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Under What Conditions Do Community Demographics Influence Aggregate Recycling?

Edward Kotter
Utah State University

UNDER WHAT CONDITIONS DO COMMUNITY DEMOGRAPHICS INFLUENCE AGGREGATE RECYCLING?

by

Edward Kotter

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Approved:

Dr. Douglas Jackson-Smith Major Professor	Dr. Peggy Petrzelka Committee Member
Dr. Arthur Caplan Committee Member	Dr. Mark R. McLellan Vice President for Research and Dean of the School of Graduate Studies

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ABSTRACT

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by

Edward Kotter, Master of Science

Utah State University, 2011

Major Professor: Dr. Douglas Jackson-Smith
Department: Sociology

Diversion rates of solid waste due to recycling and other efforts vary across communities for multiple reasons. Past research has provided demographic and attitudinal profiles of recyclers and non-recyclers at mainly the individual and household levels with some at the community level. Researchers have found both commonalities and variations in these profiles. Studies have also looked at how the structure of a recycling program influences recycling behavior. The question asked here is how community-level demographic and attitudinal characteristics interact with the structure of public recycling programs to influence aggregate rates of recycling participation and diversion in 40 cities in the western United States.

The results of this study provide modest support for my hypotheses that when recycling programs are less convenient, demographics and attitudinal characteristics will explain more variation in diversion of waste at the community scale. Similarly, as recycling programs become more convenient, the roles of demographic and attitudinal

factors (recycling friendliness) are expected to decrease. This study found increased recycling program convenience and less visible fee assessment structures were associated with higher rates of recycling among cities regardless of their degree of recycling friendliness. When recycling outcomes were cross tabulated with indicators convenience and fee assessment, low rates were generally found among cities with low program convenience and high rates were generally found among cities with high program convenience. Cities with less convenient programs were more likely to see higher rates of recycling when their underlying demographic and attitudinal attributes reflected characteristics that have been associated with increased recycling activity. However, when program convenience was high (and fee structures less visible) high rates of recycling were found across cities with both favorable and unfavorable demographic characteristics. I use case-specific detailed narratives to explore the factors that influence outcomes among selected cities that did or did not meet my expectations.

(115 pages)

PUBLIC ABSTRACT

Under What Conditions Do Community Demographics Influence Aggregate Recycling?

by Edward Kotter

Tons of household waste go to landfills throughout the western United States each year. Recycling has been a popular way for cities to extend the life of landfills by decreasing the amount of waste entering them. The development and implementation of recycling programs has not come without challenges. People recycle or do not recycle for different reasons. Much research has been done to understand who recycles, who does not recycle, and what recycling program characteristics elicit greater participation. This study adds to the existing body of literature by focusing on determinants of community-level recycling in the western United States.

This study compares the influence of recycling programs convenience and the fee structures for curbside recycling programs on recycling outcomes. It also explores the interaction of these "structural" program attributes and a set of demographic and attitudinal characteristics (recycling friendliness) of communities in explaining patterns of curbside recycling participation and waste stream diversion rates. My hypothesis was that among cities with less convenient recycling programs and more visible fee assessments, recycling friendliness would be helpful in explaining variation in participation and diversion rates. Similarly, places with convenient programs and less visible fee structures were expected have higher rates of recycling regardless of a community's underlying recycling friendliness. The overall findings provided modest support for my expectations.

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CHAPTER I

INTRODUCTION

For over 30 years, the United States Environmental Protection Agency (U.S. EPA) has kept track of the amount of waste generated and disposed in the United States. The U.S. EPA (2009) reported that in 2008, on average, people produced 4.5 pounds of trash per person per day with 1.5 pounds of that being recycled and composted. This equated to roughly 250 million tons of trash generated with 61 million tons of it being recycled (a recycling rate of 33.2 percent), 22 million tons being composted, 32 million tons being combusted to recover energy, and 135 million tons ending up in landfills. These numbers and the mounds of trash they represent have caused public officials to consider alternative waste management strategies.

Recycling is just one of the alternative methods used for disposing of trash. There are many different ways to structure a recycling program. Each way varies with regard to the burden or inconvenience placed on households. For example, drop-off sites involve local governments or private companies placing recycling bins on public or private lots to facilitate voluntary depositing of recyclables. While it does provide a means for local residents to recycle, this type of program is least convenient, since households not only need a separate place to store recyclables in their home, but also have to transport the recyclables to the drop-off site. For participating sites, a possible motivating factor for people to utilize drop-off sites would be the money received for depositing recyclables there (e.g., buyback centers).

Increased recycling participation and diversion rates have been found in communities with curbside recycling programs (CRPs) that use citizens in its education

outreach (e.g., meeting with citizen groups) (Folz and Hazlett 1991). CRPs are more convenient for households than drop-off sites because the waste management entity comes to their home to pick up their recyclables. For households with single stream CRPs, recyclables are simply placed in a single bin that is wheeled out with the regular trashcan to the curb at designated times. CRPs are not all structured in exactly the same way, which influences how convenient they are for people. For example, some programs require households to separate different types of recyclables into separate bins (source separation), which would be less convenient than single stream.

Even though the differently structured CRPs affect the convenience of recycling, all else equal, is increased convenience enough for anyone to recycle? There has been much research done on which socioeconomic characteristics and recycling program structures predict or explain individual and household recycling behaviors and differences in aggregate recycling rates across communities. Literature has compared the relative importance of demographic characteristics, attitudes, and institutional context (e.g., public recycling programs) in shaping individual behaviors. In contrast, there is much less work explaining aggregate patterns of recycling behavior at the community level. This study stands out with a focus on community-level recycling patterns across a sample of cities in the western United States. It is often assumed that the individual-level predictors of recycling are good measures of aggregate community-level behavior. In this study, because I do not have household-level data, I compare the relative impact of a community's demographic profile and the structure of their recycling programs as predictors of aggregate levels of an average household recycling. Specifically, I hypothesize that as the convenience of the recycling program increases the influence of

demographic and attitudinal characteristics (recycling friendliness) become less important in explaining aggregate patterns of recycling behavior.

In the next section, I review the research literature on recycling programs and behaviors. This is followed by my research questions and expectations, an overview of my methods, reporting of my findings, and ending with a summary and conclusion.

CHAPTER II

LITERATURE REVIEW

There is ample research on recycling behavior in the US and in other industrialized countries. This literature focuses mainly on the impacts of demographic characteristics and program design on individual- or household-level behavior. However, there are a handful of studies that focus on how these attributes impact community-level recycling. In this chapter, I review some of the findings of previous work and identify key variables that will be explored in the present study.

The following sections discuss the characteristics associated with recycling behavior at different levels, attitudes toward recycling, recycling program structure, and public media campaigns.

DEMOGRAPHIC CHARACTERISTICS

There has been much research done on the demographics of recyclers and non-recyclers, conducted at different levels. The following sections provide overview of individual-level, household-level, and community-level characteristics as they relate to recycling behavior.

Individual-level Characteristics Associated with Recycling

Gender, income, education, and age are commonly reported demographic characteristics in past studies that are associated with recycling behavior (Schultz, Oskamp, and Manieri 1995). Several studies have found that people who recycle are more likely to be higher educated (college graduate or higher), younger, female, and agree that recycling is helping their country and community (Barr 2003; Barr, Ford, and

Gilg 2003; Ungar 1994). Schultz et al. (1995) found that income was the most consistent positive indicator of recycling behavior, while gender was a relatively weak determinant of recycling participation (perhaps because recycling is more of a household behavior, which can be performed by either males or females depending on who ends up doing it at any given time).

Also, Tilikidou and Delistavrou's (2001) literature review suggests that demographic characteristics may be less influential on recycling behavior than once thought. Given that recycling has become more mainstream in many communities, people of all ages, genders, education, and income classes may participate in recycling behavior.

Household- and Community-level Characteristics Associated with Recycling

Since recycling (and waste disposal behaviors in general) typically occur at the household level, some researchers have attempted to identify the characteristics of households that are associated with recycling activity. Martin, Williams, and Clark (2006) found that households least likely to recycle were either younger residents without children or lower income families with children. They attributed low recycling rates to the possible lack of storage space for recyclables and the time needed to recycle.

Homeowners have been found to be more likely to recycle than renters (Nixon and Saphores 2009). Homeowners with a longer history in the community may have more interest in the quality of where they live and ensuring good home values. Renters come and go and with possibly less regard toward the quality of where they live, and may lack the desire to participate in or have the knowledge of local recycling programs.

Meanwhile, households' behavior can be influenced by their observations of

neighbor and peer behaviors in their broader community. How peers influence a given household's environmental behavior has something to do with where the household fits in society (Rohrschneider 1990). For example, if middle-class communities are more likely to recycle and that is where an individual lives, they may be more likely to recycle due to their neighbors' recycling efforts.

Timlett and Williams (2009: 503) found that it could take three years for recycling to become "normalised behavior for new residents" in a community. If a community has many transient short-term residents (e.g., college/university students), there may not be enough time for them to get accustomed to recycling before moving again.

While most of the published research explores factors that predict individual- or household-level recycling behavior, a few scholars have sought to identify the characteristics of communities that are associated with higher aggregate recycling rates. For example, communities with more households of higher income retirees have higher recycling rates (Martin *et al.* 2006; Tilikidou and Delistavrou 2001; Tsai 2008). Recycling takes time and retirees tend to have more time on their hands than young couples with or without kids. This extra time would influence their recycling rate by having less time tied up with a job and raising children (Tsai 2008).

I use census-based estimates of age, gender, education, and income in my analysis as proxies for community-level characteristics for individual and household-level attributes that have been cited in past household-level studies in describing who recycles.

Role of Attitudinal Factors

Recycling has been promoted as a way to curb the amount of trash being sent to landfills around the country, and to postpone the inevitable need to find new places to store municipal trash (Blaine *et al.* 2005). The more people perceive trash as an environmental problem, the more likely they are to participate in pro-environmental behavior (Hess 1998; Homburg and Stolberg 2006; Jones 2009).

Since the 1980's, recycling has become more mainstream and prevalent (Tilikidou and Delistavrou 2001). Attitudes linked to recycling may be shifting from more altruistic feelings about environmental impacts to more selfish desires to receive monetary and/or social benefits (Schultz *et al.* 1995). These benefits may be in the form of monetary incentives or looking good in the eyes of friends and neighbors. It has been suggested that the ability of generic pro-environmental attitudes' to predict recycling behavior in people has decreased. Nevertheless, personal concerns about specific environmental issues (such as landfills reaching capacity or risk of groundwater contamination) may still be positively associated with recycling behavior (Tilikidou and Delistavrou 2001; Shultz *et al.* 1995).

Some scholars have used indicators of political orientation and voting behavior as proxies for measuring environmental attitudes. For example, presidential voting results provide a general view of what environmental attitudes the majority of people in a community align themselves with based on the political party of the elected candidate. Democratic votes tend to reflect a more liberal pro-environmental citizenry that is willing to spend more on the environment, while Republican votes reflect more conservative points of view on environmental issues (Davis and Wurth 2003).

ROLE OF INSTITUTIONAL FACTORS

This section reviews results of recent research on institutional factors that influence recycling behavior. In particular, scholars have examined differences in the structure of public recycling programs, the level of convenience associated with different program designs, and how media and education programs can increase the effectiveness of household recycling programs.

Program Structure

Research has also explored the role of program structure on recycling activity. A well-structured program can be expected to elicit higher levels of recycling; whereas, a poorly designed program may hinder participation or even cause people to opt out due to bad experiences and being inconvenienced (Folz and Hazlett 1991; Timlett and Williams 2009). Several dimensions of program structure appear to be important. They include: (a) whether it is mandatory (all potential participants are charged a fee and given a bin without signing up voluntarily) or voluntary (those who sign up for curbside recycling are those who pay and receive bins); (b) whether the program utilizes drop-off sites or curbside pickup; (c) whether materials must be sorted by the individual; (d) whether there is a fee to participate; and (e) whether a full range of materials are accepted by the recycling program. In many cases, convenience is a key driver of recycling behavior. People are less likely to participate when it is inconvenient and burdensome to do so (Folz and Hazlett 1991; Tilikidou and Delistavrou 2001; Timlett and Williams 2009).

A task is convenient when it is simple and requires a low amount of energy to accomplish. The more energy it takes to accomplish a task, the more inconvenient it is and people will try to avoid doing it. Inconvenient characteristics such as de-labeling and

cleaning food particles off items are two examples of burdensome or inconvenient tasks associated with recycling. People are more likely to recycle when these and other inconvenient tasks are lessened or done away with altogether (Derksen and Gartrell 1993; Martin *et al.* 2006).

Curbside recycling programs can be voluntary or mandatory. A program that is voluntary allows people to opt-in and opt-out as they choose to pay and participate. A program that is mandatory issues bins to households and charges them a fee regardless of the desire of and participation from the households. Some mandatory programs involve city ordinances that levy penalties against households disposing of recyclables in regular trash (Everett and Peirce 1993). Other mandatory programs do not involve creating "recycling ordinances," but government officials provide a bin and charge a fee to every household. Because it is universally available to households but use of the service is not required, this less stringent type of mandatory program is referred to as a "universal" recycling program in this study. Folz and Hazlett (1991: 528) found that cities, which could "impose sanctions or warnings for noncompliance," also had higher recycling participation rates.

Two distinct kinds of recycling program structures include: curbside recycling and drop-off sites/centers. Curbside recycling is where households are provided with a recycling cart or bin(s) that they roll or place out to the curb like they do with their regular municipal solid waste (MSW) cart. In contrast, drop-off sites are designated locations with large dumpsters or containers where people can take and deposit their recyclables.

Curbside recycling has been found to be a convenient way of recycling (Derksen

and Gartrell 1993; Schultz 1998). Generally speaking, curbside recycling is much more convenient than drop-off systems and elicits higher rates of household participation and waste diversion. Once households have recycling bins, a convenient pickup schedule (e.g., same day pickup as regular trash) can increase participation in a curbside recycling program (Lansana 1993). Curbside recycling programs that incorporate a variety of items, and have the same pick-up time as their MSW have been the most successful (Martin *et al*. 2006; Perrin and Barton 2001).

Programs also differ according to the types of items that are accepted for recycling. Some programs only accept paper items, while others accept a wide array of items (Perrin and Barton 2001). Studies of people who did not initially recycle have shown that they often appreciate recycling programs that accept a wide variety of items (Martin *et al*. 2006).

When a program accepts a wide array of items, they are either co-mingled in one container or separated into multiple containers for either curbside pickup or drop-off sites. Curbside programs that accept unsorted recyclables requires less energy from the recycler than those that mandate separation of items or that require transport to drop-off sites. It is easier to throw all recyclable items into one container that is wheeled out to the curb than to have multiple containers, which also increase the space required to store recyclables prior to pick up or drop-off.

The convenience of a simple, well-structured recycling program may elicit more pro-recycling behavior from people than possibly the demographic and attitudinal characteristics of the people alone. Even with an inner belief that recycling helps the environment (inner belief may develop from participating in a well-structured program),

a person may not take the time or use the energy to participate in a poorly structured recycling program that is too inconvenient (Perrin and Barton 2001; Shaw and Maynard 2007). For example, individuals from different communities with similar pro-environment beliefs have been found to have different participation rates. The lower rate of recycling participation was found in individuals without a well-structured program, and the higher rate was found in those with a well-structured program (Derksen and Gartrell 1993).

Media and Education Campaigns

Another attribute of program structure that can impact recycling behavior is the way in which people are informed about their local programs. Media campaigns have been found to not only provide information about programs, but also encouragement for increasing recycling behaviors (Martinez and Scicchitano 1998). Studies of the effectiveness of these programs suggest that printed materials are effective, but they tend to work better in combination with other media. Clear and concise information that comes in multiple forms is vital to creating community awareness about any program. People need to know the "ins" and "outs" of their local recycling program. Multiple media outlets can help the spread of information (Martinez and Scicchitano 1998). Two of the most effective ways of providing information to impact the decision to recycle are through family and friends or at school and work (e.g., face-to-face communication at work or school programs) (Folz and Hazlett 1991; Nixon and Saphores 2009).

Transient communities can present challenges in creating an effective media campaign (Bryce, Day, and Onley 1997; Timlett and Williams 2009). For example, college-age students moving to and from communities may be more prone to not

receiving or remembering recycling information (Timlett and Williams 2009). Also, students may feel more attached to their school than the city in which their school of higher education is located. Mailed material may also be impersonal to them as the addressee may be listed as "current resident."

