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2015-16 CENTRALIZED STUDY ON AVAILABILITY OF RECYCLING

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FOREWORD FROM THE STUDY ORGANIZER

Dear Readers,

I believe the findings in this report will be pivotal to the way we assess recycling programs and the recyclability of packaging and containers.

The questions we ask to gauge the health of recycling are evolving, and our study findings reaffirm our need to dig deeper. The conventional question asks whether or not consumers *have* recycling programs. Our study found, as have previous studies, that over 90% of Americans have a recycling program of some type available to them, and by the measure of our conventional question, that figure is encouraging. America is nearly saturated with recycling programs, and if recycling could be improved, it's surely not an issue of lack of programs. But follow-up questions must be asked. Are they *good* programs? Are they convenient? Are they likely to be used? How do we reconcile a soaring rate of recycling program availability with the relatively low rates at which many types of packaging are recycled? Our study sheds light on these questions. We now have useful information on the availability of *quality* recycling programs, and a new sense of the opportunity to raise the bar for recycling as a whole.

At its core, this study was conducted to understand the acceptance of different types of packaging in recycling collection programs, revealing the first part of the answer to a complicated question: is this package recyclable? Never before has a study included so many types of packaging with such a robust study methodology. We should feel confident that the national acceptance rates discovered by this study are the most comprehensive data ever produced. It also must be recognized that other questions need to be answered in order to understand the full picture of recyclability. Recycling is a sequential process of collection, sorting, and reprocessing, and this study focuses solely on collection. Recycling rates, by contrast, describe the *other* end of the recycling process, telling us the rate at which something *completes* the recycling process, and serve as a useful complimentary piece of information. When assessing the recyclability of a package, we hope these study findings are used, and we hope there is an appreciation for the additional information needed.

Our study examined consumer-facing recycling instructions across the United States, and it is clear that those instructions need to be improved and harmonized. The acceptance of many types of packaging is left ambiguous too frequently. In addition to improving the accuracy of this study, improving instructions will simply improve recycling. Consumers need clear, concise, and consistent guidance. Harmonizing consumer-facing recycling instructions is not a small task, as there are several thousand recycling collection programs. The good news? All these programs go to sortation facilities that number in the hundreds. Harmonization is possible, and our study findings reinforce the need to address this challenge.

It also should be recognized that there are other types of collection that were not included in this study. Away-from-home recycling, commercial recycling, container deposit redemption centers, take-back programs, and other means of collection are notoriously challenging to quantify. Yet, much of our generation of recyclables does not occur at home. These collection programs are an important part of our recycling systems and they need to be understood in addition to at-home recycling.

As with all good studies, there are follow-up challenges, but they do not diminish the pride for what we have accomplished. This study is the result of an unprecedented level of collaboration between industry, government, and the NGO community involving two years of constructive conversation and careful planning. As for the challenges, our common stake in healthy recycling programs will continue to drive us. There is much more work to do, and we look forward to doing it together.

With warm regards,



Adam Gendell

Associate Director, Sustainable Packaging Coalition



EXECUTIVE SUMMARY

Through the collaboration of a dozen stakeholders and the leadership of the Sustainable Packaging Coalition, the *2015-16 Centralized Study on Availability of Recycling* provides national data on the availability of curbside and drop-off recycling programs for U.S. residents. The study, conducted in late 2015 and early 2016, involved direct research on recycling programs serving 50% of the U.S. population, and research on a random sample of recycling programs serving the other 50%. In all, over 2,000 community recycling programs were reviewed to understand the types of services provided and the materials each program accepted for recycling.

The key findings of this study include:

- 94% of the U.S. population has some type of recycling program available to them, including both curbside and drop-off recycling programs.
- Curbside recycling programs are available to 73% of the U.S. population, with 53% of the population having curbside recycling “automatically” provided at their home, while the other 20% has a type of subscription or opt-in recycling program available.
- Drop-off recycling programs are available to 64% of the U.S. population. For 21% of the population, drop-off recycling programs are the only programs available.
- 6% of the U.S. population has no recycling programs available.
- Recycling programs were more widely available to residents in higher-population communities, compared to less populated areas.
- Almost 90% of residents with single-family curbside recycling programs now have single stream collection.
- Large rolling carts for recycling collection are now used by at least 44% of residents in single family-based curbside recycling programs, and are used by more programs than use traditional recycling bins.

Additional findings of the study, published separately, provide an estimate of the availability of recycling programs for over 40 different materials. These findings are provided in condensed form in the *Findings* section of this report.

