

INCREASING RECYCLING IN CALIFORNIA:  
HOW TARGETED EDUCATION AND OUTREACH COULD INCREASE  
PARTICIPATION AND RECYCLING RATES IN LOCAL RECYCLING PROGRAMS

A Thesis

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Abstract  
of  
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*Statement of Problem*

By 2025, California must achieve a 75 percent organics recycling target. To achieve this target, local governments will soon be tasked with implementing organic waste recycling programs to divert food waste. This thesis attempts to determine the most effective education and outreach efforts jurisdictions should use to encourage the residential sector, which includes single and multi-family residences, to participate in food waste recycling programs.

*Sources of Data*

In this study, I conducted a case study review of six jurisdictions in the Bay Area that have implemented food waste recycling programs in the residential sector. These jurisdictions differed in the use of education and outreach methods, thus providing opportunities to assess which methods are more or less effective. To conduct this assessment, I interviewed jurisdiction recycling program coordinators, solid waste haulers, other organizations, and CalRecycle staff. I also reviewed and analyzed publicly available outreach materials from the jurisdictions, haulers, and other organizations.

*Policy Recommendations*

Based on the findings of my study, I provide the following recommendations regarding best practices that jurisdictions should consider when conducting outreach to residences: 1) Continue prioritizing direct contact efforts. Explore door-to-door outreach to expand education to multi-family residences. 2) Electronic platforms should be used to maximize outreach. 3) Messaging should include an extensive overview of the mechanics of recycling, information on how recycling relates to broader social issues, the use of universal images, and language translation. 4) Metrics should be developed to assess how outreach efforts affect recycling and participation rates. 5) Jurisdictions should partner with other organizations to conduct and evaluate outreach efforts.

\_\_\_\_\_, Committee Chair  
Dr. Edward Lascher

\_\_\_\_\_  
Date

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## **I. Introduction to Food Waste Recycling in California**

### *Thesis Question and Research Method*

California has the most ambitious climate change goals in the nation, with a mandated target to achieve a 40 percent reduction in greenhouse gas (GHG) emissions below 1990 levels by 2030, and a goal to achieve an 80 percent reduction in GHG emissions by 2050 (Office of Governor Brown, 2015). California Governor Jerry Brown's climate leadership and the state's progressive Legislature has led to the passage of a suite of bills aimed at reducing GHG emissions statewide through a range of mechanisms, including reducing emissions from the waste sector through increased recycling of organic waste.

To increase recycling throughout the state, local governments are statutorily mandated to implement recycling programs to divert recyclable materials from the landfill, including aluminum, plastic and glass. The California Department of Resources Recycling and Recovery (CalRecycle) oversees the implementation of these local programs. Local governments in California are also mandated to have a program to recycle yard waste and other organic materials for the commercial sector. Soon local governments will be tasked with implementing organic waste recycling programs to divert food waste and food soiled paper, and to rescue edible food for human consumption, from the commercial and residential sectors. However, implementing organics recycling programs to divert food waste will be a challenge for local governments due to a lack of local organics recycling infrastructure to process the additional materials, the need to change consumer waste generation and recycling behavior, and limited resources.

In order to determine the most effective way that local jurisdictions can recycle food waste, I aim to answer the following: Regarding food waste recycling programs, how do local governments' education and outreach strategies affect participation and recycling rates within

the residential sector? In this thesis, I attempt to determine the most effective education and outreach strategies for local jurisdictions to utilize to encourage the residential sector, which includes single- and multi-family housing, to participate in food waste recycling programs. Though jurisdictions tend to use similar education and outreach methods, including electronic, print, and direct contact, subtle differences such as the frequency of the outreach, the languages and images used in printed materials, specific communities that are targeted, messaging, and electronic platforms, can have varying effects on program participation rates and food waste recycling rates. Understanding how subtle differences in the use of education and outreach strategies affect participation and recycling rates could help jurisdictions determine the best methods for increasing participation and recycling rates in the residential sector.

In this study, I used qualitative research methods to answer my thesis question. I conducted a case study review of six jurisdictions in the Bay Area that have implemented food waste recycling programs in the residential sector. This included interviewing a representative from each jurisdiction and their solid waste hauler to discuss their respective food waste recycling programs and the education and outreach strategies they employ to increase participation and food waste recycling rates. I also interviewed several organizations that have expertise implementing food waste recycling programs for jurisdictions. Additionally, I reviewed and analyzed publicly available education and outreach materials from each of the jurisdictions, haulers, and outside organizations. I determined the effectiveness of education and outreach strategies based on the interviews and a review and analysis of publicly available materials.

### *Background on Recycling Laws in California*

In 1989, California passed AB 939, which among other major provisions, mandated that each jurisdiction recycle at least 50 percent of their generated solid waste by January 1, 2000

and beyond through source reduction, recycling, and composting activities. The first response of most jurisdictions to implement the law was to develop residential and commercial curbside recycling programs, which separate comingled recyclables from trash (CalRecycle, *Connecting Communities*). Jurisdictions continue to meet the mandates of AB 939 in addition to implementing new waste management and recycling laws passed in the last two decades. New laws include mandatory commercial recycling, passed in 2011, which requires businesses, including multi-family residential dwellings and public entities to arrange for recycling services by July 2012. The law also requires jurisdictions to implement a commercial solid waste recycling program to divert solid waste from the regulated businesses. Additionally, mandatory commercial organics recycling, passed in 2014, requires the same entities to arrange for organics recycling services beginning in July 2016. Jurisdictions must implement an organics recycling program to divert the organic waste from the regulated entities. Both laws require jurisdiction programs to include educating the regulated entities about the laws and how to recycle the specified materials. CalRecycle conducts regular reviews of jurisdictions to ensure these laws are being implemented and provides technical assistance to jurisdictions that need additional support.

Most recently, the Legislature passed SB 1383, which sets a target to reduce the state's methane emissions by 40 percent below the 2013 level by 2030. To help achieve the methane emissions reduction target, the law set a target for California's waste sector to reduce the disposal of organic materials by 50 percent under the 2014 level by 2020, and by 75 percent under the 2014 level by 2025. The bill also requires that no less than 20 percent of disposed edible food is recovered for human consumption by 2025. This is the most significant piece of legislation passed by the Legislature with regards to the management of California's solid waste since AB 939 from 1989.

Implementing SB 1383 will be a major paradigm shift for local jurisdictions.

Jurisdictions will need to plan for additional resources to change franchise agreements with solid waste haulers, site and construct new organics recycling facilities, and change consumer behavior. CalRecycle is in the process of developing regulations to implement the law, which will go into effect on January 1, 2022. However, CalRecycle is encouraging jurisdictions to implement the regulations as soon as they are adopted by the department, as the 50 percent organics recycling target is set to be achieved by 2020. As mentioned, most jurisdictions in California have programs to divert organic waste, such as green waste (also known as yard waste). However, most programs do not include food waste nor do they include requirements or partnerships for rescuing edible food. Thus, implementing food waste diversion programs and edible food rescue programs will be uncharted territory for many jurisdictions and their solid waste haulers.

#### *Background on Food Waste Recycling in the United States and California*

The recycling of food waste and the rescue of edible food is relatively new in California and in the United States more broadly. According to the Natural Resources Defense Council (2012), 40 percent of food in the United States goes uneaten, which is equivalent to a loss of \$165 billion each year. In addition, the uneaten food ends up in landfills and is the most prevalent material in the country's solid waste stream. The U.S. Environmental Protection Agency (U.S. EPA) estimates that food waste accounts for 21 percent of total disposal and generates 20 percent of the nation's methane. The NRDC (2012) estimates that reducing food waste by 15 percent would feed more than 25 million Americans every year, at a time when one in six Americans are food insecure. To address the issues associated with the abundance of food waste in the country, the U.S. EPA and U.S. Department of Agriculture (USDA) announced the first domestic goal to reduce food waste by 50 percent by 2030, which is in line with the United

Nation's Sustainable Development Goals (U.S. EPA). The U.S. EPA aims to work with local governments, businesses, non-profit and non-governmental organizations, and federally recognized tribes to achieve this goal (U.S. EPA). Though this goal is not a mandated target that is enforceable by U.S. EPA or USDA, California's new organic waste recycling mandates will work towards achieving the federal food waste reduction goal.

Organic waste comprises approximately 66 percent of California's total disposal (CalRecycle, Short-Lived Climate Pollutants). Food waste, which is included in the organic waste percentage, comprises 18 percent of the state's disposed waste stream (CalRecycle, Short-Lived Climate Pollutants). The California Air Resources Board estimates that the decomposition of organic waste in landfills accounts for 21 percent of the state's total methane emissions. Achieving the 20 percent edible food recovery goal will help address food insecurity in California, as 1 in 8 adults and 1 in 4 children struggle with food insecurity (California Association of Food Banks). In order to achieve the 75 percent organics recycling target by 2025 and the 40 percent methane emissions reduction target, Californians will need to recycle an additional 20 million tons of organic waste annually (CalRecycle, Short-Lived Climate Pollutants). However, achieving this reduction will be no easy feat. According to CalRecycle, the statewide recycling rate for all materials in 2016 was 44 percent, down from 47 percent in 2015, and 50 percent in 2014 (CalRecycle, California's Statewide Recycling Rate). The decrease in the state's recycling rate is caused by the low cost of disposal, higher wages driving increased consumption, slow-to-develop domestic markets for recyclable materials, declining international markets for recyclables and a lack of in-state infrastructure to process organics (Paben, 2017).

In order to achieve the state's recycling goals, and in a broader context, the state's climate change goals, California will need to figure out how to significantly improve organics

recycling rates statewide. As mentioned, increasing the recycling of organic waste will come with the new regulations that are being developed to implement SB 1383, which will place new organics recycling requirements on generators of organic waste and local jurisdictions. The regulations and associated enforcement measures are a necessary component of increasing organics recycling statewide. However, local governments will have to implement organics recycling and edible food recovery programs that are effective, expand participation among generators of organic waste, encourage the use of recycled organic products, and have penalty and enforcement measures to ensure compliance. Though implementing the new regulations will be a difficult task for local governments, it is essential for the state to achieve the 75 percent organics recycling target by 2025 and the 20 percent edible food recovery target by 2025.

The remainder of this thesis is organized as follows. In Chapter 2, I discuss what current literature reports as the determinants of whether a person recycles or not and the methods that institutions use to encourage recycling. In Chapter 3, I discuss the methodology I use for gathering and analyzing data. In Chapter 4, I present key findings from my analysis. In Chapter 5, I present recommendations for local governments regarding the best uses of education and outreach methods to increase participation and recycling rates in local food waste recycling programs.

## **II. Literature Review: Factors that Influence Recycling Behavior**

### **A. Introduction**

This section synthesizes academic, peer-reviewed journal articles that use a variety of analytical methods to determine how various factors influence an individual's recycling behavior or intention to recycle. Additionally, many of the articles reviewed analyze the methods that different institutions employ to encourage and increase individuals' participation in recycling programs. This section provides background information on variables that have been previously studied to determine their effects on an individual's recycling behavior or intention to recycle and that institutions consider when implementing recycling programs. These articles shed light on where gaps exist in the current literature and where further research is needed to study the variables that affect consumer recycling behavior. It is important to note that the studies synthesized in this section are not California-specific. Instead, the authors of the articles conducted their research in Illinois, Texas, and Michigan, among other countries, including Slovenia, Taiwan and the Netherlands. I did not conduct further research on these states or countries regarding their recycling laws and how they might affect consumer recycling behavior. However, most of the findings are similar across the studies regardless of the state or country the research took place in. Thus, it is likely that the findings of these studies can be generalizable to California.

Understanding which variables significantly affect consumer recycling behavior or intention to recycle has important implications for law- and policy-makers in changing public behavior and sentiment towards participating in local recycling programs. This is especially true given the new organics recycling law that California local governments will have to implement in the next five years. This literature review allows me to compare what others have found in their research to my own findings, which will be presented in Chapter 4. It also helped shape the

method I used to answer my thesis question through tailoring the questions that I asked during my interviews with local jurisdiction recycling coordinators, solid waste haulers, and other stakeholders. For a succinct synopsis of all the articles synthesized in this literature review, see Appendix A. The following sections will examine: 1) how consumer recycling behavior or recycling intention is measured; 2) which variables cause differences in an individual's recycling behavior or intention to recycle; and 3) the variables institutions have considered when implementing recycling programs to influence consumer behavior.

### **B. Measuring Individual Recycling Behavior or Intention to Recycle**

Most of the literature reviewed measured consumer recycling behavior or intention to recycle using a qualitative method, typically through the use of a survey. The use of surveys aimed to assess an individual's behavior or intended behavior through the use of a single question or multiple questions and then analyzing the survey responses. Seacat and Denine (2010), for example, measured participants' curbside recycling behavior by asking the survey question: "Of all the products in your household that could be recycled curbside, approximately what percentage do you regularly recycle?" Survey respondents indicated the percentage of materials they recycled with a possible range of 0-100 percent. Additionally, authors Owen, Videras and Wu (2012) used a survey on pro-environmental behaviors, attitudes, and knowledge to measure environmental and recycling behavior. The authors measured the frequency with which individuals conducted specific behaviors out of concern for the environment over the span of one year. Individuals' responses were observed on a scale of 1-4, with 1 corresponding to "never," 2 "occasionally," 3 "frequently," and 4 "nearly all the time." Park and Ha (2014) distributed a web-based survey to a panel of U.S. consumers in order to collect data on consumer intention to recycle, which they measured using a three-item scale adopted from Fielding, McDonald, and Louis (2008). The three-item scale included the



following questions and associated responses: “I intend to engage in environmental activism during the next 6 months”; “Do you intend to engage in environmental activism in the next six months?”; “I (1 do not intend, 7 do intend) to engage in environmental activism over the next 6 months.” The responses to the items were assessed using a seven-point Likert-type scale (1 = strongly disagree, 7 = strongly agree). Tsai (2008) used a quantitative method to measure the recycling rate, defined as the amount of waste recycled divided by the total amount of solid waste collected from all sanitation units in local governments, schools, communities and offices. Tsai (2008) used recycling rate data collected by the Directorate General of Budget, Accounting and Statistics of the Executive Yuan in Taiwan from the years 1998 - 2004. Most of the studies reviewed use subjective data, aimed at tapping people’s attitudes and beliefs about recycling. The authors often gathered the data through surveys, then analyze the data using qualitative or quantitative methods.