Timlett and Williams (2009) reported that residents of their study community received information about recycling nine times per year on average. Communications included: information with tax bills (for new residents), recycling calendars every year, and quarterly magazines. Even with these modes of communication, the information was not always getting absorbed and acted upon by new residents. Generally, people do not look forward to receiving billing information, so having recycling information with a bill may create an unintended feeling of resentment toward recycling from new residents.

A number of authors have explored the idea of targeting media and education campaigns to increase their effectiveness. Media campaigns often blanket the entire community. More focus and resources might instead be spent on helping to create within a non-recycler the desire to recycle. Based on results from their survey, Aadland and Caplan (1999: 794) recommended that the Ogden City (in Utah) public works department focus a media "campaign toward residents who are male, older, lower-income and/or have less formal education." This is due to how people fitting this description are "not willing to pay as much for curbside recycling service," which suggests less importance and desire to recycle (Aadland and Caplan 1999: 794).

Still, people who are inclined to recycle also need to know how to correctly participate in their local recycling program. A recycler who understands his or her local program may be more influential in getting his or her family and friends to recycle than

media campaigns, which provides a challenge for creating an effective media campaign that both inspires the non-recycler and informs the recycler. More involvement from residents in educational efforts for recycling programs may provide greater recycling performance (Folz and Hazlett 1991). As residents become involved in educating one another about recycling, they may be more likely to be influenced by family or friends.

CHALLENGES OF MEASURING RECYCLING BEHAVIOR

Calculating how many people or households participate in a recycling program has been used to rate the performance and effectiveness of different recycling programs (see Perrin and Barton 2001; Timlett and Williams 2008). Participation rates show the proportion of a population that utilizing local recycling programs. This helps to explain why individuals, households, and/or communities do or do not divert more trash from landfills. The challenge lies in how participation rates are calculated or measured inconsistently across municipalities, and how not all waste stream tonnages are tracked at different levels.

This study seeks to explain community-level recycling outcomes. Aggregate recycling behavior can be measured in two distinct ways. First, one can estimate the proportion of households or individuals who recycle, a statistic I refer to as the community recycling "participation rate." Estimating participation rates may be affected by the type of recycling program. For example, participation rates for CRPs are best captured as either a set-out rate (for cities that offer a standard service) or simply the proportion of households who subscribe to CRP services (for cities that have voluntary opt-in recycling).

Knowing how many residents are taking part in a recycling program is helpful,

but it is also helpful knowing how much waste is being diverted from landfills or other endpoints. This may play a large role in determining the life of a landfill with a relatively small amount of available space. Thus a second indicator of recycling outcomes is the "diversion rate" which captures the share of particular waste streams that are diverted because of recycling programs. There are two distinct types of diversion rates that are relevant for this study. The first is the overall waste stream diversion rate, which captures how much of the total waste generated by a city was being diverted from a landfill because of community recycling efforts. A second measure is the household diversion rate that is directly associated with the use of a CRP. Most cities report diversion rates using measures of weight (e.g., tons of waste in different categories), so this affects the different weights of materials in the different waste streams (e.g., residential, commercial, green waste, and so on) and the estimates of diversion rates. For example, cities whose recycling program does not include heavier materials (e.g., green waste), will tend to have lower diversion rates.

Research Question and Expectations

My study addresses the following question: **How do population demographics and the attitudinal profile of a community interact with the structure of their public recycling programs to explain variability in aggregate recycling participation and diversion rates?** In other words, do the characteristics of a community, or how recycling friendly they are, have more or less influence in explaining levels of aggregate diversion and participation given the level of convenience of the structure of the recycling program?

The research expectation for this study is: **When recycling programs are less**

convenient, demographic and attitudinal characteristics will explain more variation in diversion of waste and recycling participation at the community scale. However, as recycling programs become more convenient, the roles of demographic and attitudinal factors (recycling friendliness) are expected to decrease.

In Aadland and Caplan's (2006) household study, convenience was not found to have explanatory power on willingness to pay, which may be a good proxy for participation, when using their entire sample and accounting for a wide array of demographic and other variables. This study hopes to capture participation rates directly (without using proxy) as it compares them with convenience and recycling friendliness.

Recycling programs have encountered challenges in design or implementation along the way. Different communities have used different approaches (in terms of structuring, implementing, and informing people) and produced varying participation and diversion rates (Folz and Hazlett 1991; Schultz *et al.* 1995). My study of recycling programs in the western United States looks at the influence of demographic characteristics, and the structure and design of recycling programs including the methods used to educate and motivate people to recycle.

Figure 1 shows the conceptual framework for the independent and dependent variables included in this study. The independent variables include "Community Composition," consisting of individual and household characteristics aggregated to the community level. These include indicators for age, gender, education, income, and home ownership. It also captures aggregate differences in the environmental attitudes of community residents as captured by the number of votes for the Democratic and Republican candidates of the 2008 Presidential Election (i.e., it is assumed that more

votes for democratic candidate equaled "environmentally friendly"). A second cluster of independent variables measured the structure of local recycling programs. This included measures for the presence of various program attributes associated with convenience, including the presence of curbside pickup service, mandatory versus voluntary participation, requirements to separate recyclable items, same day pickup as MSW/different day pickup, and presence of penalties or incentives. Measures of program structure also included an assessment of recycling media campaigns, with a focus on the use of different media. The dependent variable is "Recycling Outcomes," which consists of community-level recycling participation rates and diversion rates of waste from the overall waste stream.

Arrows A, B, and C in Figure 1 reflect the following possible relationships between the core clusters of variables. Path A highlights the direct effects of "community composition" on "recycling outcomes," capturing the influence from characteristics of the community on participation and diversion rates regardless of "program structure." Path B reflects the direct impacts of "program structure" on aggregate recycling behaviors regardless of the characteristics of the community (recycling friendliness). Path C demonstrates that some of the impacts of "community composition" on "recycling outcomes" might be mediated by the program structure of local recycling programs. I expect path B to dominate as program structure gets more convenient with path A declining in importance. I also expect the flipside to occur with path A dominating as program structure gets less convenient with path B declining in importance.

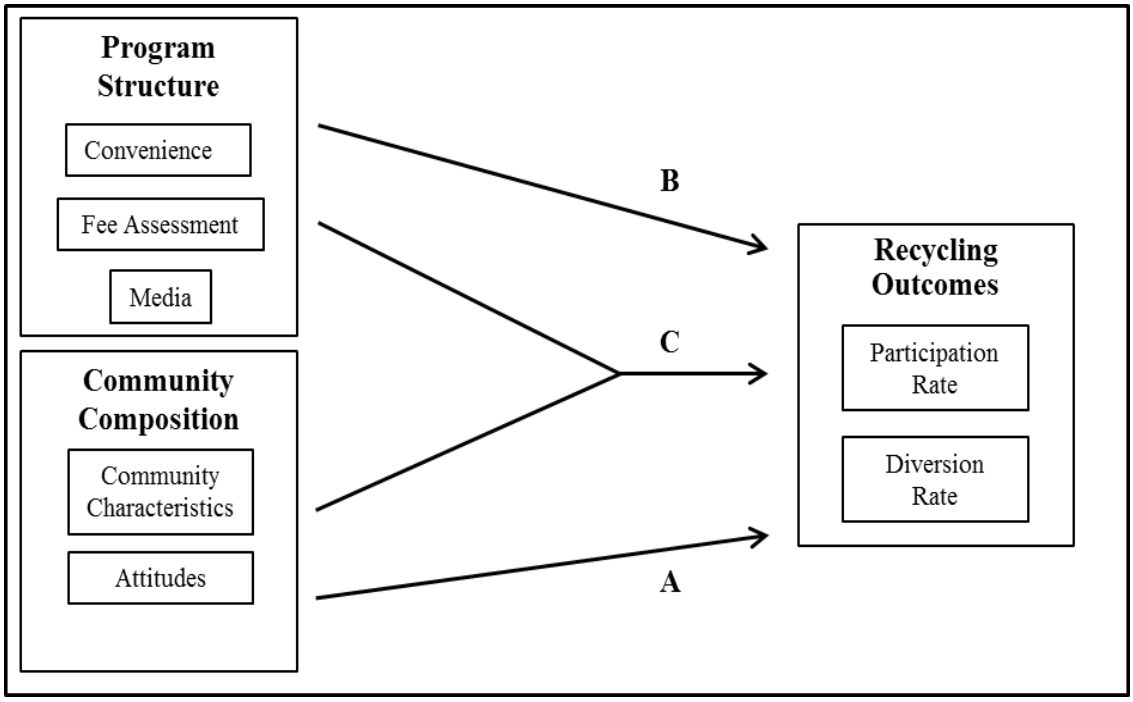

Figure 1. Conceptual Model of Independent and Dependent Variables

CHAPTER III

METHODOLOGY

This thesis examines the link between community demographics, recycling program structure, and indicators of aggregate recycling in a sample of medium-sized cities in the western United States. The study communities were drawn from Aadland and Caplan's (2006) study of social net benefits of curbside recycling. In their original study, Aadland and Caplan developed a stratified sample of 40 cities with populations greater than 50,000 in the western United States (see Appendix A). By design, one-third or 14 of the originally sampled cities were known to have had a voluntary curbside recycling program (CRP), one-third or 13 had a mandatory CRP, and the final third or 13 had no CRP as of 2002.

BACKGROUND TO AADLAND AND CAPLAN (2006) STUDY

In the original study, random-digit dialed telephone surveys were administered to over 4,000 households in sampled communities in the winter of 2002. The surveys collected information about household and demographic characteristics, attitudes toward and knowledge about recycling and indicators of recycling behavior. In addition to the household survey, telephone interviews were conducted with the recycling program coordinators in each of the 40 cities. These interviews provided systematic information about the structure and organization of their communities' recycling programs. In their original analysis, data on household characteristics and program design were used in economic models to estimate willingness to pay for recycling services (Aadland and Caplan 2006).

DATA COLLECTION

In the present study, I sought to update the information about recycling program characteristics and recycling behavior in the set of cities. I used a combination of key informant interviews with city recycling coordinators and secondary data from published or internet sources to develop a more current database including information about current community-level demographics, attitudes, and city recycling program characteristics. I also gathered information from key informants and secondary sources to quantify three community-level indicators of recycling activity. These three indicators included estimates of overall or total municipal waste stream diversion rates, household waste stream diversion rates associated with curbside recycling programs (CRP), and rates of household participation in a community CRP.

A review of Aadland and Caplan's records, searches of the Internet (city websites, U.S. Bureau of the Census, and CalRecycle) and interviews with recycling program coordinators enabled me to classify 38 of the 40 study cities relative to their underlying demographic characteristics and the structure of the city's recycling program. Interestingly, the structure of recycling programs in many of the original cities had changed since the original interviews in 2002. A summary of the former and current recycling program classifications among the study cities can be found in Table 1.

Response Rate

The overall contact rate for this research was 95 percent with only two of the 40 cities not being contacted by phone or email (no returned calls or responses to my emails). In addition, not all of the cities contacted agreed to participate in the study. Of the 38 cities contacted, 5 opted not to participate. This resulted in about 83 percent (33

cities) of the 40 cities (approximately 87 percent of the contacted cities) providing at least some information. Finally, after reviewing the information from the responding cities, approximately 73 percent (29 cities) of the original 40 cities provided enough detailed information to be included in the analysis described below. There were also two cities for which I obtained sufficient data from the Internet to keep in the analysis. I was unable to contact one of the cities and the other city was unable to participate (see asterisk in "No Contact" and "Refused" columns of Table 1).

Table 1 shows the distribution of cities according to CRP type categories (voluntary, mandatory, and no CRP) used in Aadland and Caplan's original stratified sample. The table also shows what kind of recycling program they had in 2010, whether or not the cities were contacted, and which ones were included in the analysis.

As shown in Table 1, this study found the vast majority of the original 40 cities that reported voluntary and mandatory CRPs still operating those types of CRPs in 2010. There were 5 cities between those two groups that changed between 2002 and 2010—three cities changed from voluntary to mandatory and two cities changed from mandatory to voluntary. Cities that refused to participate were assumed (except one city for which data was gathered from the Internet) to have the same type of CRP in 2010 as was found in 2002. Of the 11 cities that did not change from voluntary CRP, two refused to participate and three had missing data that left 6 cities with enough data for analysis. The three cities that changed from voluntary to mandatory also had enough data for analysis along with all the cities originally reporting mandatory CRPs. Of the cities originally reporting mandatory CRP, I was unable to contact one of them, but still able to obtain sufficient data from the Internet for use in my analysis (see asterisk in "No Contact"

Table 1. Number of Study Cities by Recycling Program Type and Availability of Data for Dependent Variables

2002 Distribution		2010 Distribution and Categories				
			38 Cities Contacted			
Voluntary CRP			No Contact	Refused	Missing Data	Useful
	Voluntary	11		2	3	6
14	Mandatory	3				3
	None	0				0
Mandatory CRP						
	Voluntary	2				2
13	Mandatory	11	1*			11
	None	0				0
No CRP						
	Voluntary	4		1	1	2
13	Mandatory	4		1*		4
	None	5	1	1	2	1
Column Totals		40	2	5	6	29

*Data was gathered from Internet for cities to be used in analysis. They are counted in both "No Contact" and "Refused" columns respectively, and in the "Useful" column.

column).

The cities with no CRP in 2002 were found to be almost evenly distributed among all three types of CRPs in 2010—4 cities changed to voluntary, 4 cities changed to mandatory and 5 cities remained unchanged. It should be noted that the group of cities where there was no CRP in 2002 produced relatively few usable responses (only 7 of 13 had usable information), particularly among those that still had no CRP in 2010. This is because such places generally do not collect information about recycling participation and diversion rates and thus had no information available for me to operationalize my dependent variable. Of the 5 cities that were unchanged, one had no contact, one refused to participate, and two had missing data for analysis. The one city that refused to participate among the 4 that changed from no CRP to mandatory (city with asterisk) was also reported in the "Useful" column and "Refused" total, but not in total cities contacted.

This is because enough information and data was obtained from its website and the CalRecycle website for analysis. The 4 cities that changed to voluntary had one city refuse to participate and one with missing data. Of the 13 cities originally reporting no CRP, enough comparable data for analysis was found for 7 of them.

Table 1 also shows how cities were found to be distributed among the different types of CRPs for this study as follows: 17 cities with voluntary CRPs, 18 cities with mandatory CRPs, and 5 cities with no CRPs. Of the original 40 cities, this study found enough comparable data for 29 cities for analysis purposes. The "missing data" cities did not have enough comparable data for the dependent variables to be used in this study.

Missing data for calculating participation/diversion rates was the primary reason cities were dropped from analysis. Some cities do not track the data themselves or have other agencies tracking city-level data. There were other agencies tracking data at multi-municipality levels, but this did not provide comparable data for this study. Also, private waste/recycling haulers do not necessarily worry about whether or not their trucks are crossing over into other cities as they go about servicing their accounts. This mixes trash from multiple municipalities and renders it impossible to track city-specific data and rates.

Similarly, I found wide variation in the availability of data on my three key dependent variables: overall waste stream diversion rates, household waste stream diversion rate from CRP, and household CRP participation rates. The most commonly available indicator was the estimated overall waste diversion rate.

Enough comparable data was found for 29 of the original 40 cities for them to be separated into 3 overlapping groups to estimate three different community-level

indicators of recycling: 20 cities reported diversion rates for their overall solid waste stream, 13 cities reported diversion rates for household solid waste stream directly associated with CRP activity, and 17 cities reported participation rates for CRP programs. Only three of the 29 cities reported rates for all three of these community-level recycling outcome indicators. The 29 cities include 10 in California (Carlsbad, Escondido, Hesperia, Inglewood, La Mesa, Newport Beach, Palo Alto, Santee, Upland, and Yorba Linda), 4 in Kansas (Kansas City, Olathe, Overland Park, and Topeka), 3 in Colorado (Arvada, Longmont, and Westminster), 3 in Utah (Ogden, Orem, and Provo), 2 in Texas (Denton and McAllen), 2 in Nebraska (Lincoln and Omaha), and 1 in Arizona (Tempe), Montana (Billings), North Dakota (Bismarck), Oregon (Eugene), and Washington (Bellevue).

The analysis below focuses on comparisons among the 29 communities for which data are available for 2010 or nearest year. A list of all variables and source information used in this study can be found in Table 2 below.

Demographics and Attitude

Consistent[1] indicators of community demographics were drawn from the 2007-2009 American Community Survey (ACS) 3-Year. Census data were obtained on three community-level demographic variables (age, gender, and education) that past individual-level research had identified as associated with recycling (Barr 2003; Barr *et al.* 2003; Schultz *et al.* 1995; Ungar 1994). These variables were: percent of the resident population aged 20-34, percent female, and percent of adults who are college graduates.

