic status blocks as these block appear to have lower participation rates. Efforts to increase social ties should address different socioeconomic status groups differently. In low socioeconomic status areas strategies should attempt to increase tie centralization. In high socioeconomic status areas strategies should attempt to increase tie density, given the presence of sufficient pre-recyclers. 16.8 percent of the SunShares block leaders responding to the questionnaire do not live on the blocks they promote recycling on. Assuming that block residents generally have more block ties than

non-residents, this analysis indicates that lower socioeconomic status blocks should be targeted for resident block leaders. Higher socioeconomic status blocks will probably be less effected by a non-resident block leader. SunShares and other block leader recycling programs should spend more effort encouraging and aiding block leaders in low socioeconomic status areas.

7. A more detailed study, in which block members are questioned, and with measurement of actual participation rates, should provide significant additional information.

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