### **C. Individual Factors that Influence Recycling Behavior**

Much of the literature concerns factors influencing the dependent variable, recycling behavior or intention to recycle. The subheadings that follow are the independent variables that various researchers have determined influence recycling behavior or intention to recycle.

#### *1. Demographic Variables: Social Class, Age, Gender*

Most of the articles reviewed do not specifically focus on the effects of demographic variables on recycling behavior or intent to recycle. Instead, the researchers control for demographic variables in their analyses. However, several studies determined that some demographic variables have a statistically significant effect on consumer recycling behavior or intention to recycle. These include social class and gender.

Tsai (2008) examined how a Taiwanese region’s degree of social coherence, measured as social capital, influences the recycling rate in the region. The percentage of volunteers in a

population above 15 years old and the number of social organizations per thousand people were used to measure social capital. Additional socio-economic variables the author included in the study were regional income, local government expenditures on environmental programs, community development, and the percentage of people under 14 and over 65. Using a fixed effect model, Tsai (2008) determined that a region's degree of social capital increases its recycling rate. The author also found that income has a positive and significant influence on the recycling rate. Additionally, Tsai (2008) found that an elderly society contributed positively and significantly to the recycling rate. The younger population's effect on the recycling rate was negative but not statistically significant. However, Tsai (2008) found that volunteers induced a higher regional recycling rate at the 5 percent significance level.

Iyer and Kashyap (2007) investigated the effects of social class on attitude and behavior towards the environment and recycling. The authors' measure of social class included family income and the education and occupation of both parents. Using a multivariate analysis, Iyer and Kashyap (2007) found that social class had a significant effect on recycling attitude and recycling behavior at the 5 percent significance level. More specifically, the authors found that people within a lower social class held significantly more favorable environmental and recycling attitudes than those in the middle or upper social class and were more likely to engage in environmentally friendly and recycling behaviors. However, the authors also found that middle class respondents showed more favorable environmental and recycling attitudes and were more inclined to engage in recycling behaviors than the upper-class respondents. Iyer and Kashyap (2007) found that women held more favorable attitudes toward the environment and recycling and were more likely to engage in environmentally friendly and recycling behaviors than their male counterparts. The authors concluded that recycling attitude and behavior vary inversely with social class, which they suggest could be a result of the norms and influence of

other family members that varies with social class. The authors suggest that family members and others in the social, work, or peer groups can be effective sources of influence to increase recycling rates.

Sidiquea, Lupib, and Joshi (2009) analyzed the socioeconomic, demographic and behavioral factors that influence the usage of drop-off recycling sites. The authors collected data for this study through in-person interviews conducted at eight drop-off recycling sites around the Lansing area in Michigan. The results of their study suggest that socioeconomic variables including household size, income, and age are highly correlated with household consumption (and therefore waste generation) at the 1 percent significance level. The authors concluded that locating drop-off recycling centers convenient to higher income, older neighborhoods is likely to lead to higher site utilization.

Ebreo and Vining (1990) collected information using a questionnaire on recyclers and non-recyclers from randomly selected households in Urbana and Champaign Illinois in May of 1986. Total respondents included 87 non-recyclers and 100 recyclers. The authors defined recyclers as those individuals who indicated that they recycled some materials within the last year, and non-recyclers as individuals who indicated that they did not recycle. The authors found minimal demographic differences between recyclers and non-recyclers. There were no differences in gender, household size, occupation, or educational level. However, there were differences in age and income. Recyclers were older than non-recyclers, with the mean value at 42 for recyclers and 35 for non-recyclers, and reported slightly higher income levels. This finding is consistent with other studies, in that older, wealthier people tend to recycle more.

## *2. Personal Attitudes Towards Recycling and the Environment*

Several of the articles measured an individual's or general population's concern about or attitudes towards the environment and recycling and how that concern or attitude contributes

to pro-environmental behaviors, including recycling. These articles provide insight into the psychological reasons why consumers choose to recycle.

Culiberg (2014) aimed to explain consumer recycling using a multifaceted ethical approach. The author hypothesized that the decision to recycle is not based on how it affects the individual, but how it affects others and the environment. To explore this hypothesis, the author analyzed three key ethical concepts in which the main focus is on others and not on the individual: (1) moral obligation, (2) moral intensity and (3) collectivism. Culiberg (2014) gathered data from a sample of Slovenian consumers and conducted individual interviews and provided self-administered surveys to participants. Participants provided detailed information regarding their attitudes and recycling behavior, perceptions of the consequences of recycling, and moral obligations. Culiberg (2014) found that the proposed ethical concepts significantly explain consumer attitudes and intentions related to recycling. The author explains that the findings indicate that individuals who feel higher levels of responsibility to recycle are more likely to recycle, thus higher levels of moral obligation positively influence intentions to recycle. The more consumers perceive recycling as morally intense, the more favorable their attitudes are towards recycling. In turn, attitudes positively affect intentions to recycle. Additionally, Culiberg (2014) found that the more collectivistic individuals held more positive attitudes towards recycling.

Park and Ha (2014) measured consumer intention to recycle by analyzing the influence of awareness of consequences, subjective norms, attitude, personal norms, and perceived behavioral control on intention. The authors explain that awareness of consequences represents a person's tendency to relate his or her own behavior to the welfare of others. Subjective norms represent a person's perception of how significant other people expect him or her to act regarding the behavior. Attitude refers to a person's overall evaluation of performing a certain

behavior. Personal norms refer to one's self-expectations for a specific behavior. Perceived behavioral control refers to a person's perception regarding his or her ability to engage in the behavior. The authors used a web-based survey to gather data from a population of U.S. consumers regarding everyday purchase decisions. The results of the study supported nine of ten hypotheses at the 1 percent significance level:

1. Attitude toward recycling is positively related to recycling intention.
2. Perceived behavioral control is positively related to recycling intention.
3. Subjective norms are positively related to attitude toward recycling.
4. Subjective norms are positively related to perceived behavioral control.
5. Personal norms are positively related to recycling intention.
6. Awareness of consequences is positively related to personal norms.
7. Subjective norms are positively related to personal norms.
8. Awareness of consequences is positively related to attitude toward recycling.
9. Awareness of consequences is positively related to subjective norms.

The authors explain that their findings indicate that an individual's intention to recycle is determined by one's attitude towards recycling, perceived behavioral control, and personal norms. Additionally, the authors found that subjective norms influence recycling intention indirectly through attitude, personal norms, and perceived behavioral control. Finally, Park and Ha (2014) conclude that consumers who are knowledgeable about potential consequences associated with not recycling tend to have a more favorable attitude, strong sense of social expectation and a personal obligation toward the intention to recycle.

#### **D. Factors Institutions Consider to Influence Recycling Behavior**

In addition to reviewing factors that influence recycling behavior or intention to recycle, many of the studies reviewed the factors that institutions consider when trying to influence

participation in recycling programs. The subheadings that follow are the independent variables that have been determined by these studies as influential in increasing participation in recycling programs implemented by an institution.

### *1. Incentives*

Several studies have reviewed how incentives can affect one's attitude and behavior towards recycling. Incentives are a mechanism that can be used by an institution to motivate consumer participation in recycling programs. As previously discussed, Ebreo and Vining's (1990) study conducted in Illinois found that while both non-recyclers and recyclers were equally motivated to recycle with concerns about the environment, non-recyclers were motivated by financial incentives, or rewards to recycle.

Iyer and Kashyap (2007) evaluated the effects of incentives and information interventions on consumer recycling. The authors reviewed recycling behaviors at the individual level and recycling output for paper and glass at the group level using two sites (an incentive site and information site) to measure differences. Iyer and Kashyap (2007) found that both interventions significantly increased recycling: the information site increased over 75 percent from the baseline and the incentive site increased 55 percent over the baseline. Throughout the duration of the study, recycling decreased 15 percent at the information site as compared to 26 percent at the incentive site. The author's main conclusions are: 1) interventions are vital to encourage recycling; 2) offering incentives has an immediate and dramatic effect on recycling behaviors; 3) disseminating information that increases consumer knowledge has a more lasting effect on recycling output than offering incentive.

Thøgersen (2003) examined the effects of monetary incentives as a motivator to recycle. The author drew a random sample from two groups of three matched municipalities in the Netherlands, where households in one group pay a fixed fee for garbage collection and in

the other a fee depending on the weight of their garbage. Thøgersen (2003) notes that the primary reason for implementing pay-by-weight schemes is to stimulate material recycling and home composting. The author found that households in municipalities with a pay-by-weight scheme delivered more of their recyclable materials to recycling and composted more of their fruit and vegetable waste in the garden. Thøgersen (2003) explains that the economic incentive enhances internalized motivation. However, the author concludes by explaining that economic incentives can promote undesirable behaviors, and can undermine internalized motivation which may result in the desired behavior becoming less, rather than more, prevalent.

## 2. *Convenience*

Many studies have found that when recycling opportunities are convenient, consumers are more likely to recycle. The easier it is for a consumer to recycle, and the less resources and physical effort a person has to put into the behavior, the more likely a person is to recycle. Across the studies reviewed, convenience continually comes up as a factor as to whether an individual recycles or not.

Authors Evans, Mukherji, and Mukherji (2011) found that among Hispanic residents in South Texas, convenience and the availability of plastic bags were key drivers of recycling efforts. The authors administered an in-person survey in English and Spanish to 262 residents in a mid-size city in Texas. The authors found several of their hypotheses regarding convenience and recycling effort to be true. First, that the inconvenience of recycling had a negative effect on the length of past recycling behavior, and the length of past recycling behavior had a positive effect on recycling behavior. Thus, as recycling becomes more inconvenient it reduces the length of time that a person will make the effort to recycle, which leads to decreased recycling efforts later on. In addition, the authors found that recycling effort had a negative effect on recycling behavior, as did the non-availability of plastic bags.

Ando and Gosselin (2005) conducted a study on 214 households in Urbana, Illinois to determine the effect that convenience has on recycling participation for different types of households. The authors found that in the community studied, individuals living in apartments reported lower recycling rates than inhabitants of single-family dwellings. The authors found higher recycling rates in multi-family households that reported having adequate interior space available for sorting and storing recyclables. The authors also found that the rate at which multi-family households recycled was significantly negatively correlated with the lateral distance that participants had to travel to recycling bins. Ando and Gosselin (2005) found that the creation of adequate space increased the diversion rate of an average household by 0.17, and that the marginal effect of space was similar in magnitude for paper recycling rates (0.19), but much larger for containers (0.43). The authors found a strong connection between recycling rates and the perceived presence of adequate interior space for processing recyclables, and that the distance to recycling bins affects container-recycling intensity.

Ebreo and Vining (1992) conducted a longitudinal assessment of the recycling attitudes and behaviors of residents of Champaign, Illinois in 1986, 1987, and 1988. In 1986, Champaign began a free, voluntary curbside recycling program for residents, which was expanded in 1987. Throughout the course of the study, the authors measured the general environmental concern and environmental attitudes and recycling behavior of survey participants and collected demographic information as recycling opportunities in the city expanded. The authors found that over time, the proportion of households that indicated they recycled increased along with the actual volume of materials recycled in the community. In addition, the authors found that environmental concern and specific attitudes regarding recycling became more favorable over time. Making recycling more convenient was shown to increase participation in recycling and improve attitudes towards recycling. In an earlier study conducted by the two authors, Ebreo



and Vining (1990) found that non-recyclers indicated that personal and household convenience were reasons individuals did not recycle. The authors suggest that improving the convenience of recycling centers would promote participation in recycling programs, especially for non-recyclers.

Additionally, Sidiquea, Lupib, and Joshi (2009) found that location plays a crucial role in influencing the usage pattern of drop-off sites. The authors found that distance and convenience are highly correlated with visits to drop-off recycling centers at the 1 percent significance level, while familiarity of recycling centers is highly correlated with drop-off visits at the 1 percent significance level. The authors found that recyclers were likely to use a drop-off site more frequently if the travel distance from home to the site was shorter. Sidiquea, Lupib, and Joshi (2009) explain that the results indicate that beliefs about recycling convenience and familiarity with recycling infrastructure are significant drivers of recycling behavior.

### *3. Education and Knowledge of Recycling*

Many authors have studied the effect of an individual's education and knowledge about recycling on recycling behavior. Most studies have found that education and knowledge plays a significant role in determining whether a consumer recycles or not. More specifically, the more a person knows about recycling, its purpose, the process, and convenient opportunities to recycle, the more likely the individual is to engage in that behavior. However, one study found that specific knowledge of the impact of recycling on such things as the environment and the economy versus the original perceived impact of recycling can determine whether one makes the effort to engage in the behavior or not.

As mentioned, Sidiquea, Lupib, and Joshi (2009) found that consumers use drop-off recycling centers more often when they feel that recycling is a convenient activity and are familiar with available recycling centers. In their study, the authors determined that

communication and education efforts aimed at improving awareness of recycling facilities and recycling convenience is effective in promoting visits to recycling centers, thus increasing individual recycling efforts. The authors explain that their findings are consistent with existing literature, confirming that communication appeals based on environmental protection are less effective than appeals that leverage social norms, such as promotion efforts aimed at children and the community in general, which can indirectly increase recycling by increasing social pressure.

Seacat and Northrup (2010) demonstrated that to influence recycling behavior, interveners must make community recycling information accessible, provide rationale and motivation to individuals to promote recycling, and teach citizens the necessary skills to recycle. Information, motivation and skills were all positively correlated with the percentage of household products that were regularly recycled through curbside recycling. The findings suggest that in order to increase recycling, residents must understand the specifics of how to recycle, including what is and isn't recyclable, and how to prepare items prior to recycling. Seacat and Northrup (2010) determined that information specific to the recycling process and information on the performance of the community is important for residents to understand in order to increase participation in recycling. The authors conclude that in order for communities to optimize recycling rates they must make recycling available and accessible while concurrently building the recycling knowledge, motivation and skills of residents.