[1] In the context of my dataset, "consistent" means that the same indicators of community demographics were obtained for all cities and from the same source (ACS); also, that the indicators were selected to be consistent with past research.

Table 2. Independent and Dependent Variables and Data Sources

Variables	Data Source
Community Composition	
Community Characteristics	
percentage age 20-34	2007-2009 American Community Survey 3-Year Estimates
percentage of female	2007-2009 American Community Survey 3-Year Estimates
percentage graduated from college	2007-2009 American Community Survey 3-Year Estimates
percentage of homes occupied by homeowners	2007-2009 American Community Survey 3-Year Estimates
percentage of households with incomes above 75K	2007-2009 American Community Survey 3-Year Estimates
Attitudes	
2008 Presidential voting by county (percent democratic vote)	County websites
Program Structure	
Convenience	
mandatory CRP	City Official
voluntary CRP	City Official
no CRP	City Official
drop-off sites	City Official
comingled/separation of items	City Official
same day/different day pickup	City Official
all recyclables accepted/selective	City Official
presence of Dirty MRF	City Official
Fee Assessment	
separate bill or included in trash services	City Official
recycling fee paid by all or only participating households	City Official
penalty/incentive	City Official
Media	
television	City Official
radio	City Official
mass mail	City Official
leaflet with utility bill	City Official
face-to-face contact with family/friend	City Official
presentation at school	City Official
other media types	City Official
Recycling Outcomes	
CRP Participation Rate	City Official
CRP and Overall Diversion Rate	City Official

In addition, census data were used to capture community-level data for two household-level variables (income and mobility) that have been linked to recycling (Timlett and Williams 2009). These include: percent of households with income over $75,000 and the percent of housing units that were owner occupied. Finally, data on voting by political party was used as a proxy for pro-environmental attitudinal orientations (see Davis and Wurth 2003). Specifically, data from the 2008 presidential election was derived from local county clerk and state websites, and the greater percent vote for the democratic candidate was used as proxy for the "environmental" or "attitudinal" orientations of city residents. For this study, I assume that democratic votes suggest "high environmental friendliness" (more likely to recycle) and republican votes suggest low "environmental friendliness" (less likely to recycle).

Characteristics for each study community are reported in Table 3 below. In 5 of the 6 categories, higher proportions of the population (or of households) were associated with greater "recycling friendliness." The exception is the proportion of young adults, where higher percentages are expected to be associated with lower community-level recycling activity. This item was reverse coded in the standardized scales described below.

To enable the aggregation of different demographic attributes into a single index, the raw percentages in Table 3 were normalized by computing Z-scores based on data from the full original set of 40 cities (see Table 4). Z-scores reflect how each city compares to the mean value for all cities in the study, and take into account the degree of variability within the entire sample. A Z-score of zero is a city whose value is exactly equal to the mean of all cities on that variable. Z-scores of +/- 1 reflect cities whose

Table 3. Cities with Raw Scores for Demographics and Attitudes Separately

	Percent					
CITY	**Persons Aged 20-34**	**Female**	**College Graduates**	**Households with income 75K+**	**Owner occupied Households**	**Vote Democratic**
Ogden, UT	27.6	49.3	24.6	17.2	57.2	34.7
Inglewood, CA	23	51.7	24.9	24.4	35.6	69.2
Denton, TX	32.5	50	38.6	29.4	49.8	37.5
Tempe, AZ	35.7	47.8	46.6	30.8	48.1	58.2
Hesperia, CA	19.8	50.4	17.7	29.3	71.4	52.2
Provo, UT	46.6	50.5	49.5	21.4	43.9	18.5
Orem, UT	30.1	50.2	46.2	33.9	64.4	18.5
Kansas City, KS	22.3	50.9	21.1	17.3	61.2	69.4
Topeka, KS	22.3	51.7	32.8	20.6	58.3	49
Upland, CA	19.1	49.7	40.1	45.3	58.7	52.2
Omaha, NE	23.8	50.7	39.1	27.4	60.8	51.5
Escondido, CA	22.4	51.6	30.6	33.2	55.7	54
Lincoln, NE	28.1	50.1	46	27.1	59.2	51.6
Billings, MT	22.8	51.7	37.5	26.4	65.1	45.3
McAllen, TX	21.1	51.2	33.5	24.3	61.3	68.9
Bismarck, ND	25.3	51.8	46.4	29.6	65.2	37.4
Eugene, OR	27.4	51.5	47.9	23.9	50.8	62.4
Longmont, CO	19.4	49.8	45.1	38.2	64.2	72
Olathe, KS	23.6	49.3	52.5	49.9	74.3	44.8
Westminster, CO	23	51.4	42.2	40.6	68.5	53.3
Arvada, CO	16.9	51.9	40.4	42.1	73.2	53.3
La Mesa, CA	34.2	52.6	42.2	31.6	47.9	54
Santee, CA	18.9	52.7	30.3	43.6	71.1	54
Overland Park, KS	21	51.5	61.8	46.6	64.8	44.8
Newport Beach, CA	21	50.6	70	64.6	55	47.6
Carlsbad, CA	16	50.9	59.4	55.6	68.9	54
Bellevue, WA	22.5	49.5	67.2	53.8	59.5	70
Yorba Linda, CA	15.1	50.3	55.4	69.5	83.7	47.6
Palo Alto, CA	17	50.2	82.5	68.1	59.4	69.6

scores are 1 standard deviation above or below the group mean. An additive index was constructed using the Z-scores of the 5 demographic variables— with the result reflecting the net degree to which a community deviated from the "average" for the entire sample in terms of "recycling friendly" demographic attributes. Finally, the Z-score for the voting

behavior variable was added to the demographic variable index and an overall "recycling friendliness" index score was obtained (see Table 4).

To simplify my comparisons, the 29 cities were then designated as high, medium, or low for demographics, attitudes and the combined recycling friendliness index (see Table 5). Rankings were based on the combined standardized indices. For example, cities ranked in the medium category in any of the three indexes had scores that were +/- 1.3[2] standard deviations above or below the mean score of the 29 cities on that index. Those with scores above +1.3 standard deviations from the mean score were designated as "high," while those with scores below -1.3 standard deviations from the mean score were designated "low" for all three indexes.

Looking at the combined standardized score rankings for demographics and attitudes in Table 5 ("Recycling Friendliness" column), 8 of the cities ranked "low," 10 ranked "medium," and 11 ranked "high" in terms of their demographic/attitudinal "recycling friendliness."

Program Structure

Updated information about recycling programs, media campaigns, and recycling indicators of diversion and participation rates in each study community was captured in a series of new telephone interviews with current recycling program coordinators or other city officials knowledgeable about the local recycling programs. A copy of the semi-structured telephone survey instrument can be found in Appendix B.

Recycling coordinators' names and contact information were obtained from local

[2] A threshold of +/- 1.3 standard deviations was used to capture natural gaps in the distribution of cities across the aggregate scale and create relatively even categories

Table 4. Cities with Standardized Scores for Demographics and Attitudes Separately and Combined

	Standardized Scores		
City	**Demographics**	**Attitudes**	**Recycling Friendliness**
Ogden, UT	-3.763	-1.177	-4.940
Inglewood, CA	-3.722	1.431	-2.292
Denton, TX	-1.226	-0.966	-2.182
Tempe, AZ	-2.467	0.599	-1.858
Hesperia, CA	-1.985	0.142	-1.833
Provo, UT	0.980	-2.398	-1.418
Orem, UT	1.003	-2.398	-1.395
Kansas City, KS	-2.771	1.448	-1.323
Topeka, KS	-1.190	-0.096	-1.286
Upland, CA	-1.342	0.142	-1.200
Omaha, NE	-0.776	0.096	-0.680
Escondido, CA	-0.798	0.278	-0.520
Lincoln, NE	-0.434	0.098	-0.336
Billings, MT	0.339	-0.372	-0.033
McAllen, TX	-1.246	1.409	0.163
Bismarck, ND	1.689	-0.975	0.714
Eugene, OR	-0.089	0.913	0.824
Longmont, CO	-0.780	1.641	0.861
Olathe, KS	1.753	-0.409	1.344
Westminster, CO	1.773	0.232	2.005
Arvada, CO	1.834	0.232	2.066
La Mesa, CA	1.873	0.278	2.151
Santee, CA	2.103	0.278	2.381
Overland Park, KS	3.029	-0.409	2.620
Newport Beach, CA	2.991	-0.201	2.790
Carlsbad, CA	2.580	0.278	2.858
Bellevue, WA	1.596	1.488	3.084
Yorba Linda, CA	4.080	-0.201	3.879
Palo Alto, CA	3.595	1.457	5.052

government websites and telephone calls or emails to city officials. If the correct contact was reached by phone, the study was explained to them with an invitation to set up a convenient time for a telephone interview; otherwise, an email was sent explaining who I was, what the study was about, why I needed their help, and how they could help. In

Table 5. Cities Ranked High, Medium, and Low for Demographics and Attitudes Separately and Combined

CITY	Demographics	Attitude	Recycling Friendliness
Ogden, UT	LOW	MEDIUM	LOW
Inglewood, CA	LOW	HIGH	LOW
Denton, TX	MEDIUM	MEDIUM	LOW
Tempe, AZ	LOW	MEDIUM	LOW
Hesperia, CA	LOW	MEDIUM	LOW
Provo, UT	MEDIUM	LOW	LOW
Orem, UT	MEDIUM	LOW	LOW
Kansas City, KS	LOW	HIGH	LOW
Topeka, KS	MEDIUM	MEDIUM	MEDIUM
Upland, CA	LOW	MEDIUM	MEDIUM
Omaha, NE	MEDIUM	MEDIUM	MEDIUM
Escondido, CA	MEDIUM	MEDIUM	MEDIUM
Lincoln, NE	MEDIUM	MEDIUM	MEDIUM
Billings, MT	MEDIUM	MEDIUM	MEDIUM
McAllen, TX	MEDIUM	HIGH	MEDIUM
Bismarck, ND	HIGH	MEDIUM	MEDIUM
Eugene, OR	MEDIUM	MEDIUM	MEDIUM
Longmont, CO	MEDIUM	HIGH	MEDIUM
Olathe, KS	HIGH	MEDIUM	HIGH
Westminster, CO	HIGH	MEDIUM	HIGH
Arvada, CO	HIGH	MEDIUM	HIGH
La Mesa, CA	HIGH	MEDIUM	HIGH
Santee, CA	HIGH	MEDIUM	HIGH
Overland Park, KS	HIGH	MEDIUM	HIGH
Newport Beach, CA	HIGH	MEDIUM	HIGH
Carlsbad, CA	HIGH	MEDIUM	HIGH
Bellevue, WA	HIGH	HIGH	HIGH
Yorba Linda, CA	HIGH	MEDIUM	HIGH
Palo Alto, CA	HIGH	HIGH	HIGH

either case, a standard implied informed consent information sheet (see Appendix D) was sent to them as an attachment to an email.

Since I asked the recycling coordinators about specific recycling program participation and diversion rates, which takes time to gather, I made them aware of the need for them to find this information prior to the formal interview. Information about participation rates and diversion rates was also sought from published solid waste program reports or other reports in each city, and an effort was made to ensure that the rates across the 40 cities were comparable.

Data on recycling program characteristics for 2010 was obtained from the telephone interviews and secondary data available on the Internet. I used this information to produce a convenience scale (see Figure 2) based on the presence or absence of different recycling program characteristics. Example of key characteristics include: curbside recycling program (CRP)/no CRP, drop-off sites/no drop-off sites, items comingled/items separated into multiple bins, and CRP same pickup time as MSW/CRP different pickup time. There is a large gap between only drop-off sites and having a dirty MRF, but there are only three cities that fit in either of these categories.The most convenient type of program was determined to be one that operates a materials recovery facility (MRF) where all household waste is sent and recyclables are extracted by the waste management service. This type of MRF is commonly referred to as a "dirty MRF."

Information about the fee assessment of CRPs was also used to create a 7-Category CRP Fee Assessment Scale for categorizing cities according to how households paid for curbside recycling services (see Figure 3). Households in cities with CRPs had the option of voluntarily signing up and paying extra for curbside recycling services

(more visible) or having it a standard service included in their garbage fee regardless of participation (universal CRP). Although, there were two cities that reported different sources of money to cover costs of curbside recycling services: various taxes (e.g., property tax) and revenue from waste collection services (less visible).

Economic incentives were also included in the CRP fee assessment scale. Households in certain cities were provided an economic incentive to recycle, such as paying lower monthly fees if they agree to use a smaller trash bin (which is made possible by separating out recyclables from the regular waste stream). This volume-based rate structure sets prices for service as determined by size of trash bin, so the less trash a household throws out the smaller the trash bin they need and the lower the price they pay. An alternative approach is to weigh household trash bins upon collection and to charge on a per-ton basis (also known as "pay-as-you throw").

Information about the structure of fee assessments and incentives associated with a community CRP program were combined to create a CRP Fee Assessment Scale. Higher scores on this scale reflect lower levels of the visibility of CRP fees as experienced by participating households. Lower levels of visibility are expected to be associated with higher rates of recycling. A key distinction is between programs in which fees are included in a single municipal waste fee (where the added fee of the CRP is impossible to see) and those where the fee is listed as a line-item in the household utility bills (or even a separate bill).

Information about the presence or absence of different attributes of media/education campaigns for promoting recycling was also qualitatively analyzed, and a scale developed to reflect the degree of intensity of media/education efforts in each

community (see Figure 4). Examples of media campaign features that were measured include: T.V. and radio ads, mass mail, leaflet with utility bill, face-to-face contact with residents/households, presentation at school, and other. Similar to how demographic characteristics were determined, past research was referred to in determining which media types were sought after and how they were categorized. Recycling coordinators were asked to describe any recycling media campaigns in 2010. To make sure the above listed media campaign features were covered, coordinators were then prompted about the use of specific media types that were not mentioned in their description. The types of educational efforts that were considered "more personal" were face-to-face contact like presentations at schools, businesses, and civic groups. Forms of media that were "less personal" included T.V. and radio ads/coverage as they tend to focus on the broad population. Levels of personal and less personal media types were combined with the diversity or variety of media types to create the categorical scales described below.

In some of the analysis presented below, the Level of Convenience Scale and CRP Fee Assessment Scale were condensed to create 5-category scales from the respective original 9- and 7-category scales found in Figures 2 and 3. Figure 5 below shows these two scales with detailed categories as condensed to the 5-category scales. For the Condensed Level of Convenience Scale, category 1 of the original 9-category scale stayed the same, categories 2 through 4 were condensed to category 2, categories 5 and 6 were condensed to category 3, categories 7 and 8 were condensed to category 4, and category 9 changed to category 5. For the Condensed CRP Fee Assessment Scale, categories 1 through 3 of the original 7-category scale were condensed to be category 1 and categories 4 through 7 were then renumbered 2 through 5 for the condensed scale.