BACKGROUND AND PURPOSE

Measuring and analyzing availability of residential recycling programs is important for stakeholders in the recycling industry, since having these programs available is a fundamental prerequisite for material recovery to take place. This information is also key to inform the packaging supply chain about the current availability of recycling for their products so they can be strategic in expanding recycling as an end of life solution. Yet recycling availability remains a challenge to quantify, in large part due to the patchwork of different ways Americans receive recycling services. Recycling programs can be curbside or drop-off, automatic or opt-in, and differ in a multitude of other ways – from the availability of multi-family services to the ways residents pay for recycling services or even how they receive recycling bins. And despite the Federal Trade Commission's (FTC) Guides for the Use of Environmental Marketing Claims ("Green Guides") thresholds for marketing packaging as recyclable, the specifics of what counts as "availability of recycling" has been left open to interpretation, making it difficult to compare this measurement across different studies.

The Sustainable Packaging Coalition's Centralized Study on Availability of Recycling used a standardized methodology to evaluate both general characteristics of U.S. recycling programs and specific availability-of-recycling metrics for a wide range of materials.

By measuring the prevalence and characteristics of recycling collection programs, this study presents a national snapshot of the ways in which consumers are able to participate in recycling at this point in time, and allows recycling stakeholders to identify and analyze gaps in service provision. Furthermore, the data collected updates producers on the acceptance of different types of packaging in recycling programs so that informed choices can be made upstream.

Finally, the study provides substantiation data on the availability of recycling for specific products and packages to marketers making recyclability claims, while noting that the data presented is not intended to represent, in and of itself, any claims regarding the recyclability of items covered in this study. Note that the liability for making a recyclability claim rests on the entity making the claim, as described by the Federal Trade Commission in Section 260.2 of the "Green Guides".

Through the SPC's leadership and the collaboration of multiple packaging stakeholders, this study not only provides recent recycling program availability measurements, but in addition demonstrates a replicable approach and methodology that can be used in future research.

ACKNOWLEDGEMENTS

Resource Recycling Systems (RRS) and Moore Recycling Associates would like to acknowledge the project sponsors for funding this study. In alphabetical order, they are:

- Plastics Division of the American Chemistry Council (ACC)
- Carton Council (CC)
- Closed Loop Fund (CLF)
- Consumer Specialty Products Association (CSPA)
- Can Manufacturers Institute (CMI)
- Foodservice Packaging Institute (FPI)
- Glass Packaging Institute (GPI)
- National Association for PET Container Resources (NAPCOR)
- SPI: The Plastics Industry Trade Association (SPI)
- Steel Recycling Institute, a business unit of the American Iron and Steel Institute (SRI)
- The Aluminum Association (TAA)
- The Recycling Partnership

We would also like to thank the Sustainable Packaging Coalition for convening the group of funding stakeholders, and the study advisors Adam Gendell (SPC), Kent Foerster (U.S. Environmental Protection Agency), Keefe Harrison (The Recycling Partnership), and Scott Mouw (North Carolina Department of Environmental Quality) for their valuable input during the planning process and review period.

DEFINITIONS

- **Availability of recycling** for this study is defined by a resident having one or more of the following services, measured separately in this study, at their place of residence:
 - Curbside recycling provided automatically to their home by public or private service providers, or
 - Curbside recycling provided on an opt-in or subscription basis to their home by public or private service providers
 - A publicly or privately operated drop-off recycling location within the municipality where the resident resides. Residents living outside the community where the drop-off is located are considered to have drop-off recycling available if their own municipality, county, or other local government directs them to that drop-off location as the appropriate recycling outlet.

Note that the study measures **availability** of recycling, not recycling rates or recycling participation.

- **Curbside** collection of recycling means that recycling is collected from homes after residents set out materials on the side of the street. In this study it is also used to refer to programs for apartment complexes where collection containers for recycling are located anywhere in the complex.
- **Drop-off** recycling refers to a program where residents bring recyclables to a collection point away from their residence.
- **Bins** are open-top containers typically 14 to 18 gallons in capacity, used to hold recyclables for curbside collection.
- **Carts** are large wheeled containers with lids, ranging in capacity from 30 to 100 gallons. Carts used for recycling collection are most frequently 64 or 96 gallons in capacity.
- **Automatic** - In an automatic program, residents receive recycling services, including bins or carts in programs that use them, by default as part of standard waste collection services. These services may be provided by municipal employees or by a contractor.
- **Opt-in** - An opt-in program, for the purposes of this study, is one provided by a community or its contractor, in which residents must sign up and in some cases pay an additional fee to participate in recycling.
- **Subscription** - In a subscription-based program, residents hire curbside recycling services on an individual basis from their choice of private service provider. These services may be bundled with the cost of regular trash collection, or priced separately.
- **Single Stream** refers to a system in which all recyclables are commingled in one container for collection and sorted after collection at a Material Recovery Facility (MRF).
- **Dual Stream** refers to a system in which recyclables are sorted into two groups ("streams"), typically containers and fiber, for separate collection. Each stream may be further sorted at a MRF.