Iyer and Kashyap (2007) aimed to determine how information as knowledge plays a role in influencing recycling behavior. They hypothesized that providing individuals with information on what recycling is and how to recycle would modify their attitude towards recycling and future recycling behaviors. They predicted that the changes resulting from an information intervention would last longer than those resulting from an incentive intervention.

As previously discussed, both interventions significantly increased recycling. At the beginning of the study, recycling rates at the information site were 20 percentage points higher than recycling rates at the incentive site. Although recycling at both sites declined by the end of the study, recycling rates at the information site were 11 percent points higher than recycling rates at the incentive site. The author's main conclusions are that disseminating information that increases consumer knowledge has a longer lasting effect on recycling output than offering incentives. In addition, the authors explain that promotional or educational messaging should be targeted at women, as gender was determined to have a significant impact on recycling.

Owen, Videras and Wu (2012) studied the factors that affect a household's environmentally favorable behaviors. The authors conducted a survey on pro-environmental behaviors, attitudes, and knowledge in September and October of 2007 to gather data from approximately 1,700 respondents in the U.S. The authors used ordered probit, ordered logit, and ordinary least squares models. They found that people tend to overestimate the impact of their own individual behaviors and that the frequency with which they engage in those behaviors increases with their estimate of effectiveness. Specifically, they found a positive and significant coefficient on the high impact belief of recycling. The authors explain that this indicates that people who believe that recycling half of one's household garbage reduces carbon emissions by more than 2,500 pounds of carbon emissions per year are likely to recycle more often. Thus, individuals who believe that a specific activity has a higher impact than the baseline are more likely to engage in the behavior most closely related to that activity with greater frequency. The authors explain that a consequence of this thinking is that more accurate information that reduces an individual's assessment of the impact may actually lead to fewer voluntary pro-environmental contributions. The authors explain that the findings indicate that participation in a voluntary recycling program might either increase or decrease as individuals learn about the

actual impact of their activities. Since higher perceived impacts correlate with higher frequency of pro-environmental behavior, the authors explain that it is possible that better informed consumers would choose to provide less effort in creating the public good than poorly informed individuals if the actual impacts are significantly less than originally perceived. The authors conclude by explaining that to the extent that the typical individual underestimates the effectiveness of some activities that have large impacts, education might cause a more efficient allocation of efforts.

Finally, Ebreo and Vining (1990) found that recyclers had more general knowledge about what materials were recyclable in their communities along with the locations for where to recycle than non-recyclers. The authors summarized their findings by stating that increasing participation in recycling for non-recyclers could be achieved through an educational approach that targets the demographic characteristics of the audience. For example, they explain that education efforts should be promoted through television and school programs for lower and middle income groups, and through newspapers to target individuals with higher income and education.

## **E. Conclusion**

As explored in this literature review, many variables affect consumer recycling behavior or the intention to recycle. Previous research suggests:

1. Socioeconomic factors that determine recycling behavior are mixed. One study found that lower and middle class consumers held more favorable attitudes towards recycling and were more likely to recycle. Another study found that income has a positive and significant influence on the recycling rate, as do consumers who are elderly.
2. Women are more likely than men to hold a more favorable attitude towards recycling, and are more likely to recycle.

3. Consumers who feel higher levels of responsibility to recycle are more likely to engage in recycling behavior.
4. Favorable attitudes towards recycling positively affect intention to recycle.
5. Offering incentives has an immediate and dramatic effect on recycling behavior.  
However, disseminating information that increases consumer knowledge has a longer lasting effect on recycling output than offering an incentive.
6. Recyclers are more likely to recycle if the travel distance from home to a recycling site is shorter. Recycling locations must be accessible and available.

Regarding ways in which institutions can encourage recycling through public information campaigns, previous research suggests:

1. Appeals that leverage social norms, such as promotion efforts aimed at children and the community in general, can increase social pressure to recycle, thus indirectly increasing recycling.
2. Promotional or educational messages regarding recycling are best targeted at women.
3. Disseminating information that increases consumer knowledge about recycling has a longer lasting effect on recycling output than offering incentives.
4. Consumers must understand the process of recycling, including how to recycle, what's recyclable, and how to prepare recyclable materials in order to increase recycling.
5. Higher perceived impacts of recycling correlate with a higher frequency of recycling behavior. To the extent that the typical individual underestimates the effectiveness of some activities that have large impacts, education might cause a more efficient allocation of efforts.
6. Communication and education efforts aimed at improving awareness of recycling facilities and convenience can be effective in promoting visits to recycling centers.

Previous research provides a starting place for the interview questions I developed to ask representatives of solid waste haulers and jurisdictions. For example, since socioeconomic and demographic factors were found to have a statistically significant effect on an individual's recycling behavior or intent to recycle, I decided to ask: "Do you target a specific demographic (e.g. gender, age, income level, etc.) or the entire residential sector?" Additionally, in order to learn about convenient opportunities to recycle, I asked whether residents are provided a kitchen pail and a separate cart to collect food waste. I also asked questions regarding how a jurisdiction or solid waste hauler evaluates their education and outreach programs, such as through the use of metrics. These questions included: "What are current participation and recycling rates (i.e. percentages, actual numbers, or other relevant data points) of the residential sector included in the program?" "Do you use any metrics for determining the effectiveness of the education and outreach methods used to increase participation and recycling rates in the residential sector?" All of the questions I asked representatives of the jurisdictions and waste haulers aimed to utilize the findings other researchers have contributed to the literature, while also aiming to find out what types of education and outreach methods are used and the most effective to encourage participation in recycling programs.

Institutions must consider many factors when implementing local recycling programs to encourage participation in the program and increase recycling. Previous research has shown that both incentives and education are successful methods an institution can use to encourage participation in a local recycling program. My research aims to add to the literature information about the education and outreach strategies that local governments use to encourage participation in recycling programs and the effectiveness of those strategies on participation rates. My research also aims to add information regarding metrics that local governments in California use to determine the effectiveness of their education and outreach efforts. My goal is

that my research will help local jurisdictions implement food waste recycling programs that effectively encourage participation in those programs to increase food waste recycling.

Additionally, my goal is that my research will be helpful to local jurisdictions and solid waste haulers as they plan to implement food waste recycling programs over the next five years to comply with the regulations being developed by CalRecycle to implement SB 1383.

### **III. Methodology: Case Study Review of Six Bay Area Jurisdictions**

#### *A. Selecting Jurisdictions*

In order to determine how education and outreach methods affect participation and recycling rates in local food waste recycling programs within the residential sector, I conducted a case study review of six Bay Area jurisdictions. I interviewed representatives from the following cities: Colma, Daly City, Millbrae, Portola Valley, San Bruno, and South San Francisco. I also interviewed representatives of each jurisdiction's solid waste hauler. I selected these jurisdictions since they are relatively similar in size and are all located on the Bay Area Peninsula, which helps control for capacity and local cultural differences that could affect the success of recycling efforts, separate and apart from actions of the local staff working on the recycling program. However, there are still some differences across the jurisdictions that I discuss later in this section that could attribute to differing participation and recycling rates. Additionally, a devoted CalRecycle staff member who works with each of the jurisdictions was available to provide information about each of the jurisdictions along with an introduction to each of the contacts for the jurisdictions and their solid waste haulers. Based on CalRecycle staff's recommendation and after speaking with several of the jurisdiction representatives, I interviewed representatives from different organizations that specialize in implementing recycling programs and in utilizing education and outreach methods to increase participation in local programs.

To conduct the review, I interviewed a representative from each jurisdiction and the solid waste hauler to understand the nuances of the education and outreach strategies that are used to increase participation and recycling rates in the residential sector. During the interviews, I aimed to determine the major challenges that jurisdictions and haulers face in trying to increase participation in residential food waste recycling programs, and their assessment of how



they can improve participation rates. I conducted nearly all interviews over the phone as it was less time-intensive and expensive than scheduling in person interviews with each representative. However, I was able to attend a meeting in San Mateo County with all the representatives that I interviewed from each jurisdiction and waste hauler. I was also able to conduct two interviews in person after the meeting. In addition, I reviewed publicly available information on each jurisdiction and solid waste hauler's website, which included text, images, links and resources, newsletters, fliers, and other materials. I was also able to interview a representative from StopWaste from Alameda County over the phone and corresponded with a representative from Global Green via email. Global Green sent me an advanced copy of a study the organization conducted regarding a pilot door-to-door program so that I could incorporate the findings into my thesis.

*B. An Overview of Education and Outreach Methods*

CalRecycle staff reviews each jurisdiction's compliance with solid waste and recycling laws by reviewing the jurisdiction's mandated Electronic Annual Report. The Electronic Annual Report provides information about required components of each jurisdiction's mandated recycling programs. One required component is the implementation of education and outreach efforts. If these efforts are insufficient, CalRecycle staff provide technical assistance to the jurisdiction to help improve the programs. If the jurisdiction continues to provide inadequate education and outreach, the jurisdiction could be put under a Compliance Order, which lays out a plan for the jurisdiction to come back into compliance. As a last resort, CalRecycle staff would fine a jurisdiction for not coming into compliance; however, this is a rare occurrence as the department has a "compliance first" approach.

There are three generic education and outreach categories that jurisdictions report on:

1. Direct contact. This includes face-to-face interactions, door-to-door outreach,

community events, school presentations, facility tours, phone calls, etc.

2. Print. This includes any informational materials that are physically printed, such as bill inserts, newsletters, fliers, signs on recycling carts, etc.
3. Electronic. This includes any form of electronic contact used to provide information, including emails, websites, newsletters, social media platforms, etc.

All jurisdictions use at least one if not all three education and outreach methods. However, slight differences in the implementation of each method, such as the frequency of the contact made, specific neighborhoods or demographics targeted, the messaging used in the materials, and the use of modern social media platforms, may determine whether the strategies are effective at increasing participation and recycling rates within the food waste recycling program. Through my interviews with representatives from the six jurisdictions and their waste haulers, along with additional stakeholders, I aimed to determine the most effective uses of these methods to increase participation and recycling rates.

### *C. Background Information on Jurisdictions*

To provide context for how each jurisdiction implements its residential food waste recycling program, in this section I provide an overview of the demographics of each jurisdiction. Understanding this information allowed me to gain insight into the education and outreach methods used by each jurisdiction to increase participation and recycling rates in food waste recycling programs within the different cities. This is important information as income level, languages spoken, and race and culture may all play a role in whether a person participates in recycling programs.

The demographic information provided for each jurisdiction came from several sources. One is U.S. EJ Screen, which is an environmental justice mapping tool developed by U.S. EPA that includes data from the U.S. Census Bureau. The tool utilizes nationally consistent data and

an approach that combines environmental and demographic indicators in maps and reports. Information also came from each jurisdiction's local government website and the U.S. Census Bureau. As a reference for the sections that follow, according to the U.S. Census Bureau, California's per capita income is \$30,318 and the median household income is \$61,818. The U.S. Department of Housing and Urban Development recently updated their income limits to consider low income housing in different counties within California (Sciacca, 2017). In San Francisco and San Mateo Counties, for example, the median income is \$115,300, the low income limit is \$105,350, the very low income limit is \$65,800, and the extremely low income limit is \$39,500 (Sciacca, 2017). To put this into context, a family of four with an income of \$105,350 per year is considered low income in San Francisco and San Mateo Counties. I use these numbers to compare the different income levels for each jurisdiction with the rest of California.

I also provide information regarding whether there are any disadvantaged communities within each jurisdiction. Disadvantaged communities are identified using CalEnviroScreen 3.0, a tool established to comply with a 2012 bill (SB 535) that required the California Environmental Protection Agency (CalEPA) to identify disadvantaged communities in California. CalEnviroScreen ranks census tracts using percentiles based on potential exposures to pollutants, adverse environmental conditions, socioeconomic factors and prevalence of certain health conditions. Using this tool, census tracts that fall within the 75<sup>th</sup> to the 100<sup>th</sup> percentiles are considered disadvantaged.

Finally, I provide an overview of each jurisdiction's waste stream to give additional context to the recycling programs. Many jurisdictions have differing waste streams, due to the number and types of businesses, the number of residences and other factors. Understanding the variations of each jurisdiction's waste stream provides background information that helps to

analyze education and outreach methods utilized in the different recycling programs. To gather this background information, I spoke with a CalRecycle staff member who works with each of the jurisdictions. The staff member has access to information reported by each jurisdiction and is in regular communication with the jurisdiction representatives. Each jurisdiction's demographic and waste stream information is discussed below.

1. Colma

The Town of Colma is known as the "City of Souls" (Town of Colma, *Colma History*). The town is the smallest city in San Mateo County with approximately 1,531 residents and a mere 1.88 square miles of land. However, Colma has 1.5 million "souls" (Town of Colma, *Colma History*). In 1924 the town was founded as a necropolis by cemetery operators. According to CalRecycle staff, the town has 16 cemeteries and one pet cemetery. Green waste is one of the most prevalent materials in Colma's waste stream, likely due to landscaping waste from the town's cemeteries. Colma began collecting organics in 2016, so its program has been in place for just over one year. Organic waste recycling is voluntary for both for single family and multi-family homes, although there are few multi-family complexes in the town. The town uses Republic Services for its solid waste hauling and includes the following materials in its organic recycling program: food scraps, food soiled paper, and yard trimmings, and compostable bags (BPI approved only). Residents in single family homes have three carts: a blue cart for recyclables; a green cart for organics, including food and yard waste; and a grey cart for garbage. In addition, each single and multi-family home gets a kitchen pail for in-home use to collect organics.

Colma is not a typical town, since it has few living residents and a waste stream that is largely comprised of organic materials. Its residents are diverse in terms of race and languages spoken. Approximately 48 percent of the population is Hispanic, 43 percent is Caucasian, 32

percent is Asian, and 4 percent is Black (U.S. EPA, *City: Colma Town*). 65 percent of the population speaks a language other than English at home. 72 percent of those individuals speak Spanish at home while 28 percent speak Asian-Pacific Islander languages. The per capita income in Colma is \$23,860 (U.S. EPA, *City: Colma Town*), which is lower than the rest of the state, and the median household income is \$79,000 (Bay Area Census, *Town of Colma*), which is higher than the rest of the state. When compared to San Mateo County, Colma's median household income falls within the low income bracket. As identified by CalEnviroScreen 3.0, Colma does not contain any disadvantaged communities, meaning that residents there are not disproportionately burdened by the effects of multiple sources of pollution.