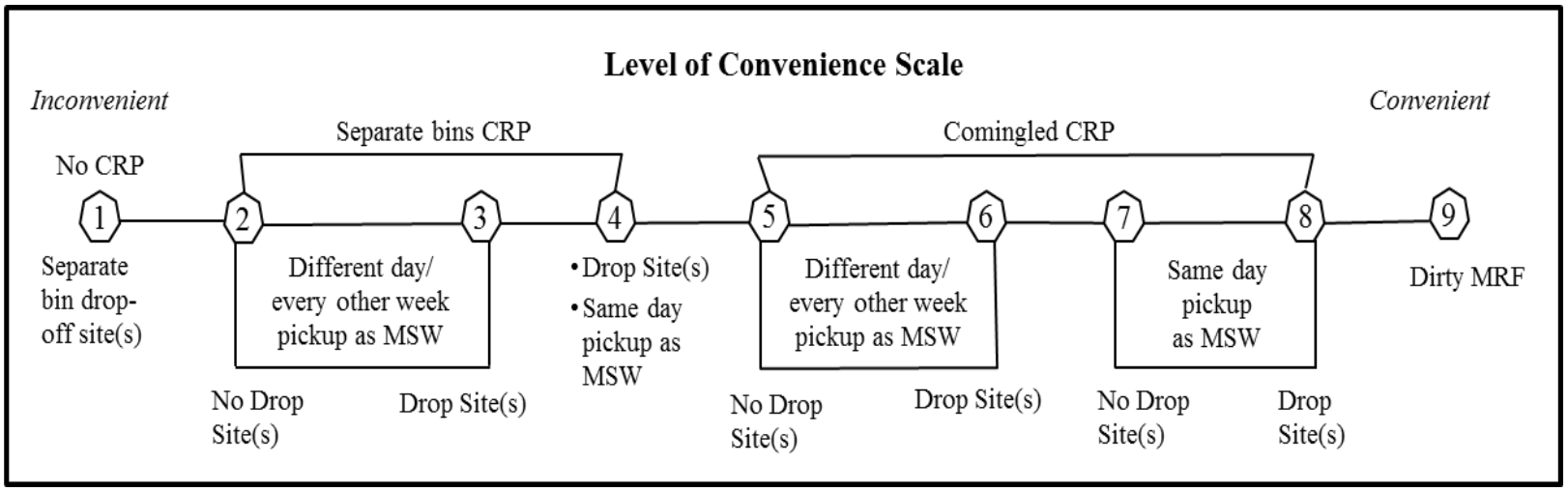

Figure 2. Original 9-Category Level of Convenience Scale

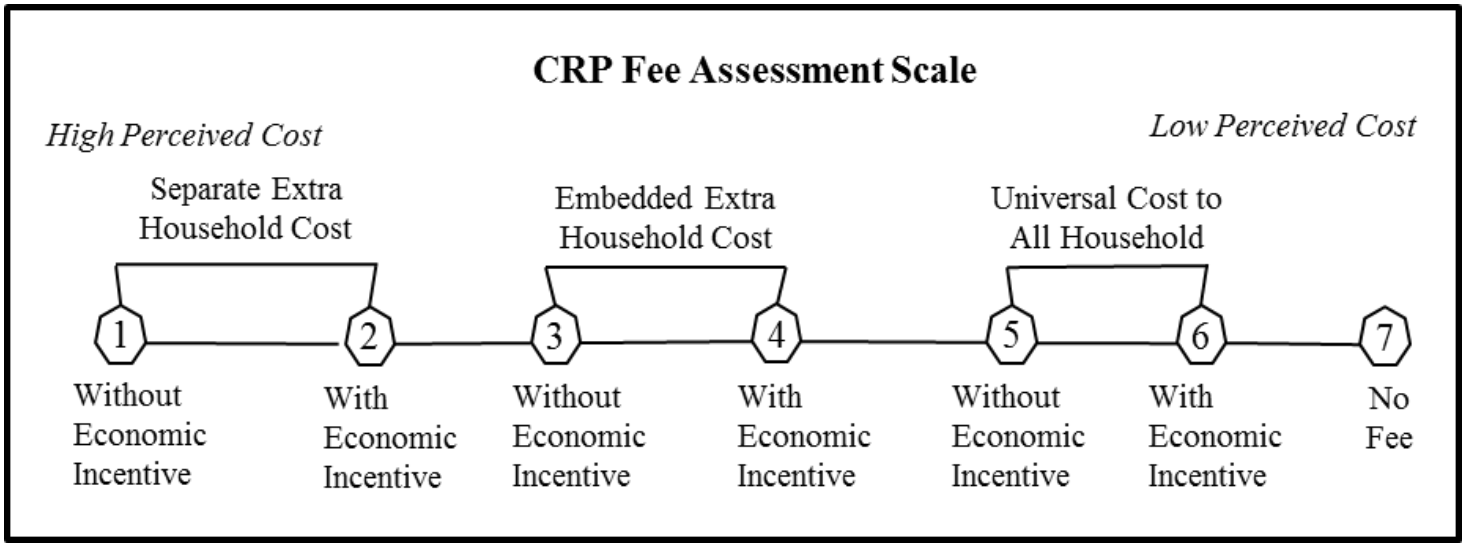

Figure 3. Original 7-Category CRP Fee Assessment Scale

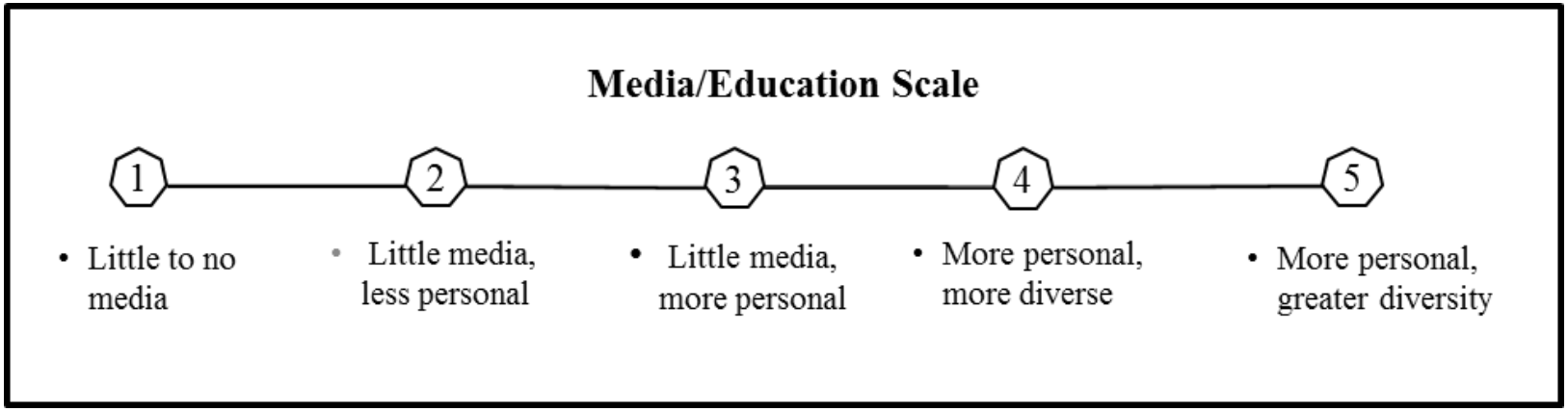

Figure 4. Media/Education Scale

These scales were further condensed to high, medium, and low rankings for further analysis with dependent variables, which were also ranked high, medium, and low as described in next chapter, in tables 7 through 12. For the Condensed Level of Convenience Scale, categories 1 and 2 were combined and labeled low, category 3 was labeled medium, and category 4 was labeled high. Since cities only showed up in category 5 for overall diversion rate, category 5 was labeled very high for Table 7 and not included in other tables. The Condensed CRP Fee Assessment Scale was condensed as follows: category 1 was labeled low, category 2 was labeled medium, and category 3 through 5 were combined and labeled high.

Dependent Variables

The goal of the overall study was to explain variation in aggregate levels of community recycling activity. There are many ways in which municipalities keep records on recycling and other waste stream diversions. In this study, I measure two general types of recycling rates: levels of municipal waste diversion (household and overall) through recycling and the proportion of households who participate in recycling. Key informants were provided with a worksheet (see Appendix C) that hoped to explain the specific definitions of each of these concepts. The original worksheet that appears in Appendix C was found to be incomplete in providing definitions and equations for calculating the two diversion rates for my analysis, but it did provide a table for reporting amounts of waste generated and amounts recycled (or not ending up in a landfill) for different waste streams. Coordinators were able to provide data for as many waste streams as possible that, in turn, provided the means for calculating household waste stream diversion and/or overall waste stream diversion.

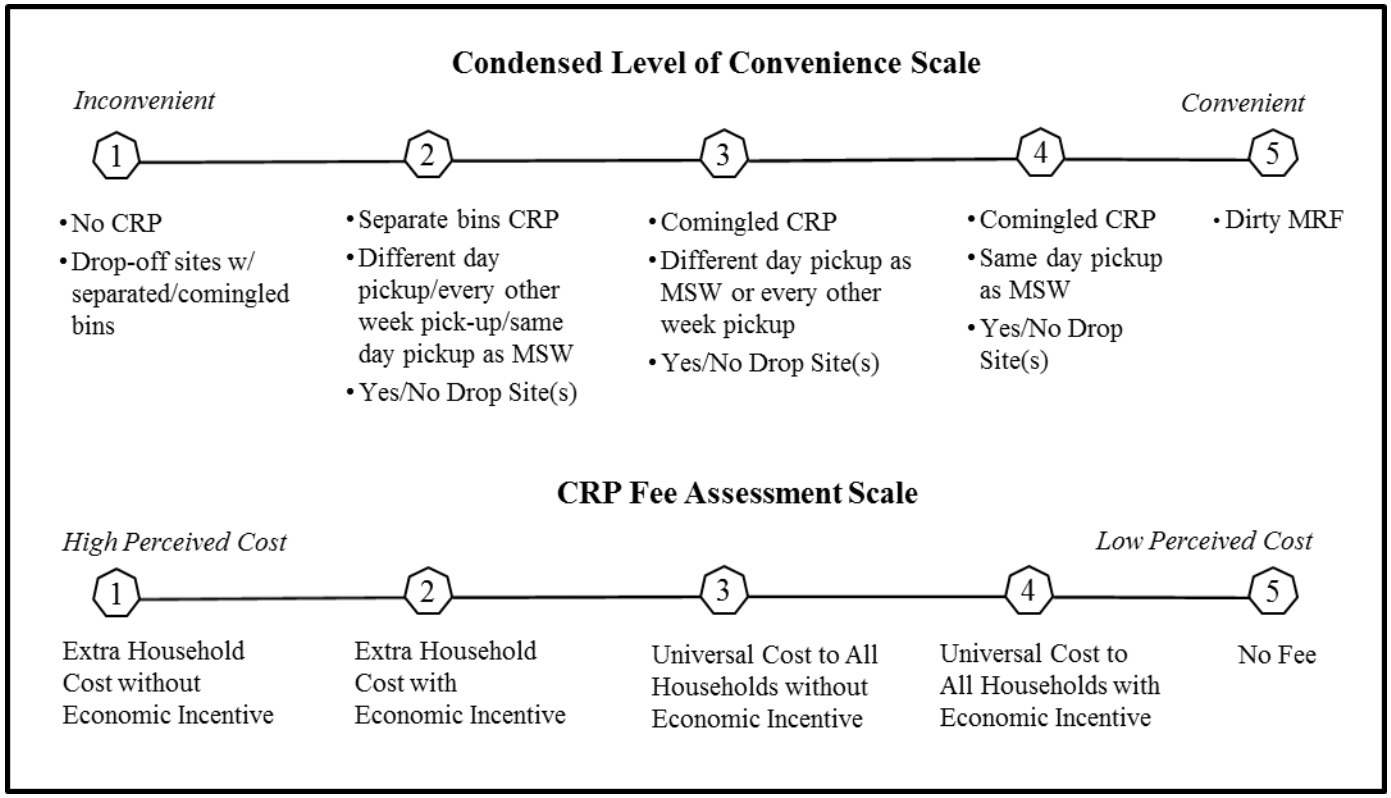

Figure 5. Condensed 5-Category Level of Convenience and CRP Fee Assessment Scales

Once I initiated interviews with recycling program coordinators, I discovered that it was virtually impossible for them to each give me complete information on waste diversion and household participation rates. This posed a challenge as less than half of the 29 cities were able to provide household waste stream diversion or data to calculate it, but most cities reported overall waste stream diversion. Even with this study's limitations and the imperfectness of using it, the overall waste stream diversion rate was used in my analysis. Even though it includes all waste streams, which is outside the realm of "Program Structure" (from Figure 1) that focuses on recycling programs for households, it does provide a community-level variable that does not need to be aggregated to be at the community level, and enables the inclusion of more cities for analysis.

This incompleteness of data also posed a challenge for measuring recycling participation with cities reporting participation using slightly different methods. The challenge was dealt with assuming that households voluntarily paying extra for curbside services were likely to be participating in those services, and those setting out their recycling bins were doing so with the appropriate recyclable materials in them.

The goal was to gather information to calculate standardized indicators for both participation and diversion rates. Since both types of "rates" have been used in inconsistent ways by different people, I have listed the definitions and equations I used for calculating them below.

CRP PARTICIPATION RATE = proportion of households participating in curbside recycling programs

$$\textit{Participation Rate} = \frac{\textit{Number of Households in City}}{\textit{Number of Households Setting out Recycling Bins OR Number of Households Subscribed to Recycling Service OR Estimated Number of Households Utilizing Curbside Services}}$$

DIVERSION RATE = proportion of overall total or total household solid waste stream being diverted away from landfill due to recycling

Overall Waste Stream Diversion Rate =

$$\frac{\textit{Total MSW Recycled/Not Sent to Landfill (tons)}}{\textit{Total MSW Generated (tons)}} \times 100$$

Household Waste Stream Diversion Rate from CRP =

$$\frac{\textit{Total MSW Recycled by Single-Family Households (tons)}}{\textit{Total MSW Generated by Single-Family Households (tons)}} \times 100$$

The overall waste stream diversion rate was calculated using total tonnage data from different common waste streams (e.g., residential, commercial, green waste, etc.) on waste generated and that which was recycled or not disposed in landfill. Household waste stream diversion from CRP refers to the amount of waste generated by households and that which was separated out due to curbside recycling efforts. CRP participation rate was calculated using data that captured the total number of households and those households putting out their recycling containers to the curb, having voluntary opt-in recycling services, or estimated as participating in recycling.

As recycling coordinators supplied available data for calculating diversion and participation rates, it was made clear by one coordinator that a distinction be made between single- (usually housing unit with 4 units or less) and multi-family households within the residential waste stream. “Residential” is an ambiguous term with differences in whether or not multi-family households are included. In practice, trucks tend to pick up single-family household wheeled carts using a side-load mechanism. The multi-family units tend to have recycling dumpsters like commercial accounts. Trucks used to service

dumpsters may not distinguish between "residential" (multi-family) and commercial, so recyclables are combined in one truck as they go about servicing accounts. Since single-family household data was most commonly reported, it was used as the basis for calculating the indicators for household waste stream diversion rate from CRP and CRP participation rate reported below.

To facilitate some of the comparative analyses below, cities were also ranked low, medium, and high according to their rates of recycling activity (overall municipal waste stream diversion rate, household waste stream diversion rate from CRP, and CRP participation rate). For each group, cities' rates were put in order lowest to highest and segregated according to a visual assessment of where natural breaks occurred, and levels were created to reflect common-sense distinctions. For example, cities with overall municipal waste stream diversion rates reported rates ranging from 4 to 74. There were three groups that stood out in these reported rates: 4 to 16, 31 to 40, and 55 to 74. Low rates included 4 to 16, medium rates included 31 to 40, and high rates included 55 to 74. Cities with household waste stream diversion rate from CRP reported rates ranging from 6 to 43. There were three groups that stood out in these rates: 6 to10, 14 to 16, and 33 to 43. Low rates included 6 to 10, medium rates included 14 to 16, and high rates included 33 to 43. Cities with CRP participation rates reported rates ranging from 15 to 100. There were three groups that stood out in these rates: 15, 29 to 34, and 50 to 100. Low rates included 15, medium rates included 29 to 34, and high rates included 50 to 100.

ANALYSIS STRATEGY

To answer my research question, I combined information about community demographic and attitudinal characteristics, recycling program structure, and recycling

outcomes, and constructed a set of cross-tabulations to help highlight any patterns among my core independent and dependent variables. In the next chapter, I will report the relationships between demographic/attitudinal characteristics and recycling outcomes, between program structure and recycling outcomes, and, finally, between all three types of indicators. I then provide a more detailed qualitative description of selected individual cities that reflect support for or challenges to my research.

CHAPTER IV

RESULTS

CROSS TABULATION ANALYSIS

Throughout this chapter, I present tables and figures portraying what factors appear to account for variations in the three different measures of recycling outcomes: (1) overall municipal waste stream diversion rate; (2) household waste stream diversion rate from CRP; and (3) CRP participation rate. I focus particularly on how recycling program structural features appear to interact with population demographics and attitudes (community recycling friendliness) to explain variations in the dependent variables. The results of this study are based on an analysis of the previously mentioned 29 western cities for which information was available on at least one of the three different community-level indicators of recycling outcomes. Of the 29 cities, there were 6 that had data for just one indicator, 20 that had data for two of the three indicators, and 3 that had data for all three indicators. Because of the relatively small sample size, a formal statistical analysis is not appropriate, and my findings below are presented using cross-tabulations and qualitative interpretations of general patterns.

My overarching research expectation was that the influence of community demographic characteristics (recycling friendliness) on aggregate recycling behavior will decline as the level of convenience of the different cities' recycling programs increases. For example, a city with high recycling friendliness and an inconvenient recycling program is expected to have higher recycling rates than a low recycling friendliness city with a similar program. In other words, as the convenience level of the recycling programs drops the influence of recycling friendliness on recycling rates will increase.

That is why the previous example expected high recycling rates. Conversely, as the convenience level increases, the influence of recycling friendliness on recycling outcomes will decrease. Similar patterns were expected for two other indicators of recycling program structure: visibility of CRP fee assessment (to households) and depth and intensity of media/education campaigns. To state slightly differently, as effort needed from households to participate in, pay for, and learn about recycling programs increases, community recycling rates will be more influenced by the demographic and attitudinal characteristics of a city's population (and vice versa).