- **Source-Separated** refers to a system in which recyclables are sorted into three or more streams prior to collection.
- **Mixed Waste** refers to a system in which all recyclables and household trash are commingled into one container for collection. Recyclables are sorted from trash after collection at a specialized mixed waste material recovery facility.
- **Single Family** housing typically refers to a detached dwelling in which one household resides. However, in recycling programs, “single family services” are often offered to residents in buildings with up to 2-8 residential units. See the methodology section below for further discussion of this study’s approach.
- **Multi Family** refers to buildings with more than one residential unit. For recycling program purposes, the definition of multi-family may vary from one community to another. This is discussed in the methodology section below.
- **Uptake Rates** refer to the percentage of the population offered an opt-in or subscription recycling service who chooses to receive that service, by signing up, subscribing, or paying the required fees, depending on the program requirements.

METHODOLOGY

SELECTION OF COMMUNITIES TO BE SURVEYED

Drawing on existing data sets identifying the local governments in each state that provide recycling services, and taking into account demographic factors such as households, population, and multi-family and single-family housing unit counts, the project team defined two groups of sample communities.

The first group consisted of a comprehensive, non-random census of over 1,600 communities consisting of the largest communities in each state, in total representing at least 50% of each state's population.

The second group consisted of a stratified random sample of approximately 500 smaller communities nationally, with representation from each state. In constructing the random sample, the database of 41,000 communities was stratified so that the sample represents each state as well as a selection of urban, rural, and suburban communities. The aim of this stratification was to fully capture the variation in recycling policies, requirements, and materials banned from landfill disposal across state lines.

Both the random and non-random samples were drawn from a custom data set of approximately 41,000 "geographies", as defined by the U.S. Census Bureau. These geographies correspond to the local governments in each state that provide recycling services, taking into account that the relevant geographic unit (e.g. city, county, town, township, village, or unincorporated community) tends to vary from state to state. The lists of geographies in each state were taken from the U.S. 2010 Decennial Census. For each geography, demographic data on households and population was also sourced from the 2010 Decennial Census. In the states where the Census "Place summary level" is used (corresponding to incorporated cities, towns, and unincorporated communities), the population in the unincorporated county area that lies outside of the municipal boundaries is not included in the Census data by default. Therefore, additional geographies have been constructed to encompass the remainder of each county that lies outside of the boundaries of the defined places. The population in these remainders is equal to the total population of the county less the population contained in the defined places, or parts of defined places, within the county.

Since recycling services often differ for residents of single-family versus multi-family housing, data was also obtained from the U.S. Census American Community Survey (ACS)'s 2014 5-year estimates on the percent of each community's population in single family homes, 2-4 unit structures, and structures with 5 or more units. For smaller geographies where this data was unavailable, percentages from the county level were applied. The definition of a "single-family home" can vary for the purposes of recycling service provisions and "single-family" programs typically include structures of 2-4 units as well, and in some cases up to 6- or 8-unit structures. For this reason, it was part of the study's research process to check how each recycling program defined multi-family units, their inclusion in the recycling program, and the type of service provided, if any. The total population served by the program was then estimated from the ACS data on the breakdown of housing units. Programs that did not specify the type of unit serviced were assumed to include permanent 1, 2, 3, and 4-unit structures. Residents housed in mobile homes, vans, etc., were not assumed to be included in the recycling program unless specified.

RESEARCH PROCESS

INITIAL RESEARCH

For most of the data sought in this study, the research method consisted of third-party verification in which the researchers independently reviewed public-facing recycling program information and materials and evaluated them for details on the program and items accepted. This method of data gathering was selected over a survey method because it is accurate, transparent, and effective in obtaining data without potential low response rates. In addition, it yields findings that are consistent with what residents seeking information about their local program would find. This is important as the FTC relies on the standard of what a reasonable consumer would believe in determining the legitimacy of recycling claims under the Green Guides.

For each community in the sample, project staff conducted a web search for recycling program information provided by the local unit of government on their official web page or other resource, typically as directed by the community. Based on the guidance available to residents, the project staff recorded information on the recycling program's characteristics and the items accepted into a web-based database hosted by Moore Recycling. Data sources (e.g. phone, web, and email) including URLs of any web data sources were documented to enable data validation and future program updates. The information was coded according to the rules and assumptions described below (see *Framework for Determining Availability of Recycling*). All data entered by project staff were reviewed on an ongoing basis by the project managers to resolve questions and spot-check for accuracy. The data collection was done over a six-month period from November 2015 to April 2016, and thus the study findings are representative of that time period, while recognizing that programs and service availability in a given community are subject to change at any time.

DATA COLLECTION AND DETERMINATION OF PROGRAM AVAILABILITY

The Project Team used the following criteria and assumptions to evaluate the availability of recycling services and translate the information provided by each community into the defined study variables.