## 2. Daly City

Daly City is located at the northernmost edge of San Mateo County adjacent to San Francisco. According to CalRecycle staff, Daly City started a new franchise agreement in February 2016 with its solid waste hauler, Republic Services. The franchise now includes organics recycling, including food scraps. The organics recycling program is voluntary for single family homes, while multi-family complexes do not participate. The city has a dedicated sustainability coordinator who helps implement the city's recycling programs. Like Colma, the city has a three-cart system for residential and commercial recycling, and includes the following materials in its organics recycling program: food scraps, food soiled paper, and yard trimmings, and compostable bags (BPI approved only). The city's solid waste stream is typical, with no one material type being significantly more prevalent than another.

Daly City has a population of approximately 105,781 residents, of which roughly 58 percent is Asian, 22 percent is Caucasian, and 4 percent is Hispanic (U.S. EPA, *City: Daly City*). Approximately 68 percent of the population speaks a language other than English at home, of which 23 percent speak Spanish and 72 percent speak Asian-Pacific Islander

languages (U.S. EPA, *City: Daly City*). The median household income is approximately \$74,449 and the per capita income is roughly \$28,814. Approximately 9.7 percent of the population is living in poverty (U.S. Census Bureau, *QuickFacts: Daly City*). Daly City has a per capita income that is just below that of the state and a median family income that is higher than the state. The median household income is considered low income when compared to San Mateo County. According to CalEnviroScreen, one census tract within Daly City has a population characteristics percentile of 76, meaning that the indicators that make up the population characteristics, which include linguistic isolation and housing burden, have a burden 76 percent greater than the rest of the state (CalEnviroScreen 3.0, CalEPA). This census tract is considered disadvantaged using CalEnviroScreen. Daly City does not contain any other disadvantaged communities.

### 3. Millbrae

Millbrae is located just west of the San Francisco Bay, and borders San Bruno on the north and Burlingame on the south. According to CalRecycle staff, Millbrae began its residential organics recycling program in January 2015. The organics recycling program is voluntary for single family homes and mandatory for multi-family complexes depending on the amount of organics generated. The city uses South San Francisco Scavenger Company as its solid waste hauler. The city collects all food scraps, food soiled paper, and yard trimmings in the green cart, however, biodegradable bags are not allowed in the green bin. The city encourages its residents to line kitchen pails in something compostable, such as newspaper. The city uses South San Francisco's organics recycling facility, an anaerobic digester, that was built in 2014. The anaerobic digester generates compost and clean fuel to power South San Francisco Scavenger Company's collection trucks. Millbrae has a typical waste stream in which no one material type is particularly higher than another.

Millbrae is smaller than South San Francisco, Daly City, and San Bruno, with a population of roughly 22,416 residents. Approximately 43 percent of the population is Caucasian, 48 percent is Asian, and 13 percent is Hispanic (U.S. EPA, *City: Millbrae*). Roughly 51 percent of the population speaks a language other than English at home. Of those individuals, 73 percent speak an Asian-Pacific Islander language, 11 percent speak Spanish, and 13 percent speak other Indo-European languages (U.S. EPA, *City: Millbrae*). The median household income is approximately \$93,777 and the per capita income is \$43,174 (U.S. Census Bureau, *QuickFacts: Millbrae*). Both of these figures are above the California averages. When compared to the rest of San Mateo County, like Colma and Daly City, Millbrae falls within the low income limit for median household income. According to CalEnviroScreen, Millbrae does not contain any census tracts that have a pollution burden or population characteristics percentile above 75, indicating that there are no disadvantaged communities in the city.

#### 4. Portola Valley

Portola Valley is located in San Mateo County just west of Stanford University. Portola Valley is unique from the other jurisdictions in several ways. Residents living in single family homes generate most of the town's waste stream, as there are few commercial entities located in the town. Additionally, the town's layout affects the way waste and recyclables are collected. Finally, the town is very wealthy compared to the other jurisdictions and to California more broadly.

According to CalRecycle staff and the waste hauler representative, Portola Valley began its organics recycling program approximately 10 years ago. This makes the town's food waste program the longest implemented of all the jurisdictions reviewed. Most of the town consists of single family residences, as the town has only eight commercial businesses and no multi-family complexes. The organics recycling program is voluntary for single family homes.

Residents are provided three carts to sort their recyclables, organics, and trash. However, the town's solid waste hauler, GreenWaste Recovery Inc., puts all organics and trash into the same waste stream. Only recyclables in the blue cart are kept separate. This is in part due to the fact that Portola Valley has narrow roads that require modified garbage trucks, also known as a split truck, which put recyclables in one side and trash and organics in the other side. GreenWaste Recovery then hauls the organics and trash to a materials recovery facility in San Jose where the organics are separated from the garbage, then sent to a composting facility in Gilroy (GreenWaste Inc., *GreenWaste Collection*).

Portola Valley has roughly 4,540 residents and is approximately 89 percent Caucasian, 6 percent Asian, and 3 percent Hispanic (U.S. EPA, *Portola Valley*). Only 12 percent of the population speaks a language other than English at home, which is Spanish (U.S. EPA, *Portola Valley*). The median household income is roughly \$185,234 and the per capita income is \$143,909 (Town of Portola Valley, 2017). Portola Valley is the 10<sup>th</sup> wealthiest town in the U.S. (Rubenstein, 2002). When compared to the rest of San Mateo County, Portola Valley falls well above the median household income limit. As would be expected, according to CalEnviroScreen, Portola Valley is among the lowest pollution burden and population characteristics percentiles in the state.

#### 5. San Bruno

San Bruno is located between South San Francisco and Millbrae, and is adjacent to San Francisco International Airport and Golden Gate National Cemetery. According to the waste hauler Recology, the city began its organics recycling services in January 2014. The organics recycling program is voluntary for single family homes and for multi-family complexes. Residents are provided three carts to sort their recyclables, organics, and trash. The following items are sorted into the green cart: food scraps, food soiled paper, yard trimmings, and paper



towels. The city has a dedicated sustainability coordinator who works on the city's recycling and waste management programs. The city has a typical waste stream with no one material being significantly more prevalent than another.

The city has a population of approximately 42,524 people. Roughly 52 percent of the population is Caucasian, 30 percent is Hispanic or Latino, and 27 percent is Asian (U.S. Census Bureau, *San Bruno City*). 49 percent of the population speaks a language other than English at home. Those include mostly Spanish and Asian-Pacific Islander languages (U.S. EPA, *San Bruno*). The median household income for the city is \$83,888, and the per capita income is \$38,412 (U.S. EPA, *San Bruno*). San Bruno has a per capita income rate and median household income rate that are higher than California. Looking at San Mateo County, San Bruno's median household income places the city within the low income bracket. According to CalEnviroScreen, one census tract within San Bruno is in the 88<sup>th</sup> pollution burden percentile, with traffic, diesel emissions, solid waste, and groundwater threats being the major contributors to the pollution burden score. However, most communities within San Bruno are not considered disadvantaged when using the tool.

#### 6. South San Francisco

South San Francisco is located in San Mateo County and is adjacent to the San Francisco Bay. According to CalRecycle staff, South San Francisco is the only city in the county with its own organics recycling facility, an anaerobic digester that was built in 2014. As mentioned, the digester produces compost and clean fuel to power South San Francisco Scavenger Company's collection trucks. According to CalRecycle staff, one of the city's largest waste streams is construction and development waste from new and re-development in the city. In addition, due to the large amount of biotech companies located within the city, South San Francisco also generates a large amount of biotech waste. The city started its organics recycling

services in January 2015. The organics recycling program is voluntary for single family homes while multi-family complexes must recycle organic waste depending on the amount of waste generated. All food scraps, food soiled paper, and yard trimmings are collected in the green cart. The city and waste hauler prefer that kitchen pails are lined in compostable paper since biodegradable bags do not break down quickly enough to compost. According to CalRecycle staff, many of the people who work in the city are commuters and likely do not live in the city. However, many large companies within the city have organics recycling programs and teach their employees to how to recycle.

South San Francisco has a population of approximately 66,229 people. Approximately 38 percent is Asian, 37 percent of the population is Caucasian, and 34 percent is Hispanic or Latino (City of South San Francisco, *South San Francisco Demographic Information*). Approximately 57 percent of residents speak a language other than English at home, which include Spanish and Asian-Pacific Islander languages (U.S. EPA, *South San Francisco*). The median household income is approximately \$81,439 and the per capita income is approximately \$31,939 (U.S. EPA, *South San Francisco*). Interestingly, the per capital income rate and median household income are slightly higher than the state average. However, looking at San Mateo County as a whole, South San Francisco's median household income falls within the low income bracket. Approximately 13.8 percent of the population is living in poverty (City-Data.com, *South San Francisco*). This is comparable to California's statewide poverty rate. According to CalEnviroScreen, a significant portion of South San Francisco is in the top 25 percent of all disadvantaged communities within the state. The city therefore faces environmental and population characteristics burdens that are much higher than the rest of the state.

#### *D. Selecting Stakeholders*

In addition to interviewing the individuals who work with and directly for the jurisdictions, I interviewed representatives from organizations that work closely with jurisdictions on implementing food waste recycling programs. I selected these organizations based on recommendations from CalRecycle staff and representatives from the jurisdictions and their waste haulers.

1. StopWaste

StopWaste is a public agency located in Alameda County that is governed by the Alameda County Waste Management Authority, the Alameda County Source Reduction and Recycling Board, and the Energy Council (StopWaste, *About Stop Waste*). According to CalRecycle staff, the organization was voted in by residents of Alameda County to create a governing board to help divert material generated within the county. The agency helps the County with its recycling services for businesses, residences, and schools and receives funding from the county and each city within the county. The organization does not manage hauler franchises for each jurisdiction; however, the organization conducts outreach campaigns to encourage residents to take advantage of the services that are established by the hauling contracts within each jurisdiction. According to the agency's website, StopWaste helped implement the nation's largest food waste recycling program (StopWaste, *About Stop Waste*).

According to a StopWaste staff member, the organization introduced an ordinance in 2012 that requires commercial entities and the multi-family residential sector to recycle food waste. Single family homes are not included in the requirement to recycle food waste. StopWaste has authority to enforce the ordinance. One enforcement mechanism the organization uses is conducting inspections of all businesses to ensure that they have the required organics recycling carts at their facility. The enforcement mechanism will soon include a monetary penalty. Additionally, StopWaste conducts education and outreach for each jurisdiction; this is in

addition to the education and outreach provided by each jurisdiction. Though this organization is specific to Alameda County and not San Mateo County, I decided to interview StopWaste because of the organization's expertise on implementing and coordinating food waste recycling programs.

## 2. Global Green USA

Global Green is a global organization that works to develop solutions to address climate change through community based projects (Global Green USA, *Global Green 2.0*). The organization aims to make affordable housing, schools, neighborhoods and cities more environmentally friendly and sustainable. Global Green works on issues including water conservation, energy conservation, and recycling (Global Green USA, *Global Green 2.0*). In 2016, Global Green expanded its food waste recovery program to multi-family complexes. To do this, the organization launched a pilot project in over 30 buildings in the San Francisco and Greater Los Angeles regions (Global Green USA, 2016). One of the jurisdictions I interviewed contracted Global Green to implement education and outreach strategies at specific multi-family complexes as part of the organization's pilot program.

### *E. Incorporating Interviews*

In this section I discuss the interview process and how I incorporated the interviews into my research. An overview of the interviews is as follows:

1. Colma and Daly City: I interviewed the jurisdiction representative from Colma, who is contracted by the town to implement the recycling program, along with the representative for Daly City. Daly City and Colma share the same waste hauler, Republic Services. I was able to interview the representative along with an additional associate in person after the meeting in San Mateo County.
2. Millbrae and South San Francisco: I interviewed the jurisdiction representatives from South

San Francisco and Millbrae, along with the representative from South San Francisco Scavenger Co., which is the waste hauler for both of the cities.

3. Portola Valley: I was able to interview a representative from GreenWaste Recovery Inc., the waste hauler, for Portola Valley. I was unable to get in touch with the jurisdiction representative from the town due to the fact that the jurisdiction representative was transitioning into a new position with the town and did not yet have a replacement for the original position. However, the hauler provided valuable information about the town's organics recycling program.
4. San Bruno: The representative from San Bruno's waste hauler Recology responded to my interview questions via email, but I was unable to speak with her over the phone. When I briefly met her in person, she mentioned that she was new to her role in working with San Bruno, was strapped for time and was unfamiliar with many of the details of the city's recycling programs. In addition, San Bruno's jurisdiction representative recently left her position with the city and that position is still vacant, thus, I was unable to speak with a representative for the city's recycling programs. However, I was able to gather information about San Bruno's food waste recycling program using data from the Electronic Annual Report and from CalRecycle staff's conversations with and knowledge about the city's program.
5. StopWaste and Global Green USA: I interviewed a staff member from StopWaste over the phone, and made contact with Global Green over email. I reviewed an advanced copy of a report by Global Green to incorporate into my review and analysis.
6. CalRecycle: I interviewed two staff members at CalRecycle, one who works directly with the jurisdictions in San Mateo County, and one who works with Alameda County and StopWaste.

Throughout the process, I was able to conduct 13 interviews. I asked the same set of questions for each of the representatives for the jurisdictions and waste haulers. I asked a slightly altered set of questions for CalRecycle staff and for representatives from StopWaste and Global Green. These questions are available in Appendix B. Each of the interviews lasted approximately 30 minutes. My interview with the CalRecycle staff member who works with Alameda County lasted for approximately one hour. The interview with the CalRecycle staff member who works with San Mateo County lasted for approximately two hours, as she provided background information on each of the jurisdictions in addition to answering the specific interview questions. During the interviews, I recorded responses and took notes on my laptop computer. All interviewees were responsive and receptive to talking to me about the recycling programs they implement. However, I did have to prompt them to provide specific information, such as which specific social media platforms they use (i.e., Facebook, Pinterest, Twitter, Instagram, etc.). In hindsight, I could have utilized a survey in conjunction with the interviews to get basic information ahead of the interviews and then prompt the interviewees on issues of importance specific to my thesis question.