DEMOGRAPHICS

Table 6 below shows the 29 cities separated according to measures of both recycling friendliness (columns) and recycling activity (rows). This provides a look at the direct influence of recycling friendliness on participation and diversion (Path A in Figure 1).

The first row of Table 6 presents cities with overall waste stream diversion rates and arranges them according to their degree of recycling friendliness. The results suggested that high overall diversion rates (over 50 percent) are most common among cities with medium and high recycling friendliness. However, there are examples of high-diversion cities in each demographic category, and two of the three cities ranked low recycling friendliness had rates over 60 percent. At the same time, there are examples of low diversion cities in each of the three demographic cities. This suggests a complex relationship between demographics and overall recycling diversion outcomes.

The second row in Table 6 presents data for cities that reported household-level waste stream diversion and arranges them according to their degree of recycling

Table 6. Recycling Friendliness with All Three Dependent Variables and Cities

	Recycling Friendliness		
	L	M	H
Overall Waste Stream Diversion Rate	Denton: 16 Inglewood: 64 Hesperia: 69	Topeka: 4 Billings: 12 Bismarck: 15 Lincoln: 15 Eugene: 33 Longmont: 40 Escondido: 55 Upland: 63	Westminster: 11 Arvada: 14 Olathe: 31 Santee: 65 Carlsbad: 65 Yorba Linda: 67 La Mesa: 71 Newport Beach: 71 Palo Alto: 74
Household Waste Stream Diversion Rate from CRP	Provo: 6 Orem: 7 Kansas City: 10 Ogden: 15	McAllen: 7 Eugene: 33 Omaha: 14	Westminster: 7 Overland Park: 8 Arvada: 10 Olathe: 16 Bellevue: 43 La Mesa: 35
CRP Participation Rate	Kansas City: 15 Provo: 29 Orem: 34 Denton: 50 Tempe: 62 Ogden: 96	Lincoln: 15 Longmont: 63 Eugene: 73 Omaha: 91 McAllen: 100	Westminster: 15 Arvada: 40 Santee: 65 Bellevue: 82 Olathe: 87 La Mesa: 100

friendliness. Because this number only exists for cities that have CRPs, there are no cities in this row from "no CRP" group. The results paint a similar picture, where a general trend links high diversion rates with recycling friendliness. However, my results are not all simple and straight forward as counter-examples of high friendliness and low diversion (and vice versa) are common. The bottom of Table 6 shows the rate of participation in CRP programs for cities reporting this statistic. In this case, both low and

high participation rates were almost evenly distributed among low, medium, and high recycling friendliness.

Even though each dependent variable had the lowest number of high recycling outcome cities in the low recycling friendliness ranking and the highest number of cities with high rates (except for CRP participation rate) in the high recycling friendliness ranking, there was at least one low rate city in each ranking for all three dependent variables.

STRUCTURE

Recycling programs in my study are structured in a variety of ways. At one extreme, two study cities (Hesperia and Newport Beach) utilized waste Materials Recovery Facilities (MRFs; also known as "dirty MRF") in which recyclables are separated from the household waste stream by the waste management agency after trash pickup from households. Operating dirty MRFs provides households with a way to recycle without much thought or effort beyond putting their trash out to the curb. There are no requirements for households to separate out their recyclables or worry about which items are accepted by the program but they are encouraged to bag green waste to keep it from contaminating paper recyclables.

At the other extreme, one city had a relatively inconvenient program that required households to sort their own recyclables and personally transport them to centralized drop-off sites (Bismarck, ND). In the middle are programs that range from voluntary curbside programs that offer recycling to households which opt-into the program (for an additional fee) and programs that offer universal curbside recycling pickup from all households in their jurisdiction (either by designating a specific CRP fee on the waste bill

or by rolling CRP into the generic monthly household waste service charges).

As discussed above, information about city recycling programs was used to create three scales for the "Level of Convenience," the "Fee Assessment of CRP," and "Media/Education Efforts." The cities who reported each of the three types of recycling outcomes (my independent variables) were then arrayed along the scales to examine whether there is a relationship between convenience, fee assessment, and media/education efforts and levels of reported recycling activity.

Program Convenience

Figure 6 shows the levels of recycling activity for different clusters of cities ranked using the 9-category Level of Convenience Scale.

The results suggest that 7 of the 29 cities had recycling programs that fell within categories 1 through 5 (the less convenient to moderately convenient end of the scale). This left 22 cities with recycling programs that fell within categories 6 through 9, which reflect higher levels of convenience. Among the 20 cities that reported overall diversion, **the general trend is that cities with higher levels of program convenience also reported higher overall diversion of municipal trash out of their landfills.** Despite the overall trend, there are a few notable exceptions where high convenience still produces low diversion (e.g., Denton, TX) or where high diversion rates were still found in places with relatively inconvenient programs (e.g., Carlsbad, CA).

Looking at the subset of cities with active CRP programs, the middle of Figure 6 presents the household waste stream diversion rates associated with the CRP program ("CRP diversion rate") based on the overall convenience of the city program. Because most CRP program cities are ranked 5 or higher on the convenience scale, the differences

are mostly observed by comparing the patterns among the top categories. The results suggest that household waste diversion rates from CRP may not systematically related to the overall program convenience rating. The scattered pattern of the 13 cities suggests that increased convenience may be less likely to affect the amount of waste diverted through CRP programs. Meanwhile, the bottom third of Figure 6 reports the percent of households who participate in CRP programs (among cities that can report this statistic). Again, the patterns are not consistent. There are examples of cities with high CRP participation rates that were classified in both high and low convenience categories, while cities with low participation rates were found in the highest convenience categories.

CRP Fee Assessment

Figure 7 shows the relationship between the CRP fee assessment to households (as rated in the 7-point scale) and the overall reported community levels of recycling activity using the three different dependent variables. As discussed in chapter III, factors distinguished between fee assessment categories included whether the fee for recycling was visible to the household (or embedded in the overall waste bill), whether households had to opt-in to participate in the CRP program, and whether the pricing structure provided any economic incentive (e.g., pay-as-you-throw or variable rate based on volume of trash disposed).

Focusing on the first row, the overall city waste diversion rates appear to increase consistently as the visibility of CRP fee assessment to households decreases. There are exceptions, as the city in category 1 did not report the lowest rate nor did all the cities in category 6 report the highest rates. However, reducing the complexity or visibility of paying for CRP service does seem to be associated with higher overall diversion rates.

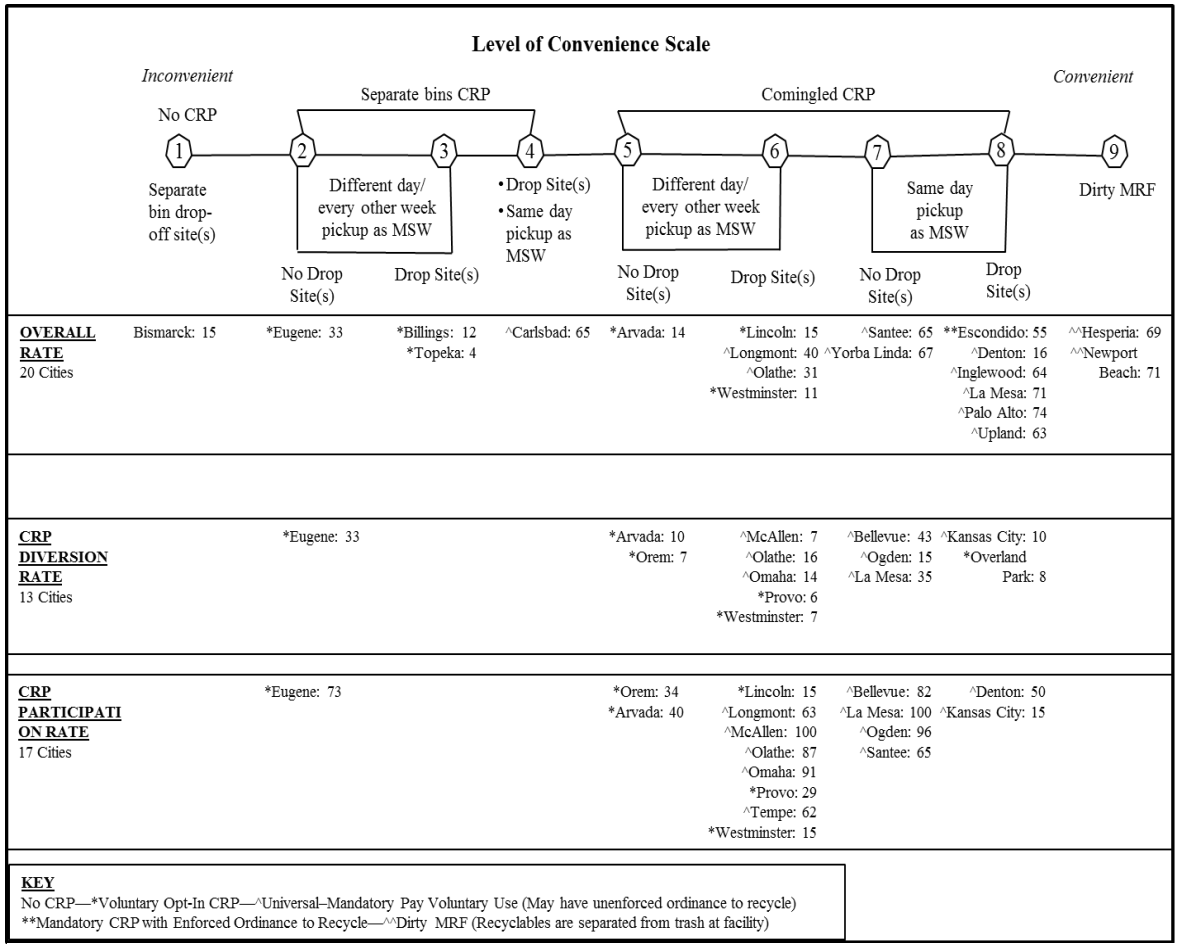

Figure 6. Original 9-Category Level of Convenience Scale with All Three Dependent Variables and Cities

Looking at the second two rows (specific estimates of CRP program diversion rates and proportion of households engaged in the CRP program), the patterns are less consistent. Cities with a CRP fee assessment structure that required less effort (or was less visible) did not always elicit the highest rates. However, cities with less visible CRP fee assessments tend to elicit higher levels of household participation.

However, similar to the impacts on overall municipal diversion rates, not all cities with lower CRP participation rates were found on the lower end of the fee assessment scale.

Media/Educational Efforts

Figure 8 shows the relationship between a city's recycling media/educational (M/E/) efforts and the three indicators of community recycling outcomes. As noted in chapter III, programs that used more personal approaches, greater diversity of media types, and greater overall effort scored higher on the M/E scale.

Looking at cities within all three dependent variable groupings in Figure 8, there does not appear to be any systematic association between M/E efforts and aggregate recycling outcomes. In other words, cities reported both high and low recycling rates within each of the M/E effort categories, and higher rates of diversion or participation were not associated with personal or diverse M/E efforts. This was a surprising and disappointing result. Based on past research, media was expected to provide visible trends during the cross tabulation analysis, but yielded similar lack of patterns as found in Figure 8.

SUMMARY OF PROGRAM CHARACTERISTIC IMPACTS

To simplify the presentation and interpretation of recycling program impacts on recycling outcomes, a simplified version (based on Figure 5) of the two of the most promising program structure scales (convenience and fee assessment)[3] was cross tabulated with a count of cities ranked according to whether they are relatively low, medium, or high in terms of the three indicators of recycling outcome (overall diversion, household diversion from CRP, and CRP participation). Cross tabulation provides frequency distribution tables to show the potential interrelations of the two variables of each table. The resulting cross tabulations are presented in tables 7-12.

Tables 7 through 12 highlight the relationships between the convenience and CRP fee assessment scales and the three dependent variables. The following paragraphs review each table addressing the possible interrelations between the variables found in the tables.

Table 7 shows a trend of increasing overall waste stream diversion rates with increasing convenience of recycling programs. This can be seen in looking from low convenience, low overall rate (4 cities) to high convenience and high overall rate (6 cities). The majority of cities fell within this diagonal pattern from low convenience, low overall rate to high convenience, high overall rate. Two cities reported medium convenience, medium overall rate and 8 cities were scattered among other frequency possibilities. This diagonal pattern (L, L to H, H) could also include medium and very high convenience to capture more cities. This inclusion of medium and very high convenience shows frequencies of cities loaded at both ends (low/medium—L/M—convenience, low—L—overall rate and high/very high—H/VH—convenience, high—

[3] The indicator for media/education effort was dropped due to lack of any systematic patterns in Figure 8.

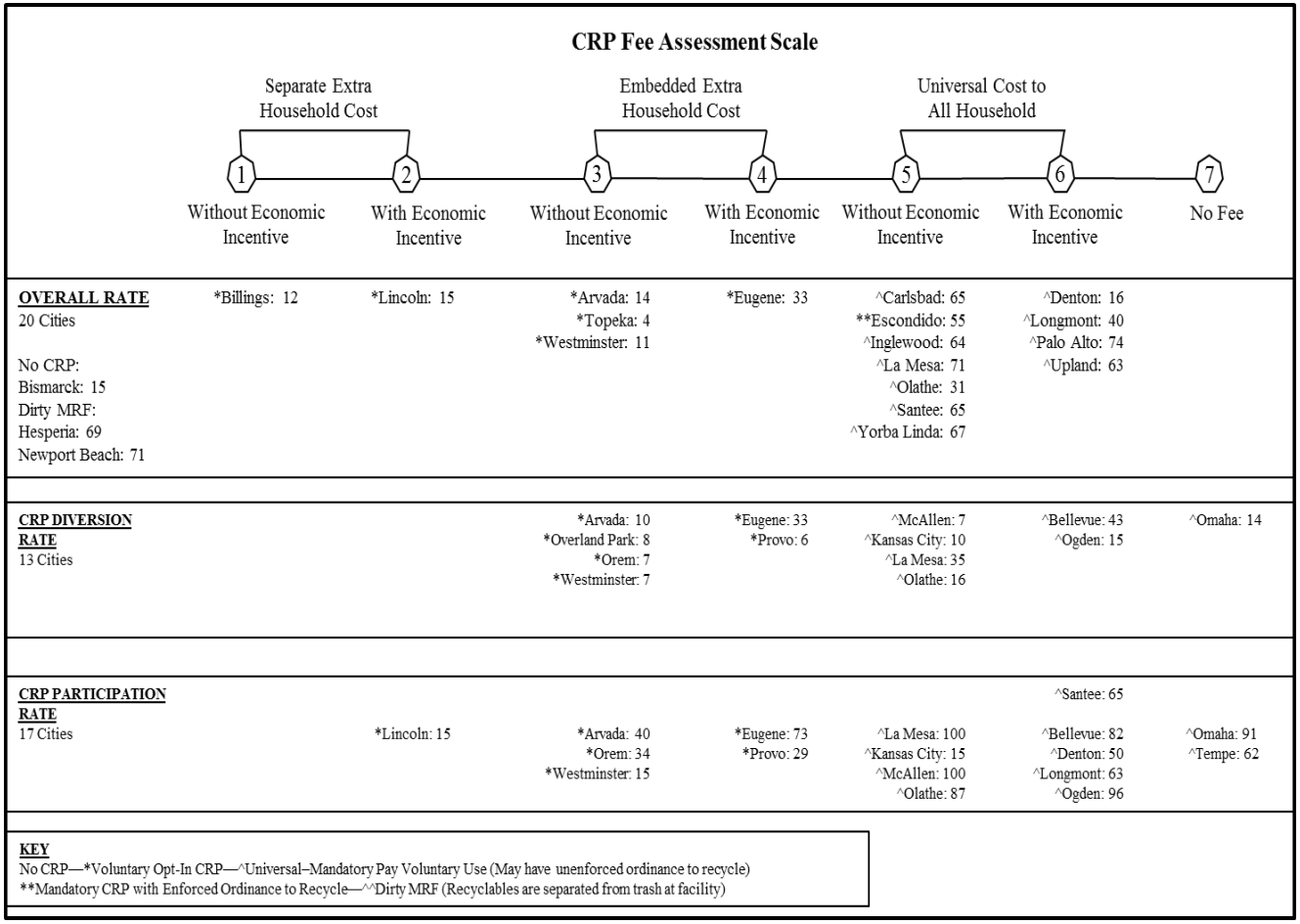

Figure 7. Original 7-Category CRP Fee Assessment Scale with All Three Dependent Variables and Cities