- **Curbside Recycling:** Services available at the place of residence were coded based on the type of service provider (e.g. private subscription, municipal or city-wide contract collection), type of collection containers, separation of recyclables (e.g. dual or single stream), and the fee structure of service provision.
 - Services available to single-family and multi-family residents were coded separately, with the cutoff point for single-family services noted, as described above.
 - Residents were considered to have **curbside recycling programs** available when the curbside recycling service is provided automatically or the resident or property owner has the ability to opt-in to receive the service.
 - In the case that residents or property owners have to opt in or subscribe to recycling services, the fraction of the population that has opted in or subscribed has also been estimated based on averages from data collected, as described further below.
- **Drop-Off Recycling:** Drop-off services available to residents were coded based on the type of service provider (e.g. city, county, or private operator) and the availability of the service (e.g. open to the public versus restricted to residents of one municipality; fee-based or free).

- Residents who live in a municipality operating or providing a drop-off, or where a drop-off open to the general public is located within the municipality limits, were considered to have **drop-off recycling** available. Residents living outside the community where the drop-off is located were considered to have drop-off recycling available if their own municipality, county, or other local government directs them to that drop-off location as the appropriate recycling outlet. The study did not include research on private drop-offs specific to one type of material (e.g. in-store drop-offs for bags and film, or manufacturer drop-off locations for foam polystyrene, or deposit return locations for specific beverage containers).
- **Separation of Recyclables:** All single-family, multi-family, and drop-off programs were coded according to the level of separation required: single-stream, dual-stream, source-separated (3 or more streams), or mixed waste.
- **Collection Container:** All curbside programs were coded according to whether residents set out recyclables using rolling carts, traditional bins, or other options.

PHONE RESEARCH

Although the primary method of data collection was third-party verification, phone surveying was used in several situations described in more detail below.

Where online information was not available or required clarification, the project staff flagged the community for phone follow-up. Staff conducting phone follow-up briefly explained the purpose of the study and requested that the community staff provide a similar level of information that would be provided to a local resident. This information was incorporated into the community's record in the study database.

Communities that were found to have opt-in or subscription recycling programs were flagged for phone follow-up to understand participation levels in these programs, as this information is rarely made available on public websites or published sources. Recycling coordinators or haulers in communities flagged as having opt-in or subscription systems were contacted and asked to provide the number or percent of residents who opt in to the system. While not all communities tracked or were readily able to provide this data, a cross-section of responses from communities of different sizes were obtained and extrapolated to provide a reasonable estimate of opt-in and subscription uptake rates.

DATA REVIEW AND QUALITY CONTROL

In addition to in-house review of data by the project team, a random sample of 25 communities was drawn from the results data set and provided to the Advisory Committee to determine if the results found by the project team researchers could be replicated. Completing this process confirmed the accuracy of the methodology and results, and provided clarification for stakeholders on the research process.

DATA ANALYSIS

At the conclusion of the data collection period all data were exported to Excel for analysis.

The Project Team used statistical extrapolation to calculate the rate of availability of recycling for each commodity included in the study and to describe the level of confidence in these results. The extrapolation process took into account program variance across state lines and between unincorporated and incorporated portions of each state. States have been divided into two groups based on similar policy environments regarding the provision of recycling services in incorporated and unincorporated areas, requirements for recycling availability, and types of services provided by different levels of government. The level of recycling availability for each group has been extrapolated from the survey findings for that group. The groups used for extrapolation purposes are shown in Table 1 below.

Table 1: Groups Used in Extrapolation

EXTRAPOLATION GROUP	STATES INCLUDED IN GROUP	NOTES
A	AK, AL, AR, AZ, GA, IA, ID, IL, KS, KY, LA, MS, MT, ND, NE, NM, NV, OK, SD, TN, UT, WI, WV, WY	Less availability of recycling programs in small communities. Services not provided consistently in unincorporated areas.
B	CA, CO, CT, FL, HI, IN, MA, MD, ME, MI, MN, MO, NC, NH, NJ, NY, OH, OR, PA, SC, TX, VA, VT, WA	Greater availability of recycling programs found in small communities, and services provided more consistently in unincorporated areas.
Individual	DE, RI, DC	These states/territories have a consistent recycling program state-wide

Availability of recycling is estimated as a percentage of the U.S. population with the specified program types, or any program, available at the place of residence. For individual materials, it is estimated as a percentage of U.S. population that can include the material in their recycling programs. The availability rates are provided with further detail including a breakdown by type of recycling service (e.g. subscription curbside, municipal curbside, drop-off only), as well as the typical descriptions and level of detail on each material provided in consumer-facing recycling guidelines.

FRAMEWORK FOR DETERMINING “AVAILABILITY OF RECYCLING” FOR SPECIFIC MATERIALS

The methodology included development of a standardized framework for evaluating how a recycling program describes its acceptance of specific materials. Identified materials were assigned a numerical score of 1-5, corresponding to how explicitly that item is included or excluded from the program’s descriptive guidelines. This metric, described in detail in Table 2, below, was used to account for some of the variation in how recyclables are described by public programs and to reduce the variation in individual interpretation by researchers as a factor in the study. The scoring system provides a basis for the assumptions and rules that are used to determine whether recycling is

available for a particular category, and allows for a high level of transparency around these definitions.