Interviewing CalRecycle staff helped provide insight into each jurisdiction's recycling program. Interviewing representatives from each of the jurisdictions and their waste haulers provided additional information about the programs and the education and outreach strategies they utilize to increase participation and recycling rates. After conducting the interviews, I coded the responses by key themes that were routinely mentioned. I provide my findings in Chapter 4 and recommendations in Chapter 5. In those chapters, I decided not to reference each specific jurisdiction or hauler by name. I did this as most of the responses and issues that came up throughout the interviews were similar throughout, so I did not think it was important to analyze each jurisdiction's responses as it relates to their demographics or other jurisdiction-

specific factors. Instead, I analyzed responses by education and outreach methods that are commonly used by jurisdictions and haulers, and the challenges they face. I provide recommendations based on the interview responses and review of additional materials.

## **IV. Synopsis of Key Findings**

### *Introduction*

In this chapter, I review several concepts that came up during my interviews with the six jurisdictions from San Mateo County and their solid waste haulers, along with the interviews I conducted with representatives from other organizations. These findings include the education and outreach methods that jurisdictions and their solid waste haulers have indicated are the most effective at reaching the greatest amount of people with the greatest impact. I also review major challenges jurisdictions and waste haulers face in terms of improving recycling and participation rates.

### *Findings*

This section reviews the following key findings related to increasing participation and recycling rates in food waste recycling programs: direct contact; electronic contact; messaging and language; metrics; and major challenges. I explain how my findings compare to the literature when applicable, provide the limitations to my study, and present opportunities for future research.

#### **A. Direct Contact**

Every jurisdiction that was included in my sample does some form of direct contact outreach to residents to educate and inform them about local recycling programs. Direct contact methods include the use of door-to-door outreach, workshops, classes, presentations, facility tours, attendance at community events, and any other form of contact with residents that includes verbal interactions.

##### *1. Facility Tours*

One jurisdiction noted placing a great emphasis on providing tours to students and to any other member of the community interested in learning more about how collected materials are



processed for recycling. The representative explained that 7 out of 10 people within the jurisdiction have never seen or been to a materials recovery facility (MRF) and do not understand how they operate or process collected materials. The representative further explained that the common thought among most residents before they toured the MRF was that their separated materials eventually ended up at a landfill. However, after the residents saw how their materials were sorted at the facility into organics, recyclables and trash, then sent to additional facilities depending on the material type, they gained a greater understanding of the process that takes place once materials are collected from their residences. Because of experiences like this, the jurisdiction representative offers tours to residents upon request, with the goal of getting as many residents into the facility as possible. To maximize the number of people taking a tour of the facility, the representative promotes the tours at community and school events. The facility has also developed and designed an education center for children and youth who are not old enough to physically tour the facility, as the age requirement due to safety reasons is 18 and over. The facility also offers a virtual tour.

During my visit to San Mateo County, I attended a tour of a transfer station led by a representative of the hauler from a different jurisdiction than mentioned above. I joined a class of fifth graders as they walked around the transfer station and an anaerobic digester. The transfer station had an education center where the students could view the facility through glass windows and live video streams, learn about which materials are recyclable and go into each cart, and view recycled content products. The representative who took us on the tour explained to me that most, if not all, haulers have an education and outreach component in their franchise agreement with jurisdictions. That specific hauler had an education program in which they took school classes on a tour of the facility throughout the school year, providing approximately 30 tours a year. The tour was very educational for all who attended.

## *2. Community Events, Workshops, Classes, and Presentations*

Hosting workshops, conducting presentations, and attending community events is common practice among the sampled jurisdictions and is viewed as a highly important outreach method to increase the success of recycling programs. Getting the solid waste hauler and jurisdiction directly involved with the community through this type of engagement is a recommendation that CalRecycle staff emphasize to increase recycling and participation rates within the jurisdiction.

Each jurisdiction indicated that a representative or a representative of the hauler attends a variety of community events, including Earth Day celebrations, art fairs, cultural events, farmer's markets, collection events, and a wide array of other local events. They also indicated that representatives from the jurisdiction and waste hauler provide presentations to the city council to keep members apprised of the city's recycling efforts. In addition, roughly half of the jurisdictions indicated that they conduct presentations at schools upon request.

Five of the jurisdictions indicated that they host workshops and classes to teach residents how to compost home-generated food waste in their backyard. At the onset of one jurisdiction's food waste recycling program, the jurisdiction offered a workshop for residents to attend so they could get a walk-through of the program and learn what materials they should be recycling. To increase participation in the workshop, the jurisdiction provided food and held the workshop around dinnertime so that people could attend after work with their children. Hosting a workshop with food and at a time when people are able to bring their children is a method recommended by government employees to increase community participation in such events. Approximately 25 people showed up to the workshop, which the representative viewed as a success. That same jurisdiction also conducts presentations to the city council, and hosts workshops and provides presentations to multi-family residences and senior housing centers.

The representative noted that the jurisdiction has seen great success in increasing participation and recycling rates after hosting workshops and conducting presentations.

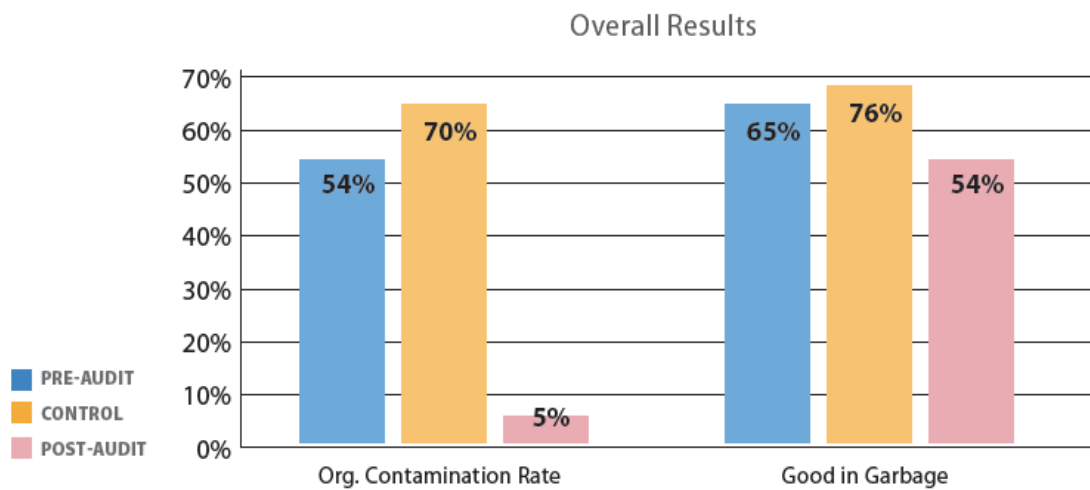
### *3. Door-to-Door Outreach*

Though not used often by jurisdictions or waste haulers, door-to-door outreach came up as a method that should be used at multi-family complexes to maximize outreach and increase participation and recycling rates at those complexes.

Global Green implemented a pilot food scrap diversion program in multi-family complexes across 31 buildings in eight Bay Area cities, including one of the jurisdictions in my sample, and three Los Angeles County neighborhoods. To implement the pilot project, Global Green collaborated with municipalities, waste haulers, and site managers of multi-family complexes. Among the cities, Global Green divided the participating sites into three sample groups to test the variation between messaging during outreach. Some sites received enhanced resident engagement that included community meetings and door-to-door outreach. During the project, Global Green utilized the help of Eco-Ambassadors, who were property managers or residents that volunteered to conduct door-to-door outreach, attend community events and handle a variety of issues at the complex throughout the duration of the project. Global Green determined that the highest percentage of residents was reached through door-to-door outreach, either alone or paired with kickoff tabling events. Data collected from the sites found an average of 70 pounds of organic materials in the organics bins at project sites with enhanced outreach versus an average of only 9.6 pounds of organic material at the control sites. Global Green estimated that control sites would have only diverted .25 tons of organic material annually per site, while participating project sites would divert 1.8 tons, which is more than seven times as much material annually. Figure 1 below provides an overview of the contamination rate, organics capture rate, and the “good in the garbage rate” (the amount of organics and recyclables in the

garbage cart) of the project sites pre- and post-audits along with the control site.

**Figure 1:** Global Green Audit Findings for Contamination and ‘Good in Garbage’ Rates of Landfill Bins for Test and Control Groups



**Source:** de la Houssaye, Matt; Gittlin, Madisen; McKay, Jordan; McKaughan. (October 26, 2017).

Piloting Food Scrap Diversion in Multi-Family Buildings, page 15. *Global Green USA*.

Throughout the pilot project, Global Green found the following:

- (1) Residents who received enhanced resident engagement were more likely to participate in the food waste recycling program.
- (2) Engaging residents through ambassador-style programs expands implementation, increases the receptivity of residents when conducting door-to-door outreach, and improves diversion rates.
- (3) Free kitchen pails provided in partnership with outreach are critical for program success.

- (4) Educational materials and program tools such as kitchen pails, brochures, door hangers and/or bill inserts significantly decreased the amount of food scraps found in the trash.

One of the sample jurisdictions had two large, low-income apartment complexes involved in Global Green's pilot project. According to a representative from the jurisdiction's waste hauler, the outreach to those complexes was not particularly successful in getting residents to properly recycle their organic waste and in reducing contamination rates in the organics carts. The hauler noted that the two multi-family complexes that participated in the pilot project worked with Global Green to pass out pails, conduct door-to-door outreach, host workshops, and participate in a variety of other educational events within the complexes. However, after several weeks residents were still not putting the correct materials in the organics cart. The hauler noted several challenges that may have led to the lack of success at these complexes in particular: the perceived amount of extra work by residents to recycle food waste; rapid turnover in management and residents; and the large amount of families with children, in which children may have helped their parents take out the trash and likely put the food waste into the wrong container. CalRecycle staff noted that the complexes are low-income, which also may have contributed to the lack of success perceived by the hauler.

Another jurisdiction, however, has two large apartment complexes that regularly partake in door-to-door outreach to promote food waste recycling and have had success. This outreach is not conducted through Global Green. One of these apartment complexes has a dedicated "green team" which is led by property management to provide materials for food waste recycling and conduct door-to-door outreach to residents. In addition, the door-to-door outreach within these apartment complexes is successful in increasing organics recycling due largely to the fact that residents are high income earners and most are owners, not renters, of their residences. One complex, for example, had a problem with illegal dumping at one point in time so they installed

cameras and took pictures of the perpetrators, which were then placed around the complex. This shows the amount of attention that property management and tenants give to the complex and the resources they have at their disposal to deal with such issues.

However, several jurisdictions noted that conducting door-to-door outreach is too resource intensive and time consuming. Additional challenges noted by the jurisdiction and waste hauler representatives include the high turnover of residents living in multi-family complexes, and ensuring that property managers are fully engaged in the effort. Depending on the neighborhood, many people involved in conducting the door-to-door outreach may not want to knock on people's doors due to safety concerns. The representatives that expressed these concerns noted that in order for door-to-door outreach to be effective and successful, buy-in from the community and property management is crucial.

Direct contact is noted as one of the most effective methods for jurisdictions and their solid waste haulers to increase the recycling of food waste among residents. It is also a strategy that is recommended by CalRecycle staff to jurisdictions when providing technical assistance. For multi-family residences, regardless of the jurisdiction, CalRecycle staff believes that one of the best ways to increase education and outreach to residents is to go door-to-door with materials, such as kitchen pails and fliers and with translators as needed. However, door-to-door is an outreach method that cannot occur just once and must be a recurring effort.

## **B. Electronic Contact**

Each sample jurisdiction uses an electronic platform to conduct outreach and provide information to residents about food waste recycling. Almost every jurisdiction or the waste hauler provides an electronic newsletter with varying frequency to residents, all have a website that contains at least minimal information about the program, and most indicated using some form of social media to provide information to residents.

### *1. Newsletters*

All of the jurisdictions or their waste haulers that send out an electronic newsletter to residents make the document available on the website. One jurisdiction's quarterly newsletter includes four main concepts: tips for reducing waste; a schedule of cart pickup; an activity for kids; and a list of upcoming community events. The representative explained that the jurisdiction uses the newsletter as an important tool to connect with residents. The jurisdiction incorporates direct feedback from residents that is received via social media and at community events into the newsletter. The jurisdiction also incorporates indirect feedback from residents into the newsletter to address common issues that the waste hauler notices on collection routes. One example that the jurisdiction described was when the hauler noticed that residents were improperly setting out their cardboard material for collection, so the jurisdiction wrote a section in the quarterly newsletter about how to properly bundle stacks of cardboard and set them out for pick up. In addition, the jurisdiction representative received numerous complaints from residents who were concerned that their source separated organics were going into the same truck as their trash. The jurisdiction then focused a section of the newsletter on explaining how the city uses a split truck that puts recyclables on one side and organics and trash in the other, then takes the trash and organics to a facility that separates the organics out from the trash for further processing.

One solid waste hauler representative that has a franchise with two of the sampled cities noted that they track readership for the electronic newsletter using specific software. The hauler was able to determine that readership among those who receive the newsletter is significant. However, another jurisdiction explained that everyone receives a printed newsletter, but must subscribe to the electronic newsletter. In this instance, print methods are more useful than electronic methods in terms of reaching the greatest number of people. However, the

jurisdiction noted that having an electronic newsletter is an important way to reach out to residents. In general, jurisdictions use newsletters to inform residents about materials that go into each bin, and to provide collection schedules, tips for how to reduce or handle specific materials, and additional contact and social media information. The use of electronic newsletters frequently came up as an important method to communicate information about recycling to residents.