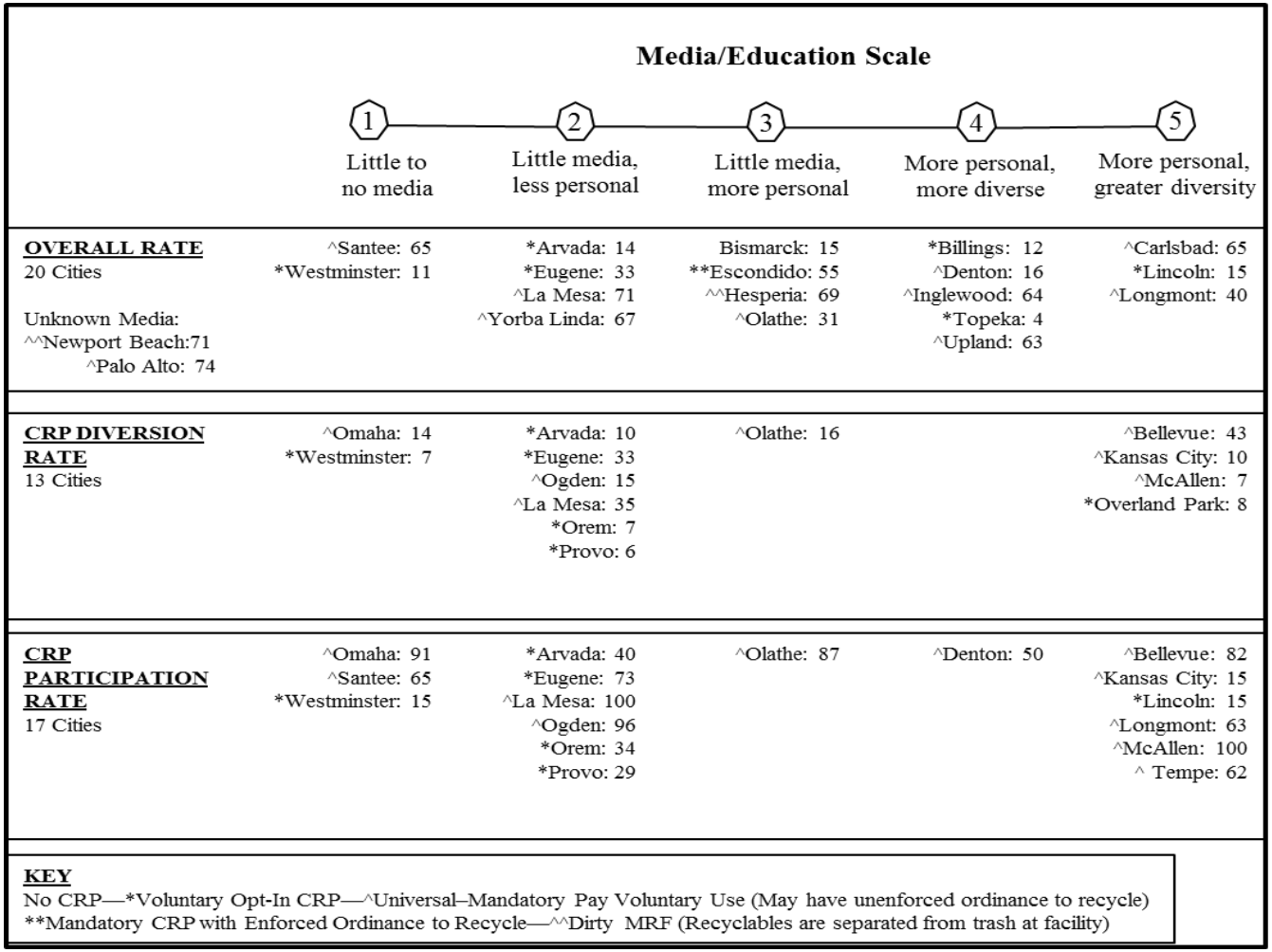

Figure 8. Media/Education Scale with All Three Dependent Variables and Cities

H—overall rate) with only two cities reporting medium convenience and medium overall rate. Six cities reported low or medium convenience and low overall rate and 8 cities reported high or very high convenience and high overall rate. This leaves 6 cities scattered among other frequency possibilities.

Table 8 also lends support to the idea that higher overall waste stream diversion rates are more often found among cities with less visible (low) CRP fee assessments for households. There is a diagonal pattern from highly visible CRP fee assessment and low overall diversion rates (H, L) to less visible (low) CRP fee assessment and high overall diversion rates (L, H). This is a similar pattern as the one in Table 6 with the loaded ends (4 H, L cities and 8 L, H cities) and, in this case, only one medium visible fee assessment and medium overall rate (M, M). There are 4 cities scattered among other frequency possibilities.

Table 9 shows low and medium household diversion rates from CRP among cities with both medium and high convenient recycling programs. This does not provide a clear visible trend, but indicates that cities with convenient programs do not all have high recycling outcomes. This suggests that there may be something else influencing the rates and not just program structure.

Table 10 shows the majority of cities reporting less visible (low) fee assessments; within the less visible (low) fee assessment column, cities were almost evenly distributed between low (two cities), medium (three cities), and high (two cities) household diversion rates. This pattern does not lend support to the idea that higher household diversion rates come with less visible CRP fee assessments. The largest frequency (4 cities) was found with cities reporting highly visible fee assessment and low household diversion rate (H,

L).

Tables 11 and 12 show the associations between average CRP household participation rates and the overall recycling program convenience and CRP fee assessment of programs. Table 11 does not seem to provide a distinct trend of increasing convenience and increasing participation rates. It does provide an ascending frequency of cities within the medium convenience column. This seems to suggest that there may be something else influencing the participation rates in these cities that would elicit increasing rates among cities with the same program convenience. The majority of cities did report medium (5 cities) or high (5 cities) convenience and high participation rates.

In general, the average household in my sample is more likely to participate in CRP programs when the overall recycling program is more convenient and has a less visible fee assessment. Table 12 provides an example of this trend (with regard to fee assessment) in which households are distributed along a line ranging from highly visible fee assessment and low CRP participation rate (H, L) to less visible fee assessment and high CRP participation rate (L, H). The frequencies ascended from one city reporting highly visible fee assessment and low CRP participation, two cities reporting medium visible fee assessment and medium participation rate, and 10 cities reporting less visible fee assessment and high participation rate. Other cities were scattered among other frequency possibilities (e.g., high convenience and low CRP participation or low convenience and high participation).

A similar analysis of the relationships between media/education efforts and recycling outcomes was conducted, but is not presented here because it showed a lack of any consistent patterns.

Table 7. Number of Cities Classified by Program Convenience and Overall Waste Stream Diversion Rate

		Program Convenience			
		L (1-2)	M (3)	H (4)	VH (5)
Overall Diversion Rate	L (0-20)	4	2	1	
	M (30-40)	1	2		
	H (>50)	1	1	6	2

Table 8. Number of Cities Classified by CRP Fee Assessment and Overall Waste Stream Diversion Rate

		CRP Fee Assessment		
		H (1)	M (2)	L (3-5)
Overall Diversion Rate	L (0-20)	4	1	1
	M (30-40)		1	2
	H (>50)			8

Table 9. Number of Cities Classified by Program Convenience and Household Diversion Rate From CRP

		Program Convenience		
		L (1-2)	M (3)	H (4)
Household Diversion Rate from CRP	L (0-10)		5	2
	M (11-20)		2	1
	H (>30)	1		2

Table 10. Number of Cities Classified by CRP Fee Assessment and Household Diversion Rate From CRP

		CRP Fee Assessment		
		H (1)	M (2)	L (3-5)
Household Diversion Rate from CRP	L (0-10)	4	1	2
	M (11-20)			3
	H (>30)		1	2

Table 11. Number of Cities Classified by Program Convenience and CRP Participation Rate

		Program Convenience		
		L (1-2)	M (3)	H (4)
CRP Participation Rate	L (0-15)		2	1
	M (25-40)		3	
	H (>45)	1	5	5

Table 12. Number of Cities Classified by CRP Fee Assessment and CRP Participation Rate

		CRP Fee Assessment		
		H (1)	M (2)	L (3-5)
CRP Participation Rate	L (0-15)	1	1	1
	M (25-40)	2	2	
	H (>45)			10

INTERACTIONS BETWEEN RECYCLING FRIENDLINESS AND PROGRAM CHARACTERISTICS

My overarching research question addresses the relative impact of demographic characteristics and recycling program structures on community-level recycling activity. In the tables that follow, I report cross-tabulations that use simplified versions of the measures for demographic "recycling friendliness" and the program structure scales (see Figure 5) as the X and Y axes, then report the number of cities that have relatively low, medium, or high rates of recycling on various indicators within each cell. For example, in Table 13, the cell that coincides with category 2 of program convenience and medium demographics/attitudes (recycling friendliness) has listed two cities with low (l) and one city with medium (m) overall diversion rates. This approach provides insights into how recycling rates may be influenced by the interacting effects of demographic and program attributes.

Overall Diversion Rate

Tables 13 and 14 report overall waste stream diversion rates among cities that are categorized according to their demographic recycling friendliness (on the left) and two indicators of program structure (Program Convenience and CRP Fee Assessment). As reported above, 7 of the 20 cities were found to have high recycling friendliness, nine cities were found to have medium recycling friendliness, and three cities were found to have low recycling friendliness.

The two cities with dirty MRFs (category 5) in Table 13 had roughly the same high diversion rate, but were ranked oppositely high and low recycling friendliness. These two cities show that a very convenient way to recycle for households can elicit

Table 13. Overall Rate of Diversion by Program Convenience and Recycling Friendliness

Recycling Friendliness	Program Convenience				
	1	**2**	**3**	**4**	**5**
Low				l **H**	**H**
Medium	l	l l **m**	l **m**	**H** **H**	
High		**H**	l l **m** **H**	**H** **H** **H**	**H**

Key: l=Low, **m**=Medium and **H**=High

high overall diversion rates regardless of the background recycling friendliness of the population. Cities with high rates were also found in each ranking of recycling friendliness in category 4 of convenience. This lends support to the idea that program convenience may have greater influence on overall diversion rates than recycling friendliness. In this case, high overall diversion rates were found among cities with highly convenient programs and varying recycling friendliness, so convenience may have had greater influence than recycling friendliness on overall rates for these cities.

Categories 1, 2, and 3 in Table 13 do not provide as clear a picture as does category 4. Cities with high overall waste stream diversion rates also had high recycling friendliness and cities with medium rates had medium recycling friendliness with one exception. The low-rate cities reported both medium and high recycling friendliness. Since the cities with low rates were not found to have low recycling friendliness (except for one in category 4) and category 4 has high rates all around, the two medium and two

high rate cities in categories 1-3 are not enough to suggest recycling friendliness has a greater influence on overall waste stream diversion rates when the convenience of community recycling programs is lower.

Table 14 shows that all of the cities that reported high overall waste stream diversion rates were ranked in the middle or less visible fee assessment categories of paying for CRP service (categories 3 and 4). Within category 3, there are instances of high waste diversion found in communities with all three levels of recycling friendliness. Meanwhile, nearly all low rates of waste diversion were found in cities with highly visible CRP fee assessment (category 1). This lends some support to how visible the CRP fee assessment is to households having more influence on rates than the recycling friendliness of the community. There is one outlier in the table (Denton, TX) that combines low recycling friendliness, less visible fee assessment, and low recycling rates.

Table 14. Overall Rate of Diversion by CRP Fee Assessment and Recycling Friendliness

	CRP Fee Assessment				
Recycling Friendliness	**1**	**2**	**3**	**4**	**5**
Low			**H**	l	
Medium	l l l	**m**	**H**	**m** **H**	
High	l l		**m** **H** **H** **H** **H**	**H**	

Key: l=Low, **m**=Medium and **H**=High

This case reveals that adverse demographics may be capable of overriding a friendly pricing structure in some instances.

CRP Diversion Rate

Tables 15 and 16 report the household diversion rate from CRP among cities categorized according to their demographic recycling friendliness (on the left) and two indicators of program structure (Program Convenience and CRP Fee Assessment). As reported above, 6 of the 13 cities were found to have high recycling friendliness, 4 cities were found to have medium recycling friendliness, and 4 cities were found to have low recycling friendliness.

Table 15 shows that cities with relatively convenient recycling programs occur in cities with diverse demographics/attitudes (recycling friendliness), and that rates of

Table 15. Household Waste Stream Diversion Rate from CRP by Program Convenience and Recycling Friendliness

	Program Convenience				
Recycling Friendliness	**1**	**2**	**3**	**4**	**5**
Low			l l	l **m**	
Medium		**H**	l **m**		
High			l l **m**	l **H** **H**	

Key: l=Low, **m**=Medium and **H**=High

diversion are only weakly associated with the combination of recycling friendliness and program convenience. For example, in Categories 3 and 4 – cities that have moderately convenient programs – there are examples of low and medium rates of recycling across all three recycling friendliness groups, but only the most recycling friendly cities experienced the highest rates of recycling. This provides support for the idea that **recycling friendliness influences rates even with the presence of a convenient recycling program.**

Table 16 shows cities spread out according to recycling friendliness and how visible CRP fee assessment is to households. Category 1 of CRP fee assessment includes cities with low rates categorized low and high recycling friendliness. This lends support to the idea that **highly visible fee assessment for curbside service influences rates regardless of recycling friendliness**. Recycling friendliness does seem to gain some

Table 16. Household Waste Stream Diversion Rate from CRP by CRP Fee Assessment and Recycling Friendliness

	CRP Fee Assessment				
Recycling Friendliness	**1**	**2**	**3**	**4**	**5**
Low	l	l	l	**m**	
Medium		**H**	l		**m**
High	l l l		**m** **H**	**H**	

Key: l=Low, **m**=Medium and **H**=High

influential strength in categories 3 and 4, which include cities with high rates categorized high recycling friendliness and cities with low and medium rates categorized low and medium recycling friendliness. This lends support to the idea that recycling friendliness influences rates when the visibility of the fee assessment for curbside services is somewhat low.

CRP Participation Rate

Tables 17 and 18 report CRP participation rates among cities categorized according to their demographic recycling friendliness (on the left) and two indicators of program structure (Program Convenience and CRP Fee Assessment). As reported above, 6 of the 17 cities were found to have high recycling friendliness, 5 cities were found to have medium recycling friendliness, and 6 cities were found to have low recycling friendliness.

Table 17 shows nine of the 18 cities with reported CRP participation rates having somewhat convenient (category 3) recycling programs with 6 cities found to have convenient (category 4) recycling programs. Moving from category 3 to category 4, the majority of cities with high CRP participation rates shifted from medium recycling friendliness to high recycling friendliness. Also, in categories 3 and 4, cities with medium rates were found to have low recycling friendliness with two cities reporting high rates. There are also more high rates in the high recycling friendliness row than low recycling friendliness row, which suggests recycling friendliness may be influencing rates more than convenience. In the high recycling friendliness row, the transition from low, medium, and high rates (category 3) to three high-rate cities (category 4) shows convenience and recycling friendliness working together with three high rates among

Table 17. CRP Participation Rate by Program Convenience and Recycling Friendliness

Recycling Friendliness	Program Convenience				
	1	**2**	**3**	**4**	**5**
Low			**m** **m** **H**	l **m** **H**	
Medium		**H**	l **H** **H** **H**		
High			l **m** **H**	**H** **H** **H**	

Key: l=Low, **m**=Medium and **H**=High

cities with convenient programs and high recycling friendliness.

Table 18 shows the 17 cities with CRP participation rates spread out on the CRP fee assessment scale and recycling friendliness. There is a visible segregation of cities with high rates and those with lower rates. The cities reporting high rates are found in categories 3, 4, and 5 of CRP fee assessment, while the cities reporting medium and low rates are mainly found in categories 1 and 2 (except for one low city in category 3). The segregation of cities supports the idea that as the visibility of paying for curbside recycling services decreases the participation rates increase in all categorizations of recycling friendliness.

A trend among the cities starts with the medium- and low-rate cities with high recycling friendliness in category 1 (highly visible fee assessment) and ends with the

Table 18. CRP Participation Rate by CRP Fee Assessment and Recycling Friendliness

Recycling Friendliness	CRP Fee Assessment				
	1	**2**	**3**	**4**	**5**
Low	**m**	**m**	l	**H H**	**H**
Medium		l **m**	**H**	**H**	**H**
High	l **m**		**H H H**	**H**	

Key: l=Low, **m**=Medium and **H**=High

high-rate city with low recycling friendliness in category 5. Basically, the trend is visible going from the bottom left to the upper right of the table. This trend also lends support to the idea that the visibility of the fee assessment for curbside services influences participation rates regardless of recycling friendliness.