Table 2: Rating Scale with Examples

ITEM	RATING SCALE DETAIL EXPLANATION	EXAMPLE: PET BOTTLES/JUGS & JARS	EXAMPLE: FROZEN FOOD BOXES
1: Explicitly Accepted	A "1" is a specific mention of the item, or a photo of a common example. For plastic refers to product form and doesn't exclude resin	Plastic bottles; #1 bottles; Plastic bottles and containers; Plastic containers; Water and soda bottles	Freezer boxes, frozen food boxes, freezerboard; frozen food packaging; microwave meal boxes
2: Implicitly Accepted	A "2" means that the program accepts a broader category of material that residents would presume the material belongs to	Plastic; Rigid Plastic; Plastics 1-7	Flatboard (cereal boxes, gift boxes, etc.); all types of cardboard and chipboard
3: Neither Accepted nor Prohibited	A "3" is either highly general instructions that rely on resident prior knowledge, or a specific material not being mentioned in any category. Phone follow-up will be conducted to attempt to move items out of the "3" category as appropriate.	Not mentioned; All recyclables; non-specific lists like "paper, cardboard, and other recyclables"	Not mentioned; non-specific list
4: Implicitly Prohibited	A "4" does not call the item out as prohibited, but goes into sufficient detail (e.g. with photos and text) of all the items that are part of the program, that a reasonable consumer could assume that anything not listed is not allowable. An item that is part of a larger category that is prohibited.	Detailed plastic list that does not include plastic bottles	No coated boxes; detailed types of paperboard and cardboard boxes that does not include frozen food boxes
5: Explicitly Prohibited	A "5" means that the material is specifically called out as prohibited in either text or pictures.	No Plastic; No plastic bottles; No #1 plastic	Nothing from the fridge or freezer; no freezerboard; no frozen food packaging; no frozen food boxes
Additional exclusions to track	Specific exclusions (e.g. particular colors, shapes, forms, or sizes excluded despite acceptance of the broader category) will also be recorded		

These individual ratings were then translated to a determination of “availability of recycling” according to the rules in Table 3. The framework, application to individual materials, and cut-off points for determining availability of recycling for each material were reviewed by the study stakeholders.

Table 3: Determination of Acceptance Based on Rating Scale

RATING	COUNTED AS AVAILABILITY?
Explicitly Accepted	Yes
Implicitly Accepted or Broader Category Accepted	Yes, if similar in shape and structure to other accepted items of the same material type such that a reasonable consumer would consider them to fall within the category; if broad categories are typically used to describe the inclusion of this item; or if item has been found to be widely accepted in previous studies, and is not known to be problematic in the MRF. No, if unlikely to be considered included in the language.
Neither Accepted nor Prohibited	No
Implicitly Prohibited	No
Explicitly Prohibited	No

KEY FEATURES OF STUDY METHODOLOGY

As described above, the methodology of this study differs from previous studies of this topic in a few key ways. Some highlights of the study methodology are:

- First, this study quantifies the number of residents served by municipal recycling programs by identifying the sizes of single- and multi-family housing each program serves. Subsequently, the study considers separately the question of service availability for residents living in multi-family housing who are not served by these municipal programs. These residents are considered to have services available to them only if drop-off recycling is available in the community, or, if commercial recycling services are available from area hauling companies. Previous studies have not looked at multi-family recycling at this level of detail.
- Second, the identification of curbside recycling programs as opt-in (free and fee-based), subscription, or automatic/universal is a special focus of this study.
- Third, this study uses independent review of recycling program materials to evaluate which items are accepted in each recycling program. While this method has been used in some past studies, other research on this topic has relied on program coordinators, recyclers, or county officials to self-report the materials accepted locally. The purpose of the independent review process is to evaluate the messaging and education practices that the public actually encounters in using their recycling programs.

Further research on availability of recycling would be useful to more fully understand a number of areas not addressed in-depth by this study. This study did not include research on networks of drop-offs set up to accept particular items, such as locations set up for drop-off of foam polystyrene or in-store drop-offs for bags and film. It also did not analyze or seek to characterize the fine points of drop-off program availability, in particular household distance from sites or any other kind of access challenge. Additionally, this study did not have a consumer research component and thus does not address actual consumer perceptions of availability; rather, its goals are to make reasonable assumptions based on program guidelines provided to consumers. It did not address consumer perceptions of what makes drop-off recycling sites “available” to them.