## 2. *Websites*

Each jurisdiction and waste hauler has a website that provides information regarding recycling programs, rate information, and which materials go into each bin. One jurisdiction includes information about the city's diversion rates and information about where the materials are sent for additional processing. Another jurisdiction's website includes a visual for how to put together a kitchen pail liner, a calendar of events for workshops and classes about composting, and provides visuals for what types of materials can go into the food waste cart in both English and Mandarin. This website provides some of the most useful and abundant information for residents. Another jurisdiction's website includes a variety of resources to inform residents about the food waste recycling program, including downloadable posters for residents that show which materials go into each bin, an organics recycling service guide that has frequently asked questions in both English and Spanish, and a move-in and move-out guide for residents at multi-family complexes. At a minimum, all websites by the jurisdictions and their waste haulers include basic information about the services provided and about which materials go into each bin. Some of the websites provide more robust information and resources than others. However, most jurisdictions or their haulers explained that utilizing a website in conjunction with an electronic newsletter is an important way to provide information to residents about recycling programs.



StopWaste's campaign Stop Food Waste, has a website dedicated to providing information about how to reduce food waste at home. The website utilizes images to a great extent and also provides videos. The website provides an endless amount of recipes aimed at using food scraps to eliminate the amount of food waste that goes into the garbage. The website provides several tools for helping residents reduce food waste at home, including downloadable signs for inside of the fridge, a shopping list, a fruit and veggie storage guide, and others. The website also provides links to other resources, including film and media. It is a valuable example of how jurisdictions and haulers could more fully utilize information and visuals to engage residents in recycling food waste.

### *3. Social Media*

Nearly all jurisdictions and their waste haulers use some form of social media to conduct outreach to residents about food waste recycling programs. However, it is not clear how effective jurisdictions and haulers are at reaching a large follower base. Some jurisdictions or haulers have a larger follower base while others have a smaller follower base. I did not review specific posts by jurisdictions or haulers relating to recycling as part of my review. One jurisdiction explained that though it uses Nextdoor, Facebook, and Twitter to provide information about recycling programs to residents, it does not have a large following. However, this jurisdiction does post videos in the electronic newsletter, which links to YouTube. The videos, according the representative, are a hit among the residents who view them. The videos provide tutorials for how to deal with specific issues, such as showing which materials are compostable and should go into the green cart. These videos have just over 100 views and are posted approximately once a month depending on resource constraints. I was able to review the videos, as they were easily accessible to the public. The videos are an innovative and creative way to reach out to residents and catch their attention. They also provide context to the residents

regarding the people who help manage their trash and recyclables on a daily basis. Another jurisdiction's hauler representative prides himself that the hauler's social media outreach is more active than other national haulers. The company's Facebook page has over 600 followers, which include residents from four counties, not just San Mateo County. The use of social media platforms is recognized as a useful tool by jurisdictions and their waste haulers, but is noted as a method that should be used in conjunction with other platforms in order to maximize outreach capacity.

### **C. Messaging and Language Translation**

Messaging is a critical part of all outreach and education provided to residents to increase participation and recycling rates in local programs. This includes providing basic information about the recycling process, including what is recyclable, what materials go into each bin, the collection schedule, and other technical information. Messaging should also include explaining the importance of recycling as it relates to larger social issues such as climate change, green energy creation, natural resources conservation, and the economy. Finally, language translation is a form of messaging that is necessary to help maximize outreach to the greatest number of people. Each jurisdiction utilizes at least one of these types of messaging through various forms of outreach, and translates into languages other than English through direct contact and electronic methods.

#### *1. Process*

All jurisdictions use messaging to explain the recycling process. In the literature review, this was discussed as statistically significant in increasing recycling. Some jurisdictions provide a better use of this messaging than others. The best examples include visual images to portray what materials go into each cart, a visual for how to fold a kitchen pail liner, tips for how to handle specific materials, tips for how to reduce food waste generation, and a more detailed

description of the food waste program. Some examples of jurisdictions that utilized this messaging more fully than others is provided in the section above (B. Electronic Contact).

### *2. Social Implications*

There is minimal utilization of messaging the importance of recycling as it relates to broader social issues. One jurisdiction explained that it provides this type of information through social media; another provides it in printed newsletters. Several jurisdictions mentioned providing this information to residents during direct contact methods, such as at community events or during presentations. One hauler's website provides information about its anaerobic digestion facility. However, these are the few examples that use this type of messaging to influence recycling behavior. However, I reviewed the Bay Area Recycling Outreach Coalition's website, and it provides information about the relationship between food waste prevention and recycling and water conservation, energy conservation, hunger, and global economic cost. This is an organization that works with jurisdictions in San Mateo County. I heard about the organization through several of my interviews. The organization's website provides the best utilization of messaging regarding the importance of recycling that I was able to find during my research. Based on the interviews and a review of publicly available websites and materials, all jurisdictions and haulers should aim to improve messaging as it relates to the social importance of recycling as it is a method that has been determined in other research to be statistically significant in improving recycling behavior.

### *3. Language Translation*

Each jurisdiction that has a large percentage of residents that speak a language other than English at home includes materials in another language on its website or at least provides it in print. However, I was not able to assess how many materials are translated into other languages and whether those communities have adequate access to those materials or are in need of

additional materials in their primary language. From my research, it is not clear to me that translation is utilized enough in order to maximize outreach to residents who speak another language other than English at home. One jurisdiction explained that the only materials that are translated (mainly into Spanish, Mandarin, and Tagalog) are informational fliers, but newsletters and other materials that are sent out to all residents are only in English. Several jurisdictions provide materials on their website that utilize visuals that can be accessed by all residents regardless of the primary language spoken. CalRecycle staff explained that several jurisdictions customize signage based on the demographic. For example, one jurisdiction provided signs to a Chinese-seafood restaurant that indicated which materials go into each bin using images that included chopsticks and abalone shells. CalRecycle staff noted that tailoring images to specific demographics or targeted audiences is helpful in reaching a greater number of people. The use of visuals is universal regardless of language spoken and may prove to be a less resource-intensive way to reach residents. However, language translations are still needed to provide information to residents.

#### **D. Metrics**

None of the jurisdictions I sampled use metrics to analyze how different education and outreach methods affect food waste recycling rates or participation in food waste recycling programs. One jurisdiction plans to conduct a survey to measure participation rates, which would go out through the jurisdiction's quarterly newsletter both in print and electronically. Though this survey is a work in progress, it is a step in the right direction in terms of beginning to assess participation rates and feedback directly from residents. However, it does not aim to assess which outreach methods work best from the residents' perspectives.

One jurisdiction explained that it tracks the quality, volume and weight of material collected from residents by haulers as a way to assess the contamination rate of the material. The

jurisdiction does not use methods to track how specific education and outreach efforts affect these numbers. The data that is collected, however, could be used in conjunction with additional metrics to assess how education and outreach efforts could be more fully utilized to expand participation and recycling rates. Another jurisdiction explained that as part of the franchise agreement with its waste hauler, there are defined diversion requirements that the hauler must meet. The diversion requirements are not specific to organic materials and are on an increasing scale so that each year the hauler must achieve increased recycling rates through the franchise. If the requirements are not met, there are performance incentives and liquidated damages for noncompliance that come into place. The jurisdiction representative explained that this type of requirement must be put on the hauler in order to ensure that the hauler is making progress towards achieving increased recycling rates and minimizing contamination. While this effort is necessary to track recycling rates, it could be used in conjunction with other methods to track how different efforts affect rates and to see how the jurisdiction and hauler can best use its resources to effectively maximize recycling and participation rates in recycling programs.

#### **E. Major Challenges**

When interviewing representatives from the jurisdictions and waste haulers, the factor that came up the most as one of the biggest barriers to getting residents to participate in food waste recycling programs is the “ick factor.” The ick factor includes perceived issues with collecting food scraps at home, which include the following: odors from the indoor kitchen pail as well as the outdoor organics cart; bugs, such as fruit flies, that could become a problem inside the residences due to the kitchen pail; rodents, such as raccoons, outside near the organics cart; and the grime that might accumulate in kitchen pails and organics cart. Most jurisdictions explain that providing education through electronic and direct contact methods is the best way to combat these barriers.

Another challenge faced by all jurisdictions includes constrained and limited resources. Many jurisdiction representatives work on programs outside of recycling, and cannot devote all of their staff time to work on recycling programs. A lack of monetary and staff resources is a factor that plays into how much time jurisdictions are able to spend on providing education and outreach to residents about recycling programs and in evaluating the effectiveness of those programs.

#### **F. Limitations and Opportunities for Future Research**

There are several limitations to my research. First, none of the jurisdictions or their waste haulers collect data on residents' attitudes towards recycling. Second, this study looked at both multi-family and single family housing. Some jurisdictions and haulers consider multi-family housing residential while others consider it commercial. Additionally, jurisdictions and waste haulers have different requirements on single and multi-family housing, and use different strategies to conduct education and outreach to those residences. This also factors into how jurisdictions and haulers track recycling and waste tonnages. My assessment considers education and outreach methods conducted to both multi-family and single family residences when it could have easily focused on one over the other.

The biggest limitation of my research is that I did not analyze how specific education and outreach methods directly affect organics recycling rates or participation rates. For example, if a jurisdiction began using social media, such as posts on Facebook, in addition to other strategies already being used, looking at whether the organics recycling rate went up, down, or stayed the same during a set time period, while controlling for other factors, could allow the jurisdiction to determine whether there is a correlation between the outreach method and the recycling rate. Most of the food waste recycling programs in the samples are new, so there is little to no benchmark data to indicate how education and outreach efforts might be influencing recycling

rates. Thus, it would not have been possible to conduct this type of analysis. In addition, this type of analysis would have required additional time and resources to conduct. However, this could be an opportunity for future research on the subject and would provide a more thorough and definitive analysis of how specific education and outreach methods affect recycling and participation rates. This would add considerable value to the current literature on the topic.

Despite the fact that I did not have data to conduct a rigorous analysis of how specific education and outreach efforts affect recycling and participation rates, through my interviews I was able to identify approaches that appear to be effective, as discussed in this chapter. I then used these findings to provide recommendations on the use of those methods by jurisdictions and haulers, as discussed in Chapter 5.

### *Conclusion*

As mentioned, Chapter 5 provides recommendations for jurisdictions and their haulers on the best education and outreach methods to utilize to maximize the output of information about recycling programs to residents. The present chapter provided a discussion of the best uses of education and outreach methods used by jurisdictions and haulers. The following points summarize my key findings from the interviews and review of publicly available materials:

1. All jurisdictions use some form of direct contact to provide information to residents.

These methods include conducting door-to-door outreach, hosting workshops and classes, conducting presentations, and providing facility tours. Door-to-door is a method that should be explored more fully to maximize outreach to multi-family residences, which would require significant engagement with property management and continual efforts at each complex.

2. All jurisdictions use a form of electronic media to conduct outreach to residents, including websites, electronic newsletters, and social media. Most jurisdictions

recommend using electronic platforms as an important and effective way to reach residents.

3. All jurisdictions provide messaging regarding the recycling process through electronic media and direct contact efforts. Some jurisdictions and organizations have a more effective use of this messaging than others.
4. Most jurisdictions provide minimal information on the importance of recycling as it relates to broader social issues through electronic media or direct contact methods. All jurisdictions and haulers should focus on providing this information more frequently as part of the outreach methods conducted.
5. All jurisdictions translate some materials into other languages. However, it is unclear to what extent materials are translated, whether the materials are getting to the correct audience, and how the audience reacts to the information.
6. All jurisdictions use some visuals to portray information. Again, some jurisdictions and organizations have a more effective use of visuals than others.
7. No jurisdictions or haulers use metrics to evaluate the effect of education and outreach efforts on participation and recycling rates. All jurisdictions collect tonnage information on the residential sector that could be used to help evaluate effectiveness once metrics are established.
8. Jurisdictions and haulers have identified the “ick factor” as a major barrier towards getting residents to participate in food waste recycling programs. All outreach methods should be utilized to provide information to residents on how to address this barrier.
9. Jurisdictions, haulers, CalRecycle staff, and organizations recommend utilizing a range of methods to maximize outreach to residents, including electronic media and direct contact. It is also necessary to utilize these efforts in conjunction with other



mechanisms, such as providing convenient opportunities to recycling and using enforcement mechanisms.

## **V. Recommendations for Jurisdictions to Increase Participation and Recycling Rates**

### *Introduction*

In this chapter, I aim to answer my research question based on the results of the interviews with jurisdiction representatives, solid waste hauler representatives, CalRecycle staff members, and other stakeholders. This is in addition to my analysis of publicly available education and outreach materials used by jurisdiction, haulers, and other stakeholder organizations. As previously noted, I lack quantitative data about the impact of education and outreach efforts on participation and recycling rates. However, in this chapter, I summarize the implications of the subjective interview data I gathered along with my review of publicly available materials to describe the education and outreach practices that seem to work best for the jurisdictions and waste haulers who are directly implementing food waste recycling programs. I also explain how jurisdictions and waste haulers could improve upon these methods and develop metrics to begin collecting quantitative data. I then discuss why my findings are relevant for jurisdictions to consider as they begin to implement or expand food waste recycling programs.

### *Recommendations*

#### **A. Education and Outreach: A Combination of Direct Contact and Electronic Platforms**

Nearly all jurisdiction representatives that I interviewed, including CalRecycle staff members, recommended using a combination of approaches to maximize outreach to increase participation and recycling rates. The most commonly recommended combination of methods includes utilizing electronic platforms and direct contact methods. The following sections provide my recommendations for the use of outreach methods to increase participation and recycling rates as a result of my research. I also provide recommendations for other methods that were identified as important to improve participation and recycling rates and that should

also be considered.

*I. Electronic: Newsletters, Websites, and Social Media*

Utilizing electronic services allows the jurisdiction or the hauler to send out information to residents on a regular basis. As mentioned, newsletters, both electronically and in print, were cited by jurisdiction and waste hauler representatives as one of the most effective methods to reach all residents and to provide information about recycling programs and messaging about the broader social implications of recycling. The following bullets summarize recommendations jurisdictions and haulers should consider when providing newsletters to residents:

- Continue to provide newsletters electronically or in print. If newsletters are distributed in print, encourage the use of electronic newsletters by residents and upload the newsletter onto the website.
- Continue to provide newsletters to residents quarterly or more frequently and include a range of information about recycling programs and the importance of recycling.
- Incorporate direct and indirect feedback from residents and address recurring issues.
- Translate newsletters into languages other than English so communities that might be linguistically isolated are able to receive the same information. Otherwise, target linguistically isolated communities and provide translated newsletters to those residents.