CASE STUDY NARRATIVES

The analysis of patterns above illustrates the variety of interactions between the independent (program structure and recycling friendly demographics) and dependent (community recycling outcomes) variables. Some cities could be termed classic cases that confirmed my research expectations: increasing recycling program convenience and less visible fee assessments tended to decrease the influence of population demographics. Similarly, differences in recycling rates in settings with low convenience programs appeared to reflect the greater influence of recycling friendly demographics. At the same time, I found instances where adverse demographics appeared to “trump” a favorable

program environment and others where recycling rates were robust[4] despite apparently unfavorable program and demographic conditions.

In the following section, I provide a more detailed narrative description of several key cases to illustrate the complex relationships between program structure, demographics, and recycling outcomes in real-world settings.

Bellevue, WA: High Convenience, High Friendliness, and High Recycling

The City of Bellevue was one of the cities where all conditions were present to promote high rates of recycling and outcomes. My analysis of census data and program information led me to classify it as a recycling friendly community with a very convenient program. A key informant reported high rates of household waste stream diversion and household participation in CRP programs. However, data for calculating the overall waste stream diversion rate was not sufficient to provide a good estimate on this measure in Bellevue.

The City of Bellevue is located in western Washington with approximately 123,000 people and 54,000 households (U.S. Census 2011). On Bellevue's website, it describes itself as a "high-tech and retail center" (City of Bellevue 2011). Both the city's demographic composition and political attitude were high in favor of recycling (with almost 67 percent of adults having a college education, over half of households earning $75,000 or more, and 60 percent of the last presidential electoral votes going to the democratic candidate). This positive direction toward recycling in the city combined with a relatively convenient structure and less visible fee assessment of recycling program

[4] I use "robust" to mean that even with less than convenient program structure and less than high recycling friendliness, there were cities that had reported high rates.

elicited a high household diversion rate from CRP and high CRP participation rate.

In Bellevue, the city handles collection of household waste, which is then transferred to the county for processing and disposal. Bellevue's recycling program includes curbside recycling within the city and access to drop-off sites within the county.

The city curbside recycling program has been in place for over 20 years. It started out with a three-bin source separation at the curb. Households saw the implementation of single stream collection system in 2004. Over the last 10 years, households also saw the implementation of a volume-based rate structure for waste pickup based on size of trash can. Households are billed quarterly with recycling fees included in the garbage rate (less visible fee assessment). Like many other cities, Bellevue contracts out with a private hauler for collecting waste and picking up recyclables. Bellevue's media and educational efforts were categorized as more personal with greater diversity.

According to the state Department of Ecology, a 1989 state law established a goal of 50 percent recycling (or diversion) statewide (DENR 2010). This goal was originally to be reached by 1995, then extended to 2007 under the RCW (Revised Code of Washington) 70.95 (WSL 2011). Also under RCW 70.95, municipalities could apply for financial aid in completing solid waste management plans that incorporated ways to meet the 50 percent recycling goal. Funding was also available for implementing recycling, reduction, and composting programs and educational efforts. The mandated goal does not have penalties for noncompliance by municipalities (BWPRR 2004).

Arvada, CO: Medium Convenience, High Friendliness, and Low Recycling

Another city with high recycling friendliness and a relatively convenient recycling

program (medium convenience) was Arvada, CO, but relatively positive conditions there have not lead to high rates of community recycling. Taking demographics and attitudes separately, Arvada ranked high and medium, respectively, for an overall community composition favoring recycling. Their recycling program was rated "medium" in convenience solely due to the fact that their curbside recycling was not being picked up the same day as regular trash. Arvada also was categorized as having a highly visible CRP fee assessment for households with media/education efforts categorized as little with less personal efforts. Arvada reported a low overall diversion rate.

Arvada also reported a low household waste stream diversion rate from CRP and only medium rate of household participation in the CRP program. Interestingly, Arvada households participating in the CRP had to pay extra for curbside recycling services from a hauler of their choice (several to choose from).[5]

Arvada is a suburb of Denver with approximately 107,000 people and 45,000 households (U.S. Census 2011). With regard to waste management, the Arvada City Council has required that the City of Arvada itself stay out of the business of hauling and billing for trash services. The Council's provisions also allow for multiple haulers operating within the city avoiding a single hauler situation. Of the 12 haulers that operate within city limits, at least 8 offer curbside recycling services (MSW Consultants 2011). This allows for households to voluntarily opt-in to curbside recycling services from one of the multiple haulers with a more visible fee.

At the time of this study, Arvada also did not have city-wide composting. This affects overall diversion rates because green waste is a weighty waste stream item that

[5] This open market with several haulers to choose from for recycling services seems like a large factor depressing recycling rates

was used in calculating overall waste stream diversion. Without composting, households were not separating green waste from trash for pick up.

To be proactive in addressing issues relating to recycling activities and sustainable waste management practices, the City of Arvada had a study done on the hauling of residential waste in 2010 (MSW Consultants 2011). The study provided three options for the city in improving residential waste management practices. The three options were increasing criteria/standards (licensing) for haulers to follow in order to operate within the city that would expand recycling and composting services, creating districts within the city and contracting with a smaller number of haulers to operate in those districts, or to contract with a single hauler for the whole city. All three options included a provision for having bundled rates with a pay-as-you-throw rate structure to provide an economic incentive to encourage the use of smaller trash bins by recycling more materials (MSW Consultants 2011). Of these three options, increasing criteria/standards (licensing) for haulers is the only one being considered at the time of this study (City and Community of Arvada 2011).

Carlsbad, CA: Low Convenience, High Friendliness, and High Recycling

Like Bellevue and Arvada, Carlsbad provides another example of a city with relatively recycling friendly demographics. In this case, however, Carlsbad's recycling program ranked low on measures of convenience and less visible CRP fee assessment, but the city reported a high overall waste diversion rate. The main factor that put Carlsbad's recycling program low was the need for households to separate recyclables into two containers (one for paper and one for everything else). This suggests that the

composition of the community at least partly made up for the lack of full convenience in the recycling program in contributing to a high overall diversion rate.

Carlsbad is a coastal city in southern California with approximately 100,000 people and 40,000 households (U.S. Census 2011). Their population is relatively affluent, well-educated, and politically liberal. Their waste management consists of a contracted hauler providing curbside trash (solid waste) and recycling pickup services to residents with recycling bins provided to households and businesses. This universal recycling program for all Carlsbad households was not only categorized as having less visible CRP fee assessment, but also more personal with greater diversity of media/education efforts.

Unlike some of the other cities in this study, Carlsbad and other municipalities in California have had a strong fiscal and legislative motivation to reduce the amount of waste disposed of in their jurisdictions through a reduction, recycling, and composting of waste. Mandated diversion targets were implemented for jurisdictions within California through state law (AB 939) in 1989, which mandated that California jurisdictions meet a 50 percent diversion rate by 2000 through above mentioned means (CalRecycle 2009). Non-compliance to these mandated goals meant stiff daily fines and other negative consequences for the given jurisdiction[6]. In 2008, a supplemental law (SB 1016) was passed to improve the measuring and accuracy of how jurisdictions were meeting the mandated diversion goals and implementing effective programs. This was done by changing how the measure of compliance (diversion rate) was being calculated for jurisdictions. Diversion rates were being calculated to measure how well jurisdictions were complying with state law. This was changed to a jurisdiction-specific per capita

[6] These mandates and negative incentives do seem to be important factors in reaching high recycling rates.

disposal rate from the previously used diversion rate. This was done to simplify calculations for a measure that would capture the efforts of jurisdictions in complying with state law and how much waste was being disposed on a per capita basis. It also allows for population growth and decline by being jurisdiction-specific and incomparable among jurisdictions (CalRecycle 2009); although, a formula was obtained for converting the disposal rate to a diversion rate for comparison for the purposes of this study. Carlsbad also provides subsidies to residents purchasing compost bins to promote the separation of green waste from waste being disposed (City of Carlsbad California 2011).

The state mandated diversion goals with the negative incentives to achieve them combined with high recycling friendliness may have had the needed mix of influence to elicit a high overall diversion rate; although, all of the cities from California in this study were found to have high overall diversion rates and varying recycling friendliness and convenience of recycling programs. This suggests that state mandated goals with the negative consequences of noncompliance may have had an overriding influence on overall diversion rates than convenience and recycling friendliness.

Hesperia, CA: High Convenience, Low Friendliness, and High Recycling

Hesperia is another southern California city with a reported high overall diversion rate. It also has an extremely convenient recycling program combined with relatively unfavorable demographics. Hesperia has approximately 86,000 people and 26,000 households. As mentioned above, as a California city it shares the same state mandated waste reduction goals as other state jurisdictions. Again, the pressures from the negative incentives for not complying with mandated goals are potentially a strong influential

factor in the reported high overall diversion rate.

As mentioned previously in this chapter, the recycling program in Hesperia is unique among all but one of the other cities analyzed in this thesis. Instead of having households separate recyclables from trash at the curb, the City of Hesperia operates a mixed waste material recovery facility (a.k.a., dirty MRF) that allows households to put all their waste to the curb. All household waste goes first to the dirty MRF where the recyclables are separated from waste headed to a landfill.

Hesperia has mandatory trash collection for households and reported roughly the same number of residential accounts as the number of occupied households as reported by the U.S. Bureau of the Census. This level of convenience for a recycling program basically takes almost all the effort of recycling at the curb from the households and puts it into the dirty MRF. According to Hesperia's website, the effort left for households, if they choose, is the bundling of green waste and paper items. The paper items are not good if contaminated with other waste (Hesperia California 2011). This also provided for a reported recycling program participation rate of 100 percent of households. The increased effort comes when households decide to utilize buyback centers for recyclables (such as glass bottles) with California cash redemption value (CRV).

Hesperia reported that over a quarter of the waste going to the dirty MRF was being separated out for recycling, but combined with other efforts to reduce waste, the city was able to report a much higher city wide overall waste stream diversion rate.

An interesting question is how a comparatively young, developing city with relatively unfriendly recycling demographics (as categorized in this study) maintains State diversion requirements by using a mixed waste processing approach. Even though

this study places Hesperia as low recycling friendliness, it was reported that there is much recycling activity among residents and businesses in Hesperia. The dirty MRF came about to not only maximize diversion by pulling out recyclables from all the waste in Hesperia, but to also cut down on the number of trucks going house to house picking up waste and thereby lowering resultant emissions and stress on roadways. It is Hesperia's way to meet State diversion and emission reduction mandates and maximize convenience for households to recycle.

Denton, TX: High Convenience, Low Friendliness, and Low Recycling

Denton, TX provides an interesting counterpoint of a community with a relatively convenient recycling program and less visible fee assessment for that program, but a low overall waste stream diversion rate. Denton is also notable for ranking near the bottom of the study cities on recycling friendly demographics and attitudinal variables.

Denton is situated north of the Denver-Fort Worth Metroplex in Texas with approximate estimates of 119,000 people and 42,000 households (U.S. Census 2011).

Denton's recycling program provides households with recycling carts and bills households on one bill for all utilities (less visible fee assessment). Households are still able to voluntarily use the cart (universal program). Households not using the cart simply pay for a service not used and potentially more for larger trash carts.

The U.S. Census reported an estimate of approximately one-third of Denton's population being 20-34 years of age. Only three other cities of the 29 being analyzed had higher percentage of this age group. There are two universities located in Denton that attract young people and create a situation for many apartments needed to house

university students. According to the U.S. Census, less than half of all housing units in Denton are owner occupied; it was reported during the key informant interview that the number of apartments is about the same as the number of single-family households. Living in a city with a university and many apartments, I have witnessed the difficulty of educating a transient population of students on a recycling program to elicit high rates of participation and diversion. University students may have a stronger tie to the university they are attending than to the City of Denton, and not have the desire to learn about and fully participate in Denton's recycling program (see Timlett and Williams 2009). There is much being done in Denton to get information out about recycling at schools and events with a recycling mascot, but this study found no evidence suggesting that these efforts have been effective at changing household behavior.

Two of the other three cities with higher proportions of "young people" (20-34 years of age) than Denton were also home to universities and ranked low recycling friendliness. The transient nature of a young university population with a conservative political atmosphere, as captured by county 2008 presidential voting, may be two strong factors keeping overall diversion rates low.

Westminster, CO: Medium Convenience, High Friendliness and Low Recycling

Westminster, CO is another anomalous case in which favorable population characteristics were combined with a reasonably convenient program, but the overall waste stream diversion, household CRP participation, and CRP diversion rates were lower than most other study communities. Of the 5 cities with high recycling friendliness reporting participation rates for CRPs, Westminster reported a rate that was almost three

times lower than a different Colorado city with a similar recycling program structure.

Located on the outskirts of Denver, CO, the suburban city of Westminster has approximately 107,000 people and 43,000 households (U.S. Census 2011). Westminster ranked high on demographics and medium on attitudes separately.

Westminster's recycling program design allows for households to opt-in to curbside recycling services by paying extra and selecting from a group of licensed haulers (13 haulers) that also offer trash services (highly visible fee assessment). The haulers have the freedom to operate curbside recycling services as they like without a uniform system among them all set out by the City of Westminster. Most haulers operate a single stream recycling pickup, but do not have weekly or same day pickup. The biweekly/different day pickup was the factor in Westminster's recycling program being ranked medium convenience with single stream (from most haulers) keeping it from going to low convenience. The medium convenience of program structure, highly visible fee assessment for curbside recycling, and little to no media/education efforts by haulers (who are required to but have little incentive) or the city seem to be overriding the background community attributes that should be receptive to higher rates of recycling.

Westminster recently contracted with a consulting firm to study its waste management practices and to recommend programs for improving recycling participation and diversion rates (see SERAI 2010). The study came about as a response to the 2008 Citizen Survey results that regarded recycling (City of Westminster 2011). Interviews of licensed haulers (not all collecting recyclables) and public meetings were conducted by the city in 2010 as part of the process in providing information to the city council for determining what changes the city council would make to the Solid Waste Collection

Code (Harlow-Schalk & Rangel 2011). Westminster's Environmental Advisory Board and Green Team are using the recommendations from this study to actively pursue potential changes to be made to the Solid Waste Collection Code. Some examples of the potential changes being discussed are establishing a diversion rate goal for the city, creating a pay-as-you-throw waste collection system that would be for single-family households, and expanding recycling services to multi-family and commercial customers (Harlow-Schalk and Rangel 2011). Westminster provides another example of a city seeking to improve waste management practices with regard to recycling in an attempt to increase recycling participation and amount of waste being diverted from a landfill (diversion rate).

CHAPTER V

SUMMARY AND CONCLUSION

Overall, the results of this study provide modest support for my research expectations. In most cases, recycling program characteristics that increase convenience and reduce the visibility of the fee assessment for recycling services are able to generate fairly consistent high rates of recycling despite wide variability in community demographics. Conversely, areas with relatively unfavorable program structures are more likely to see recycling rates that reflect their underlying demographic and attitudinal attributes.

In summary, among cities with high overall waste stream diversion rates most had relatively convenient recycling programs. When demographics and attitudes (recycling friendliness) were taken into account, the cities with high rates and convenient programs were scattered among all three categories of recycling friendliness. It did not seem to matter how recycling-friendly a city was when the recycling program was well designed and convenient. Similarly, when recycling friendliness was not part of the analysis, the trend was low rates with low convenience of program increasing to high rates with high convenience of program.

Both convenience and fee assessment are important attributes of recycling programs that affect overall diversion rates. The cities that reported high overall diversion rates also had fee assessments for curbside recycling that required less effort from and were less visibly “added costs” to households. The convenience at which households pay for curbside recycling (less visible fee assessment) provided more strength to the idea that positive program structures increase recycling. The fee assessment structure that

required the most effort and was most visible (highly visible fee assessment) was found in the majority of cities with low recycling rates, but participation and diversion rates increased when the fee for curbside recycling was more convenient and less visible (low fee assessment).

Differences in household participation and diversion rates from curbside recycling programs presented a less clear picture. Cities with low CRP diversion rates and convenient overall recycling programs were found in all three types of communities (low, medium, and high recycling friendliness), but the cities with high CRP diversion were mainly those with high recycling friendliness. The examples of high CRP diversion cities with high recycling friendliness and the low diversion rate cities with low recycling friendliness lend some support to the idea that recycling friendliness can still exert an important influence on CRP activity.

Similar to overall diversion rates, cities reporting high CRP participation rates and convenient recycling programs were scattered among low, medium, and high recycling friendliness. The cities reporting low CRP recycling rates were also found in each of the three recycling friendliness categories. This lends more support to the idea that convenience and fee assessment elicit higher participation rates regardless of the demographics and attitudes in most cities.