FINDINGS

COMMUNITY PROGRAM CHARACTERISTICS

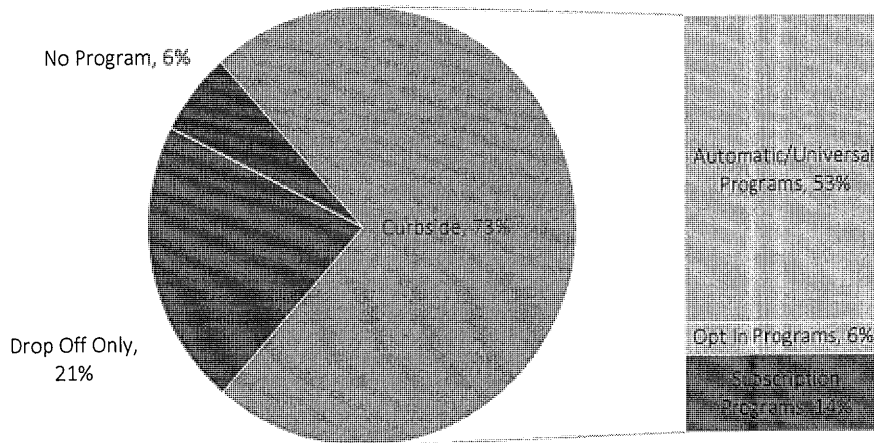
The study found that a considerable majority (94%) of U.S. residents have some type of recycling program available to them. Approximately 73% of the population has curbside recycling available, with some of those having drop-off programs available as well, while 21% has drop-off recycling as the only available recycling service. About 6% had no program available. Note that availability of recycling is not the same as a recycling rate. Availability of recycling measures the percent of the population with opportunities to recycle.

Table 4: Availability of Recycling Programs

AVAILABILITY OF RECYCLING PROGRAMS	ESTIMATED POPULATION (IN THOUSANDS) WITH PROGRAMS AVAILABLE	PERCENT OF TOTAL US POPULATION WITH PROGRAMS AVAILABLE
All Programs	288,765	94%
Curbside Recycling Programs	224,253	73%
Automatic/Universal	165,023	53%
Opt In Programs	17,514	6%
Subscription Programs	41,716	14%
Drop Off Programs Only	64,512	21%
No Program Available	19,981	6%

Figure 1: Availability of Recycling Services

AVAILABILITY OF RECYCLING SERVICES
PERCENT OF POPULATION WITH PROGRAMS AVAILABLE



Curbside recycling, where available, may be provided to residents automatically in a similar manner to other municipal services, or it may require residents to opt-in or sign up to receive a recycling container or regular collection services. The requirement to sign up to participate in the program may be a barrier to participation, especially when an initial or monthly fee is required to receive services. Where recycling is provided in an open-market system by the private sector, the need to research potential service providers and contact them to establish service represents another hurdle to participate in recycling. In some cases haulers in a subscription area offer recycling as part of a bundle of services, while in other cases it may be offered separately for an additional fee. This study found that only between 30 to 40 percent of residents eligible for opt-in or subscription services end up opting in to receive curbside recycling collection, as shown in Table 5 below.

Table 5: Uptake Estimates for Optional Services

UPTAKE ESTIMATES FOR OPTIONAL SERVICES	ESTIMATED POPULATION, IN THOUSANDS, WITH OPTIONAL PROGRAMS AVAILABLE	ESTIMATED POPULATION, IN THOUSANDS, OPTING TO RECEIVE SERVICES	ESTIMATED PERCENT OPTING TO RECEIVE SERVICES
Total Residents with Optional Curbside Recycling Services Available	59,230	19,171	32%
Residents with Opt In Programs Available	17,514	6,656	38%
Residents with Subscription Programs Available	41,716	12,515	30%

Drop off recycling was found to be available to 64% of the US population, with 21% of residents having drop off as the only program available. Of these, multi-family residents are over-represented compared to their share of the total US population, representing 44% of the drop-off only population versus 17% of the total US population. This is because automatic curbside recycling programs are much less likely to include residents in multi-family housing compared to single-family homes. As noted above (see *Definitions*) drop-off recycling locations were considered “available” to residents if they were either located within the municipality where the resident resides, or if a resident’s own municipality, county, or other local government directs them to that drop-off location as the appropriate recycling outlet.

Table 6: Availability of Drop-Off Recycling

AVAILABILITY OF DROP OFF RECYCLING	ESTIMATED POPULATION, IN THOUSANDS, WITH PROGRAMS AVAILABLE	PERCENT OF TOTAL US POPULATION
Population with Drop Off Recycling Programs Available	196,918	64%
Population with Drop Off as the Only Program Available	64,512	21%
Multi Family Population with Drop Off Only	28,386	9%
Single Family Population with Drop Off Only	36,126	12%

Multi-family recycling was found to be commonly left to private-sector collectors or available only via drop-off. Twenty-one percent of the US population is estimated to live in communities providing a uniform collection program to residents of all building types – single-family homes, small multi-family buildings, and large multi-family complexes.

Table 7: Availability of Uniform Program Covering Single- and Multi-family Residents

AVAILABILITY OF UNIFORM PROGRAM FOR SINGLE- AND MULTI-FAMILY RESIDENTS	ESTIMATED POPULATION, IN THOUSANDS, WITH PROGRAMS AVAILABLE	PERCENT OF TOTAL US POPULATION
Population In Cities Extending Curbside Recycling to Single-Family, Small Multi-Family, and Large Multi-Family Residences	63,994	21%

Recycling availability was found to vary among different areas of the country, with the Northeast having the highest availability and the West the lowest as a percent of the region’s total population.