Websites are another valuable tool for jurisdictions and waste haulers to utilize in order to make information available to nearly all residents. They are relatively easy to manage, do not require an extensive use of resources, and are a resource that is readily accessible. As mentioned, all jurisdictions and waste haulers provide basic information about the recycling programs, such as what materials go into each bin. Websites are also used to provide links to other useful resources such as social media sites or other organizations. However, websites are under-utilized for messaging about the importance of recycling as it relates to climate change

and other social issues. Jurisdictions and their haulers should ensure the best use of their websites for residents through more effective messaging. The following bullets present recommendations jurisdictions and haulers should consider when using websites as a tool to provide information to residents:

- Expand the use of visuals and provide additional materials in other languages.
- Expand information on the mechanics of recycling and access to other helpful resources.
- Significantly increase messaging about broader social issues related to recycling.
- Provide information about direct contact approaches, such as a calendar of events, and available classes and tours.
- Refer to other websites, such as those mentioned in chapter 4, as models for making improvements to webpages.

As discussed, social media platforms are used by most jurisdictions and haulers as a means to conduct outreach to residents. However, it is not clear that those forms of outreach are highly utilized by residents as a way to receive information. Additionally, jurisdictions and haulers did not mention that these methods were as important as providing newsletters and using websites. In order to utilize social media platforms more effectively, jurisdictions and waste haulers should consider the following:

- Advertise social media platforms when conducting other forms of outreach. This could include providing links to these platforms on websites, in newsletters, and in other materials that go out to residents.
- Increase the amount of content that goes out through these platforms to keep residents engaged and using the platforms as a way to gather information.
- Provide visuals, fun facts, messaging on the mechanics of recycling, and messaging on

how recycling relates to broader social issues.

- Promote the use of videos and other media through these platforms.

## *II. Direct Contact*

Direct contact methods were identified by representatives of jurisdictions, haulers, and outside organizations as a useful method that provides residents access to ask questions and voice concerns, and to provide assistance to residents when necessary. Direct contact efforts can enable the hauler or jurisdiction to get feedback directly from residents regarding questions or concerns that can then be addressed through electronic platforms. Many jurisdiction and hauler representatives along with CalRecycle staff explained that direct contact methods must be utilized in order to engage people and help change behavior. They explained that direct contact provides a more personal and individual touch to help people get and stay engaged and understand the importance of recycling. The following are recommendations for jurisdictions and haulers to consider when conducting direct contact outreach approaches:

- Continue attending community events, providing tours, and providing the opportunity to meet with residents in person.
- When hosting community events, classes, and workshops, representatives should “walk the talk” by ensuring that recycling is in place at hosted events. This helps emphasize the importance of recycling to residents.
- Emphasize the availability of facility tours as a method for providing valuable information about the recycling process.
- Engage local government officials and encourage them to get involved in promoting and emphasizing the importance of recycling programs to residents. This includes providing presentations to local government officials to keep them apprised of local recycling programs, and could include inviting officials to tour

facilities.

- For multi-family complexes, the best way to reach the greatest number of residents is to go door-to-door with materials, including kitchen pails and informational fliers, and with language translators. This includes engaging directly with property management to ensure information is passed along to residents. Door-to-door requires conducting outreach throughout the complex every 6 months, or once a year at a minimum.
- One or more direct contact methods should be utilized to message technical information about the recycling process and information about the importance of recycling as it relates to broader social issues.

#### **B. Other Methods: Convenience and Enforcement**

Though my research focuses specifically on education and outreach methods that are utilized by haulers and jurisdictions, I did receive feedback from CalRecycle staff, and representatives of jurisdictions, haulers, and other organizations that other methods to increase participation and recycling rates are necessary to use in conjunction with education and outreach. These include convenience and enforcement mechanisms.

As discussed in the literature review, convenience was proven to significantly affect recycling behavior and rates. Convenience was also discussed as a method used by jurisdictions and haulers as a way to overcome the “ick factor.” Recommendations regarding convenience include:

- Providing kitchen pails, along with other educational materials, to residents at the onset of food waste recycling programs, and making these materials easily available to new residents.
- Providing kitchen pails to multi-family complexes to improve participation and rates.

- Providing information with kitchen pails regarding how to line the pails with newspaper to keep them clean.

Another critical factor that was mentioned by many jurisdiction representatives and CalRecycle staff members is the need for enforcement mechanisms to ensure that residents are participating in programs and putting materials in the proper bins. This includes making programs mandatory instead of voluntary for residents. An example of an ordinance that is having success in increasing recycling and participation rates is StopWaste's ordinance, which requires commercial entities and multi-family complexes to recycle or compost generated waste. The ordinance allows haulers to flip the lids of containers that look as though they may be contaminated and to tag bins to notify residents that the hauler will not pick up the bin until the materials are properly sorted. Nearly all of the jurisdictions in Alameda County have a waste diversion rate of 65-75 percent, as opposed to the minimum state requirement of 50 percent, which a CalRecycle staff member attributed in part to the prescriptive requirements of the ordinance along with the use of enforcement mechanisms. When implementing an ordinance or a new program, jurisdictions and haulers should consider:

- Modeling ordinances off of other successful ones, such as StopWaste's.
- Making participation in food waste recycling programs mandatory.
- Including prescriptive measures to ensure that all regulated entities, including residents, know what is required.
- Ensuring that haulers are responsible for a particular aspect of the program, such as training, providing education, lid flipping, and bin tagging.

### **C. Metrics**

If jurisdictions are meeting their AB 939 mandate, which is the requirement that no less than 50 percent of generated solid waste is diverted, then they may not be interested in learning

about how specific education and outreach methods, along with any other strategies, specifically affect recycling rates. In addition, if they are implementing their mandatory commercial recycling and mandatory commercial organics recycling requirements, as mentioned in the introduction, the jurisdictions may not be interested in collecting and analyzing data to see how education and outreach strategies affect recycling rates in those programs. However, as stricter requirements come into effect to divert food waste and achieve a statewide 75 percent organics recycling goal, jurisdictions will need to ramp up their education and outreach methods to significantly increase the recycling of food waste. Although those regulatory requirements are still being developed by CalRecycle, the state's requirements will likely be less lenient than they are for other laws in regards to how jurisdictions implement and enforce their recycling programs.

As mentioned, one of the most important things I learned from my research is that most jurisdictions do not use metrics for determining how effective their education and outreach methods are in increasing participation and recycling rates. Additionally, most jurisdictions do not use metrics for determining the effectiveness of other strategies, such as enforcement measures, on recycling rates. Since food waste recycling programs are new for many jurisdictions, little data has been collected by local governments to benchmark and assess how education and outreach methods have influenced organics recycling rates. Thus, jurisdictions should create metrics to determine how specific education and outreach methods, and other strategies, affect recycling rates.

There are three types of metrics that jurisdictions and solid waste haulers should consider developing:

1. The first entails collecting quantitative data. Examples could include the number of times an outreach method was conducted, the amount of resources and staff time spent



on that method, the number of people reached, the tonnage of collected organics from those residents, etc. Using this type of data would be beneficial in establishing benchmarks to allow a jurisdiction to see how recycling rates go up or down during the implementation of a specific outreach method. It could also be used to assess the amount of resources spent on that particular method. These metrics should be the first step for jurisdictions and solid waste haulers to implement metrics in order to begin assessing how education and outreach strategies affect participation and recycling rates.

2. Once a jurisdiction and solid waste hauler have developed metrics to assess outreach or other efforts using quantitative data, they could then measure the quality of those efforts. Jurisdictions or their haulers could do this by building in control groups when trying a new approach, conducting before and after surveys of the materials in residential carts, or conducting surveys of residential participation in the program and an assessment of particular outreach strategies on that behavior.
3. Finally, the jurisdiction could measure how its residents are better off as a result of its efforts. For example, if the materials are effective at explaining how to recycle and why it is important to recycle, the jurisdiction should be able to measure, such as through a survey or other means, whether the residents are actually better at recycling specific materials, and understand how its efforts affect larger systems, such as the economy and environment. This could be assessed through measuring actual recycling rates and through conducting a survey to residents.

During my research, I assessed two organizations that work directly with cities and counties to implement recycling programs and that conduct targeted education and outreach efforts to increase recycling and participation rates. These organizations, Global Green USA and StopWaste, use metrics to assess how particular education and outreach methods affect

recycling and participation rates. These two organizations provide model examples of what jurisdictions and solid waste haulers should strive for in terms of developing metrics to assess their education and outreach efforts. During Global Green's pilot food waste recycling project in which they implemented door-to-door outreach in conjunction with other methods, the organization used a variety of metrics to assess how their outreach strategies affected participation and recycling rates. Global Green provided a pre- and post-consumer survey to all residents in a participating multi-family complex to assess residents' attitudes and behaviors regarding food waste recycling. The organization also conducted pre- and post-waste audits, which included measuring the amount of compostable material in the trash and organics carts, along with contamination rates of organics carts.

A representative from StopWaste explained that during a similar project, the organization provided periodic phone surveys to residents to assess a number of issues including awareness of the program, availability of and access to the program, diversion rates, attitude and stated behaviors, among other factors. Over the course of 3-4 years, StopWaste gathered benchmark data, which included measuring the amount of recyclables and food scraps in the garbage carts at single and multi-family homes. These methods provide an excellent example of what jurisdictions should aim to develop and incorporate into their recycling programs.

Many jurisdictions and solid waste haulers may not have the expertise or resources to create these types of metrics. One way to address this problem is to have CalRecycle develop a prototype of different types of metrics that jurisdictions and solid waste haulers could use or modify to suit their needs. This would save time and resources for the jurisdictions and would be technical assistance provided by CalRecycle. In addition, CalRecycle could put requirements in the SB 1383 regulations to mandate that jurisdictions or their solid waste haulers develop metrics to assess how certain efforts, such as outreach or ordinances, affect recycling rates.

Metrics are necessary to track how an effort is affecting a desired outcome. If there are no metrics to determine the effectiveness of an activity, then it is difficult to know if resources and efforts could be better used elsewhere.

#### **D. Partner with Other Organizations**

In order to help with resource constraints or a lack of expertise on how to develop appropriate metrics to assess education and outreach methods, jurisdictions and their waste haulers should consider partnering with other organizations to conduct some or all of their education and outreach or to pilot a specific outreach strategy. Outside organizations like StopWaste and Global Green have many more resources available to expend on conducting targeted education and outreach methods and to study the effect of those methods on recycling rates. Partnering with organizations like these could help local government staff who are constrained by limited staff and resources gather benchmark data and establish metrics. These organizations have proven to be effective at conducting the type of analysis that is needed by local governments to focus their efforts more efficiently to increase food waste recycling rates. In addition, these organizations can offer advice and expertise on other mechanisms they use to increase participation and recycling rates, such as enforcement mechanisms and convenience factors.

#### *Conclusion and Implications*

Though my research covered only six jurisdictions that are located within the Bay Area Peninsula, it is likely that my findings can be extrapolated to other jurisdictions, as the findings are not specific to jurisdictions with particular demographic or geographic characteristics. As CalRecycle develops regulations to implement SB 1383, it is likely that all jurisdictions will need to have a food waste recycling program for residents and it will likely be a mandatory requirement. In order to ensure the success of these programs, and ensure the best use of

resources and staff time, jurisdictions should consider the recommendations provided in this section, especially as they relate to the development and use of metrics. Each jurisdiction would need to consider the recommendations as they relate to specific problems identified within the jurisdiction and tailor the recommendations to its needs.

More specifically, following are the key recommendations that jurisdictions and waste haulers should consider based on my findings:

1. Direct contact efforts should continue to be a priority for jurisdictions and haulers as a way to provide information to residents. Door-to-door outreach should be more fully explored by jurisdictions as a method for expanding outreach to multi-family residences.
2. Electronic platforms should be used to ensure outreach is maximized to all residents. This includes emphasizing the use of websites and newsletters, and using these platforms to increase access to and the use of social media platforms.
3. Messaging should include an extensive overview of the recycling process, including what is recyclable, which materials go into each bin, how to line kitchen pails, rate information, and how to deal with common challenges such as odor and insects, among other general information. Most jurisdictions and waste haulers can improve this information on their public websites and outreach materials.
4. Messaging should include information on how recycling relates to climate change, the economy, the creation of green jobs, energy conservation, water conservation, and natural resources conservation, among other broader social issues. Jurisdictions and haulers should place more emphasis on increasing this type of messaging when conducting outreach.
5. Messaging should include the use of universal images that can be understood by all

individuals regardless of the primary language spoken. Visuals should be tailored towards specific demographics. Jurisdictions and haulers should place additional emphasis on increasing the use of visuals through all outreach efforts.

6. Jurisdictions and haulers should increase the translation of materials on electronic platforms and in print to maximize outreach to individuals and communities that speak a language other than English at home.
7. Metrics should be developed and used in order to assess how education and outreach efforts along with any other efforts that are being utilized (i.e. convenience and enforcement) affect recycling and participation rates. This would help ensure an efficient use of resources.
8. Jurisdictions and solid waste haulers should partner or consult with other organizations that have specific expertise and resources to evaluate and assess education and outreach methods through the development of metrics, and to provide other technical expertise.

To reiterate, my research has shown that jurisdictions can improve participation and recycling rates in local programs and can do so through a variety of methods, including more focused and targeted education and outreach efforts. With new regulations regarding the implementation of food waste recycling programs approaching within the next five years, jurisdictions and their waste haulers will be forced to figure out 1) how to implement food waste recycling programs for generators of organic waste, and 2) how to implement the programs in a manner that ensures that the jurisdiction can measure recycling and participation rates in order to continually improve them. Taking my recommendations into consideration could help jurisdictions as they implement new programs or as they look to improve and expand existing programs. No matter what a jurisdiction's local program recycling and participation rates are, they can always be improved. This thesis has provided insight into some of the mechanisms that

can be used to improve those rates and help California achieve its ambitious recycling and climate change goals.