While there was modest support overall for my research expectations, I also found several instances where the results painted a more complicated picture. It is certainly possible that an adverse demographic and political climate can create social and cultural conditions that resist recycling even in the face of relatively well designed programs. Additionally, highly motivated communities may generate surprisingly robust recycling

activity even without a supportive recycling program.

The small sample size, measurement challenges, and limited information on my key recycling outcome variables precluded me from making strong generalizations from my results to the broader universe of western or US cities with similar characteristics.

One issue that stood out was the inability of cities to provide consistent estimates of recycling and waste diversion rates due to them not tracking the data themselves or relying on other agencies tracking data at a multi-municipality level. Also, the use of private haulers means that some municipalities have no direct data on household recycling. In such settings private haulers do not necessarily worry about whether or not their trucks are crossing over into other cities as they go about servicing their accounts. This mixes trash from municipalities and renders it impossible to track city-specific waste stream data.

During the course of this study, it was also found that issues of convenience can include elements of both behavior and fee assessment. Convenience certainly captures program elements that affect the amount of behavioral effort required by the household to participate in a recycling program. The more effort (e.g., source separation at curb) that is required to recycle the less convenient it is to participate. However, it also applies to how visible CRP fees are to households. The more effort households are required to exert to pay for curbside services (e.g., opting into the program or paying extra bill separate from their regular trash bill) the less convenient or more visible the fee is for them. This study shows that both types of convenience affect recycling outcomes.

Past research has shown a variety of descriptions of the demographic predictors of individual recycling behavior, and has noted how recycling program structure can affect

recycling participation at individual, household, and community levels. My review of the literature found many more studies done at the individual and household levels than at the community level with little focus on the western United States. My study adds to this literature on recycling behavior in two distinct ways: the use of community-level analysis and a focus on the western United States, and offers evidence that demographics and program structures interact in interesting ways.

Future research could look at why cities in this study changed types of recycling programs over time. It could also use household surveys to capture perceptions of and self-reported participation in recycling programs. Household surveys could also capture how long households have been exposed to recycling media and recycling activity in the home (grew up recycling, first generation recycler, or do not recycle). Inclusion of more demographic and attitudinal characteristics may be useful in future research to capture a broader picture of influencing factors. Future research could also provide a more qualitative picture with in-depth interviews of a variety of public officials to capture their perspective of how recycling programs were developed and implemented.

Finally, this thesis focused on recycling efforts, but there are still two more R's to conservation and sustainability: reduce and reuse. It does take all three R's to make a lasting impact on sustainable efforts. Hopefully this thesis will help in the efforts to promote sustainability in the study cities and others just like them throughout the US.

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APPENDICES

Appendix A.

AADLAND AND CAPLAN'S (2006) STRATIFIED SAMPLE OF 40 CITIES

Western U.S. Cities from 13 States

Abilene, TX
Baytown, TX
Denton, TX
Lubbock, TX
McAllen, TX
Arvada, CO
Colorado Springs, CO
Longmont, CO
Pueblo, CO
Westminster, CO
Bellevue, WA
Billings, MT
Bismarck, ND
Fargo, ND
Carlsbad, CA
Escondido, CA
Hesperia, CA
Inglewood, CA
La Mesa, CA
Newport Beach, CA
Palo Alto, CA
Santee, CA
Upland, CA
Yorba Linda, CA
Eugene, OR
Kansas City, KS
Lawrence, KS
Olathe, KS
Overland Park, KS
Topeka, KS
Wichita, KS
Las Cruces, NM
Lincoln, NE
Omaha, NE
Norman, OK
Ogden, UT
Orem, UT
Provo, UT
Peoria, AZ
Tempe, AZ

Appendix B.

INTERVIEW INSTRUMENT FOR RECYCLING COORDINATOR INTERVIEWS

Draft Recycling Coordinator Telephone Survey[1]

The purpose of this survey is to gather information from the administrators of curbside recycling in the sampled communities. The survey is divided into three sections. Section I applies to all communities. Section II applies to communities that currently have a curbside recycling program. Section III applies to communities' media campaigns for recycling programs. Section IV applies to participation and diversion rates with regard to recycling programs.

Section I. General Questions

1. **Do you work for the Public Works department? If no, what organization do you work for?**

2. **What is the title of your position?**

3. **Please describe the structure and organization of your community/s recycling program** (open ended):
   - *If coordinator states drop-off facility, refer to question 4*
   - *If coordinator states curbside, refer to question 6*

[1] Based on questionnaire from Aadland, D. and Caplan, A.J. 2006. Curbside Recycling: Waste Resource or Waste of Resources? Journal of Policy and Management 25(4):855-874.

4. **Does your community have centralized recycling drop-off facilities for households to use?**

5. **Now I would like to ask detailed questions about the drop-off facilities. Please describe the nature of these facilities** (open ended):
   - *Note Answer questions as mentioned and ask about items not mentioned.*

   a. *Approximately how many drop-off facilities are located within the city?_____*

   b. *What types of materials are currently collected at the drop-off facilities?*
      1.___ Paper (of any kind)
      2.___ Plastic (of any kind - #1, #2, etc.)
      3.___ Cardboard (corregated or non-corregated)
      4.___ Aluminum cans
      5.___ Tin cans
      6.___ Glass (of any color)
      7.___ Hazardous waste (i.e., motor oil, paint, etc.)
      8.___ Green waste (i.e., yard debris, kitchen scraps, etc.)
      9.___ Other. Please specify.
      _____

   c. *Are there separate bins for different types of recyclables or are they comingled?*

   d. *Do residents currently receive money from the sale of their recyclables at any of these facilities? If so, which items can they receive money for?*

6. Does your community have a curbside recycling program?

7. *If not:* **What are the main reasons that have prevented your community from adopting a recycling program?**

- *If community has curbside recycling, skip to Section II*
- *If not, skip to Section III*

END OF SECTION I

Section II. Details about Curbside Recycling Program

8. **How many years has the community in which you currently work been serviced by a curbside recycling program?**
   - *Note "a curbside recycling program" also means the years during which the community might have had a curbside recycling program in place before the current one.*

9. **Please describe the nature of the curbside recycling program** (open ended):
   - *Note Answer questions as mentioned and ask about items not mentioned.*

   a. *What type of collection system is in use? (e.g., recyclables separated into multiple bins, separated in same bin, comingle in one bin, etc.)*

   b. *Is participation in the curbside program a standard service provided to all households in the community, or do households need to 'opt-in' to the program?*

   c. *Is curbside recycling mandatory for households in your community? (e.g., are households required to place recyclable materials in their curbside recycling bins? Are households banned from throwing out recyclables with their regular trash?)*

d. If so: How is household participation monitored and enforced?

e. What is the current pickup schedule for recyclables from households (weekly, biweekly, etc.)?

f. Is this the same as MSW pickup?

g. What is the current household fee for the curbside recycling program?
- *Note Make sure to distinguish between a monthly, quarterly or annual fee*

h. Are there incentives or rewards used in the program? If so, please explain.

i. Are there any penalties for not participating in the program? If so, please explain.

j. What recyclable materials are collected in the curbside program? (Mark items in list as mentioned and ask about items not mentioned)
1.___ Paper (of any kind)
2.___ Plastic (of any kind - #1, #2, etc.)
3.___ Cardboard (corregated or non-corregated)
4.___ Aluminum cans
5.___ Tin cans
6.___ Glass (of any color)
7.___ Hazardous waste (i.e., motor oil, paint, etc.)
8.___ Green waste (i.e., yard debris, kitchen scraps, etc.)
9.___ Other. Please specify.
_____

k. Is the curbside recycling program administered on community or county level?

10. **Are there any state-mandated recycling goals that the community is required to reach?**

11. *If so:* **What are they?**

END OF SECTION II

Section III. Educational and Media Campaigns

12. How much money was spent in 2002 and 2010 on media campaigns to educate people on the recycling program?

2002 Expenditures_____

2010 Expenditures_____

13. What types of media are being used currently in the media campaign for the recycling program?

- *Note: Mark items in lists and ask about others not mentioned by saying, "Now I would like to ask detailed questions about the media campaign."*

For 2010
___ T.V. ads
___ Radio
___ Newspaper
___ Mass mailing
___ Utility billing (or other billing)
___ Presentations at businesses
___ Presentations at schools (elementary, middle/junior high, high school—circle which applies)
___ Other (please specify)

_____

14. What types of media were used during 2002 in the media campaign for the recycling program?

- *Note: Mark items in lists and ask about others not mentioned by saying, "Now I would like to ask detailed questions about the media campaign."*

For 2002
___ T.V. ads
___ Radio
___ Newspaper
___ Mass mailing
___ Utility billing (or other billing)
___ Presentations at businesses
___ Presentations at schools (elementary, middle/junior high, high school—circle which applies)
___ Other (please specify)

_____

END OF SECTION III

SECTION IV: Estimated Recycling Participation and Diversion Rates

15. What are the *participation rates* for the recycling program for 2002 and 2010?

2002_____

2010_____

16. How much waste is being diverted from the landfill or other end point for MSW due to recycling participation for 2002 and 2010? *(e.g. diversion rate)*

2002 Amount_____ 2002 Rate _____

2010 Amount_____ 2010 Rate_____

END OF SECTION IV

Appendix C.

ORIGINAL PARTICIPATION AND DIVERSION RATE WORKSHEET

Thank you for your willingness to participate in this research project.

As I mentioned on the phone, my thesis research focuses on explaining variation in household recycling *participation rates* and residential waste *diversion rates* in a sample of 40 cities throughout the Western United States.

As part of my project, I am hoping to gather information to calculate standardized indicators for both participation and diversion rates. I recognize that both types of 'rates' have been used in inconsistent ways by different people, so I am sending you this worksheet to outline how I hope to operationalize these concepts in my research. Because the underlying data required for calculating these rates is not always readily accessible, I also wanted to give you advance notice of what details I need before we talked on the phone again.

I am most interested in gathering data on recycling participation and diversion rates for the last year (or for the most recent year for which you have data available). However, I am also trying to build on a study that was conducted in 2002 in your community, so if you were also able to track down similar data for a time period around that year, that would also be very helpful.

To help keep these rates standard throughout my research, I define them and calculate them as described below.

PARTICIPATION RATE = proportion of households participating in recycling programs

The core idea is to estimate the share of households in your community that participate in public recycling programs. I recognize that precise data might not be possible for less formal programs (like unmonitored public recycling drop-off sites), but please give me the best estimate of household recycling program participation rates in your community. If it is helpful, you may use the following table to estimate recycling rates in your community:

	2010 (or other recent year: _____)	**2002** (or other similar year: _____)
A) Total # households in community	_____	_____
B) Number of households who participate in formal curbside pickup service	_____	_____
C) Estimated number of households who participate only in a drop-off recycling program	_____	_____
D) Estimated TOTAL # of households who do any type of recycling in your community	_____	_____
Estimated participation rate = (line D)/(line A) * 100	_____%	_____%

<u>DIVERSION RATE</u> = proportion of total residential solid waste stream being diverted away from landfill due to recycling

The following is an equation for calculating a residential waste diversion rate.

$$\textit{Residential Waste Diversion Rate} = \frac{\textit{Total Residential MSW Recycled (tons)}}{\textit{Total Residential MSW Generated (tons)}} \times 100$$

The table below may be useful for estimating diversion rates in your city.

Waste Stream Components – 2010 (or other recent year, specify: _____)

	Column A	Column B	
Type of Waste	**Total Waste Generated but not Recycled (tons)**	**Total Amount Recycled (tons)**	**Diversion Rate (by waste type)** $\frac{Column\ B}{Column\ A+B}$ **X 100**
Residential MSW[1] (multi- and single-family households)			
***Residential MSW[1] (only multifamily households)**			
***Residential MSW[1] (only single-family households)**			
Commercial MSW[1]			
C & D Materials[2]			
Green Waste			
HHW [3]			
All solid waste combined:			

[1]Municipal Solid Waste; [2]Construction and Demolition; [3]Household Hazardous Waste
*Please indicate whether your residential MSW data combines single- and multi-family households (or has them separated) by filling in the appropriate boxes. This will allow for more accurate comparison of cities in this research.

Waste Stream Components – 2002 (or other similar year, specify: _____)

	Column A	Column B	
Type of Waste	**Total Waste Generated but not Recycled (tons)**	**Total Amount Recycled (tons)**	**Diversion Rate (by waste type)** $\frac{Column\ B}{Column\ A+B}$ **X 100**
Residential MSW[1] (multi- and single-family households)			
***Residential MSW[1] (only multifamily households)**			
***Residential MSW[1] (only single-family households)**			
Commercial MSW[1]			
C & D Materials[2]			
Green Waste			
HHW [3]			
All solid waste combined:			

[1]Municipal Solid Waste; [2]Construction and Demolition; [3]Household Hazardous Waste

*Please indicate whether your residential MSW data combines single- and multi-family households (or has them separated) by filling in the appropriate boxes. This will allow for more accurate comparison of data in this research.

If you wish to return this information to me directly – please send it to me at Ed Kotter, 0730 Old Main Hill, Logan, UT 84322-0730, or email a copy to me at ed.kotter@aggiemail.usu.edu

Appendix D.

ADVANCED LETTER AND INFORMED CONSENT DOCUMENT

USU IRB Approved: Page 1 of 3
Approval Terminates:
Protocol Number:
IRB Password Protected per IRB Administrator

Utah State University
Sociology, Social Work, and Anthropology
0730 Old Main Hill
Logan UT 84322-0730
(435) 797-1230

Letter of Information
Comparing Community Characteristics to Structure of Recycling Program
Research Project

Introduction/ Purpose: This research is being conducted by Master's student, Edward Kotter, under the advisement of Dr. Douglas Jackson-Smith in the Sociology program at Utah State University. The research will find out more about recycling programs and what influences participation rates in the programs and diversion rates from landfills (or other end point of MSW) from recycling efforts. Research findings will be used to write a thesis in fulfilling the requirement for the Master's program.

Procedures: You have been selected to take part in this research because of your position and understanding of your local recycling program. You will be one of forty participants in this research. The study includes recycling contacts from 40 different cities across the western United States.
Information will be gathered about the recycling program in your city, which includes the structure of the program, nature of media campaign, and participation and diversion rates.
As a participant in this research study, the following will happen:
1. Shortly after you receive this letter, a call will be made to you for scheduling a convenient telephone interview time
2. A telephone interview consisting of approximately 16 questions and lasting approximately 30 minutes will be conducted at the scheduled time
3. A follow up call may be made to clarify any of your responses

The questions will include: participation rates for recycling program and diversion rates (from endpoint of municipal solid waste(MSW)) from recycling efforts for 2002 and currently for 2010. To help the interview go smoothly, will you have these rates ready at time of interview. Thank you.

Utah State University
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Risks: There are minimal risks associated with participation in this project. None of the questions should be sensitive. Every effort will be made to respect your privacy and confidentiality of all information that is shared in the interview.

Benefits: The information you provide will enable a comparison of the influence of community demographic characteristics and structure of recycling program on participation rates in recycling programs and diversion rates from endpoints of MSW.

Voluntary nature of participation and right to withdraw without consequence: Participation in research is entirely voluntary. You may refuse to participate or withdraw at any time without consequence or loss of benefits.

Confidentiality: Research records will be kept confidential, consistent with federal and state regulations. Your answers will be recorded taking written notes. To protect your privacy, a code number will replace your name on all data and personal identifying information by using individual ID numbers for you and your city. If I wish to use direct quotes, I will contact you for permission before using your name or identity in any of my reporting results. Personal, identifiable information will be kept until Master's degree requirements are finished, which is projected to be May 2011.

IRB Approval Statement The Institutional Review Board for the protection of human participants at USU has approved this research study. If you have any pertinent questions or concerns about your rights or a research-related injury, you may contact the IRB Administrator at (435) 797-0567 or email irb@usu.edu. If you have a concern or complaint about the research and you would like to contact someone other than the research team, you may contact the IRB Administrator to obtain information or to offer input.

Sociology, Social Work, and Anthropology
0730 Old Main Hill
Logan UT 84322-0730
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Letter of Information
Comparing Community Characteristics to Structure of Recycling Program
Research Project

If you have any questions or concerns about this study at any time, we encourage you to contact the Master's student and advising professor who are leading this project. The lead investigator and advisor are:

Edward Kotter
ph: (435) 797-1230
email: ed.kotter@aggiemail.usu.edu

Dr. Douglas Jackson-Smith
ph: (435) 797-0582
email: doug.jackson-smith@usu.edu