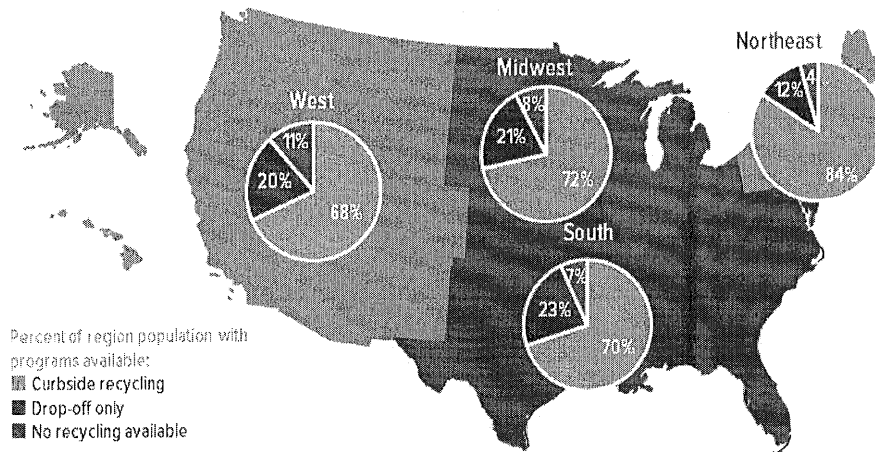
Table 8: Program Availability by Region of U.S.

PROGRAM AVAILABILITY BY REGION OF U.S. (REGIONS DEFINED BY U.S. CENSUS BUREAU)	ESTIMATED POPULATION, IN THOUSANDS, WITH PROGRAMS AVAILABLE	PERCENT OF TOTAL REGION POPULATION
Northeast (CT, MA, ME, NH, NJ, NY, PA, RI, VT)	52,935	96%
South (AL, AR, DC, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV)	81,932	93%
Midwest (IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI)	68,457	92%
West (AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, WY)	52,837	89%

The fraction of each region's population estimated to have curbside recycling, drop-off recycling only, and no recycling is shown in the figure below.

Figure 2: Availability of Recycling Programs by Region

AVAILABILITY OF RECYCLING PROGRAMS BY REGION



Recycling services were found to be most widely available in large communities. 93% of the communities in the study with a population of over 125,000 provided a single-family curbside recycling program. In contrast, only 65% of small communities with populations below 50,000 did. Incorporated cities were also found to be more likely to provide recycling services compared to unincorporated county areas.

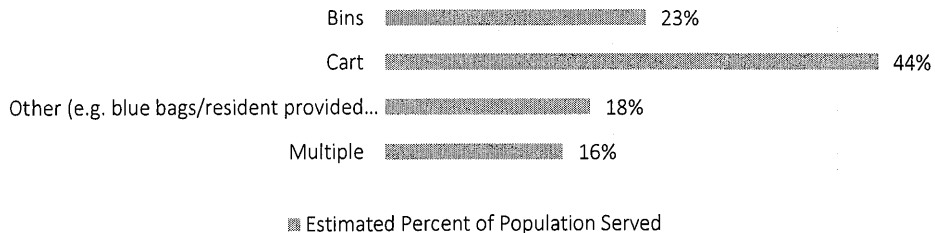
Table 9: Availability of Recycling Programs By Community Size and Type

PERCENT OF COMMUNITIES SURVEYED WITH PROGRAMS AVAILABLE BY COMMUNITY SIZE & TYPE	SINGLE FAMILY CURBSIDE	MULTI FAMILY CURBSIDE	DROP OFF
Largest (Population 250,000+)	100%	71%	70%
Incorporated	100%	73%	69%
Unincorporated	100%	60%	80%
Large (Population 125,000-250,000)	88%	46%	66%
Incorporated	96%	48%	61%
Unincorporated	66%	39%	82%
Medium (Population 50,000-125,000)	83%	36%	70%
Incorporated	94%	42%	64%
Unincorporated	59%	23%	83%
Small (Population under 50,000)	65%	28%	59%
Incorporated	73%	33%	58%
Unincorporated	32%	10%	62%

The study found that large rolling carts, which enable collection by automated and semi-automated trucks, have been adopted by a majority (59%) of the communities surveyed, serving 44 percent of the population in single-family based curbside programs. (As noted above, these programs may include only single-family homes, or smaller multi-family housing as well.) Traditional recycling bins were used by 23% of the population, and other containers by 18%. Programs serving 16% of the population gave multiple options for containers, such as allowing residents to purchase a cart or use a bin if they prefer, or providing carts to single-family homes and alley-way dumpsters in denser multi-family areas – additional evidence of adoption of cart-based collection.