## Appendix A.

### Literature Review Summary

<b>Authors and Year</b>	<b>Ando, Amy; Gosselin, Anne (2005)</b>	<b>Culiberg, Barbara (2014)</b>	<b>Ebreo, Angela; Vining, Joanne (1990)</b>
<b>Data Used &amp; Method of Analysis</b>	Applies probit and double-censored tobit analysis to survey data from 214 households in Urbana, Illinois.	Data collected from a sample of Slovenian consumers. The proposed conceptual model was tested using structural equation modelling. In-depth interviews were conducted with eight individual consumers.	Total respondents included 87 non-recyclers and 100 recyclers from randomly selected households in Urbana and Champaign Illinois in May of 1986.
<b>Dependent Variable(s)</b>	Recycling rates	Consumer intention to recycle	Recyclers and non-recyclers
<b>Measure of Dependent Variables</b>	The percent of total waste the household recycles, the percent of newspaper waste they recycle, the percent of recyclable containers they actually recycle, and the percent of recyclable non-newspaper paper fiber they actually recycle	The respondents' intentions to recycle were measured with a 7-point semantic differential scale, setting the anchors at: likely-unlikely, possible, impossible, certain-no chance.	Recyclers: individuals who indicated that they recycled some materials within the last year. Non-recyclers: individuals who indicated that they did not recycle.
<b>Explanatory Variables</b>	Household size, gender composition, age, education, work/ student status, physical situation of the dwelling/ convenience	Gender; Age; Attitude towards recycling; moral obligation, i.e. the level of guilt to perform the behavior; moral intensity, i.e. the moral issue characteristics; collectivism, i.e. an individual-level value orientation	Knowledge; Motives; gender; household size; occupation; education level; age; income level
<b>Statistically Significant Effect / Results</b>	Factors that decrease the time cost of recycling have significant positive correlations with recycling rates in multifamily dwellings. Strong connection between recycling rates and perceived presence of adequate interior space for recycling. Distance to recycling bins affects container-recycling intensity.	Proposed ethical constructs, i.e. moral obligation, moral intensity and collectivism, significantly explain consumer attitudes and intentions related to recycling. Individuals who feel higher levels of responsibility to recycle more likely intend to recycle. More collectivistic individuals have more positive attitudes towards recycling. Higher levels of moral obligation positively influence intentions to recycle.	Minimal demographic differences between recyclers and non-recyclers. No differences in gender, household size, occupation, or educational level. Recyclers were older than non-recyclers, and reported slightly higher income levels.
<b>Authors and Year</b>	<b>Ebreo, Angela; Vining, Joanne (1992)</b>	<b>Evans, Robert; Mukherji, Jyotsna; Mukherji, Ananda (2011)</b>	<b>Ha, Sejin; Park, Joohyung (2014)</b>
<b>Data Used &amp; Method of Analysis</b>	Surveyed recycling attitudes and behaviors of residents of Champaign,	In-person survey in English and Spanish to 262 residents in a mid-size city in Texas.	Data on consumer intention to recycle collected from a panel of

	Illinois in 1986, 1987, and 1988. Longitudinal assessment of variables as a function of changes in the solid waste management policies in the area.		U.S. consumers through a web-based survey. Final sample consisted of 421 participants. Structural equation modeling was employed to test the proposed model.
<b>Dependent Variable(s)</b>	General environmental concern; specific recycling attitudes; recycling behavior	Hispanic recycling behavior measured by recycling effort and environmental concern	Consumer intention to recycle
<b>Measure of Dependent Variables</b>	General environmental concern as measured by the New Environmental Paradigm; Specific recycling attitudes as measured by constructs of the Schwartz moral norm model; Recycling behavior as measured by respondents' survey answers regarding if they participated in any recycling program in the past year; Recycling behavior: the total volume of materials recycled obtained from the city of Champaign and from the Community Recycling Center.	Environmental concern: four-item scale. Recycling effort measured by asking: "Recycling requires a lot of extra time, and "... takes lot of extra space."	Consumer intention to recycle measured using a three-item scale, which was assessed using a seven-point Likert-type scale (1 = strongly disagree, 7 = strongly agree).
<b>Explanatory Variables</b>	Age; gender; occupation	Demographic information; importance of recycling; inconvenience of recycling; length of past recycling; non-availability of bags	Age; Gender; Race; Highest education; Highest income;  <i>Variables from TPB and NAM:</i> Awareness of consequences; subjective norms; attitude; personal norms; perceived behavioral control.
<b>Statistically Significant Effect / Results</b>	The curbside program was highly successful in enlisting greater cooperation among recyclers and in converting non-recyclers to recyclers.	Key drivers of recycling were convenience, effort, past experience, and availability of bags. The importance of recycling was not a principal driver of recycling behavior. Concern for the environment was a partial driver of efforts.	Results support that personal norms with attitude and perceived behavioral control influence intention to recycle. Subjective norms influenced the intention to recycle indirectly through attitude, personal norms, and perceived behavioral control. Awareness of consequences influenced intention to recycle indirectly through attitude, subjective norms, and personal norms.



<b>Authors and Year</b>	<b>Iyer, Easwar; Kashyap, Rajiv (2007)</b>	<b>Joshi, Satish; Lupib, Frank; Sidiquea, Shaufique (2010)</b>	<b>Northrup, Denine; Seacat, Jason (2010)</b>
<b>Data Used &amp; Method of Analysis</b>	Longitudinal field experiment. Two residence hall clusters at two different locations on the campus of a large university served as experimental sites.	Survey of drop-off site visitors. Data collected through in-person interviews at eight drop-off recycling sites in Lansing area in Michigan. Use endogenous stratified and truncated Poisson regression	Telephone surveys with two random community samples in Western Massachusetts. Adaptation of the empirically validated Information–Motivation–Behavioral Skills model (IMB).
<b>Dependent Variable(s)</b>	Four dependent measures at the individual level: recycling attitudes, recycling behaviors, environmental attitudes, environmental behaviors. Four dependent measures at the group level: recycling output for paper and glass; contamination for paper and glass	Trips an individual took to a recycling site in past year	Participants' curbside recycling behavior
<b>Measure of Dependent Variables</b>	Individual level recycling attitudes measured using 10 items. Individual level recycling behaviors measured using 5 items. Individual level environmental attitude measured using 15 items. Individual level environmental behavior measured using 13 items. Recycling output measured by the amount of recycled paper collected in the blue bins and recycled glass collected in the red bins at each site.	Trips taken by sample members	Curbside recycling behavior assessed with global question: "Of all the products in your household that could be recycled curbside, approximately what percentage do you regularly recycle?" Respondents provided input of percentage recycled with range of 0–100%.
<b>Explanatory Variables</b>	<i>Social Class</i> : household income; level of both parent's education; parent's occupations <i>Demographics</i> : age; gender <i>Interventions</i> : incentives; information	Total number of site visits in last 3 months; total number of site visits in last year; total round-trip distance from home to site; number of different types of recyclables brought onsite; time taken to sort recyclables brought; access to curbside recycling; educated with bachelor's degree or higher; annual household income; household size; age; gender; marital status; employment status; affiliation with environmental org	Gender; level of education; employment status; household income; living status; participants' levels of recycling information and recycling motivation; participants' recycling behavioral skills
<b>Statistically Significant Effect / Results</b>	Either intervention program is effective, but information programs have more long-term effects.	All coefficients are statistically significant at 5% except three, indicating access to curbside recycling services, gender and education level do not have	Analysis indicated that participant levels of information, motivation and behavioral skills all significantly associated

		statistically significant effects on the expected number of site visits.	with percentage of household products regularly recycled through curbside recycling. To influence recycling behavior, interveners must make community recycling information accessible, provide rationale and motivation to individuals to promote recycling, and teach citizens the necessary recycling skills.
<b>Authors and Year</b>	<b>Owen, Ann; Videras, Julio; Wu, Stephen (July 2012)</b>	<b>Thøgersen, John (2003)</b>	<b>Tsai, Tsung-hsiu (2008)</b>
<b>Data Used &amp; Method of Analysis</b>	U.S. survey on pro-environmental behaviors, attitudes, and knowledge. Data for approximately 1,700 respondents from a new nationally representative U.S. household survey conducted in 2007. Ordered probit models, ordered logit models, ordinary least squares	Random sample from two groups of three municipalities in the Netherlands. Households in one group pay a fixed fee for garbage collection, the other group pays a fee on the weight of the garbage. Structural equation modelling (SEM)	Data drawn from city and county data from the Directorate General of Budget, Accounting and Statistics of the Executive Yuan in Taiwan from the years 1998 - 2004. Regression analysis on how social capital affects recycling rates. Fixed effect model in conjunction with OLS.
<b>Dependent Variable(s)</b>	Environmental and recycling behavior	Recycling behavior	Recycling rate
<b>Measure of Dependent Variables</b>	The frequency over the past 12 months individuals undertake behaviors out of concern for the environment.	Self-reported material recycling	The amount of waste recycled divided by total amount of waste collected from sanitation units in local governments, schools, communities and offices.
<b>Explanatory Variables</b>	3 variables measure basic knowledge about climate change; degree to which individuals think their actions influence environmental quality; 2 variables related to individual's overall propensity to contribute to public goods; age; race; education; marital status; health status; household income; homeownership; geographic factors	Monetary incentives; demographic variables; self-reported home composting; personal norms; perceived self-efficacy; knowledge of the collection fee type; opportunities for composting	<i>Social capital</i> : percentage of volunteers in a population above 15 years old and the number of social organizations per thousand people.  <i>Other demographics</i> : regional income; education; local government expenditures on environment; community development; percentage of people under 14 and over 65.
<b>Statistically Significant Effect / Results</b>	Beliefs affect behaviors. The voluntary provision of the public good might increase or decrease as	Households with a pay-by-weight scheme delivered more recyclable materials to recycling and composted more fruit and	A region's social relations are highly correlated with its recycling performance. A region's degree of social

	individuals learn about the impact of their activities. Higher perceived impacts correlate with higher frequency of pro-environmental behavior.	vegetable waste in the garden. Economic incentives enhance internalized motivation.	capital increases its recycling rate.
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**Appendix B.**  
**Interview Protocol**

Questions for Jurisdiction Recycling Coordinators and Waste Haulers:

1. Basic residential food waste recycling program information:
  - a. How long has the food waste recycling program been in place in the residential sector?
  - b. Are residents provided a kitchen pail and separate cart?
  - c. Is it mandatory for single family homes? For multi-family homes?
  - d. What do you consider as multi-family housing?
2. Which material types are included in the food waste recycling program for residences (i.e. food waste, green waste, food soiled paper, etc.)?
3. Which education and outreach methods or strategies do you employ (e.g. letters with utility bill, email, door-to-door, public meetings, etc.) to encourage participation and recycling rates in the program from the residential sector?
  - a. Do the methods explain to residents the process of recycling (e.g. what's recyclable, how to prepare materials)?
  - b. Do the methods message the importance of recycling (such as in relation to climate change, green job creation, natural resources conservation, energy conservation, etc.)?
4. Do you target a specific demographic (e.g. gender, age, income level, etc.) or the entire residential sector?
5. What are current participation and recycling rates (i.e. percentages, actual numbers, or other relevant data points) of the residential sector included in the program?
  - a. How do you know?
  - b. Is any data regarding participation and recycling rates that is publicly available?
6. Do you use any metrics for determining the effectiveness of the education and outreach

methods used to increase participation and recycling rates in the residential sector?

7. Are there any specific patterns or trends regarding participation rates that you've been able to identify (i.e. demographic differences, location, disadvantaged communities, etc.)?
8. Given what you've learned from the program thus far, have you done anything differently to expand participation and recycling in the residential sector (e.g. what has worked well, what hasn't)?
9. What do you see as the greatest difficulty in increasing participation and recycling rates in the residential sector?

Questions for CalRecycle Staff:

1. Basic residential food waste recycling program information:
  - a. How long has the food waste recycling program been in place for the residential sector?
  - b. Are residents provided a kitchen pail and separate cart?
  - c. Is it mandatory for single family homes? For multi-family homes?
  - d. What does the jurisdiction consider as multi-family housing?
2. Which material types are included in the jurisdiction's food waste diversion program for residences (i.e. food waste, green waste, food soiled paper, etc.)?
3. Which education and outreach methods or strategies does the jurisdiction employ (e.g. letters with utility bill, email, door to door, public meetings, other) to encourage increased participation and recycling rates in the residential sector?
4. Do you have any data or information on the participation and recycling rates (percentages, actual numbers, or other relevant data points) of the jurisdiction's food waste recycling program in the residential sector?
5. Do you know of any metrics for determining the effectiveness of the education and outreach methods that are particularly useful for increasing participation and recycling rates in the

program from the residential sector?

6. Are there any best practices regarding increasing participation and recycling rates in the residential sector that CalRecycle shares with jurisdictions to help improve programs?
7. From your role as CalRecycle staff, have you noticed any particular trends or patterns in the use of specific education and outreach methods that are used by jurisdictions to increase participation or recycling rates in programs?
8. Are there any other specific methods, outside of education and outreach, that the jurisdiction has employed that have been noticeably effective in increasing participation and recycling rates from the residential sector?
9. What do you see as the greatest difficulty in increasing participation in and food waste recycling from the residential sector for the jurisdictions?

Questions for Other Stakeholders:

1. Which education and outreach methods or strategies do you know of that local jurisdictions tend to employ (e.g. letters with utility bill, email, door to door, public meetings, etc.) to encourage participation in food waste recycling programs in the residential sector?
2. What do you see as the greatest difficulty for jurisdictions to increase participation and recycling rates in the residential sector?
3. What do you see as the greatest place for potential improvement for jurisdictions to increase participation and recycling rates in the residential sector through the use of education and outreach strategies? Through other methods?
4. Do you know of any metrics that jurisdictions use to determine the effectiveness of education and outreach methods for their recycling programs?
5. Are there any best practices that you know of regarding increasing participation and recycling rates of food waste recycling programs in the residential sector?

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