Figure 3: Prevalence of Collection Containers in Single Family Curbside Programs

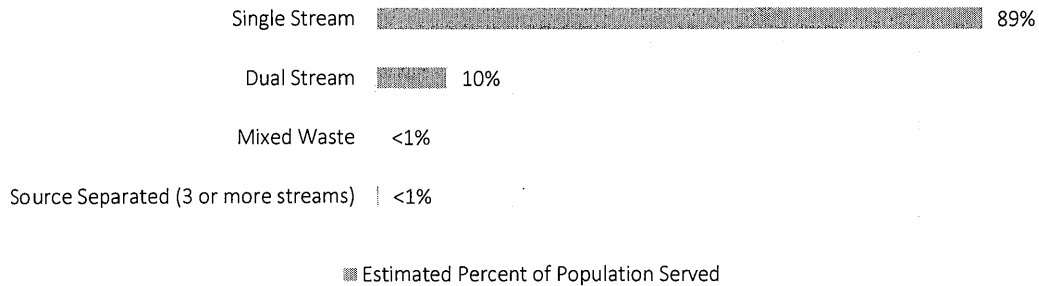
PREVALENCE OF COLLECTION CONTAINERS IN SINGLE FAMILY-BASED CURBSIDE PROGRAMS



The vast majority (89%) of single-family curbside recycling programs in this survey were found to be single-stream, with only 10% utilizing dual stream collection. These single stream programs served 89% of the population receiving single family-based curbside service, as well. Less than one percent of the population in these programs was found to be served by mixed waste or source-separated (3 or more streams) collection.

Figure 4: Prevalence of Single Stream in Single Family Curbside Programs

PREVALENCE OF SINGLE STREAM IN SINGLE FAMILY-BASED CURBSIDE PROGRAMS



ACCEPTANCE OF RECYCLABLE MATERIALS AND AVAILABILITY OF PROGRAMS FOR INDIVIDUAL MATERIALS

Materials included in the study were evaluated based on whether they were included as an acceptable recyclable in programs available to residents. Table 10, below, shows the study materials categorized by the fraction of the US population with recycling programs available that include the specified material. The three tiers used in the table correspond to the SPC's How2Recycle label program, for which this data may be used.

Table 10: Availability of Recycling for Individual Materials

MATERIAL	PERCENT OF US POPULATION WITH RECYCLING PROGRAMS AVAILABLE FOR MATERIAL		
	Less than 20%	20%-60%	60% or Greater
PET bottles/jugs & jars			X
HDPE bottles/jugs & jars			X
PP bottles/jugs & jars			X
LDPE and LLDPE bottles/jugs & jars			X
PVC bottles/jugs & jars			X
Other bottles/jugs			X
Bottle Caps			X
PET cups			X
PET containers/trays			X
PET clamshells			X

MATERIAL	PERCENT OF US POPULATION WITH RECYCLING PROGRAMS AVAILABLE FOR MATERIAL		
	Less than 20%	20%-60%	60% or Greater
PET lids			X
HDPE tubes	X		
PP cups			X
PP tubs/containers (including <5gal buckets)			X
PP clamshells			X
PP lids		X	
PP cutlery	X		
LDPE/LLDPE tubs (including <5gal buckets)			X
LDPE/LLDPE lids		X	
LDPE/LLDPE tubes	X		
PVC non-bottle rigid packaging (blisters/formed packaging)		X	
PVC clamshells		X	
PS cups		X	
PS containers		X	
PS clamshells		X	
PS lids		X	
PS cutlery	X		
Bulky Plastic (e.g. buckets/crates/baskets) without Resin Code		X	
Bulky Plastic With Resin Code		X	
Plastic Buckets 5 gallons and over		X	
Foam PS cups	X		
Foam PS trays/containers	X		
Foam PS clamshells	X		
EPS packaging shapes (protective or transport packaging)	X		
Aluminum beverage cans			X
Glass beverage bottles			X
Cartons		X	
Aluminum aerosol containers			X
Steel aerosol containers			X
Steel food cans			X
Paper cups	X		
Paper take-out clamshells/containers/trays	X		

MATERIAL	PERCENT OF US POPULATION WITH RECYCLING PROGRAMS AVAILABLE FOR MATERIAL		
	Less than 20%	20%-60%	60% or Greater
Molded fiber food packaging (service ware/carriers/containers/egg cartons)		X	
Aluminum foil food packaging (containers/pans/trays)		X	
Paper ice cream tubs	X		
Frozen food boxes		X	
Coated non-foodservice paper containers		X	

STATISTICAL VALIDITY

The study combined a census approach for approximately half the US population with a stratified random sample approach for the other half. For the combined total population, the following procedure was used to calculate a margin of error for the study's findings. The standard error of

proportion was calculated for the random sample using the equation $Std. error of prop. = \sqrt{\frac{p(1-p)}{n}}$

where p is the sample proportion and n is the sample size. Next, a z-score was calculated to correspond to a 95% confidence interval (CI), meaning that there is a 95% probability that repeated random samples would result in findings within the margin of error identified. The margin of error for the small random sample is equal to: $z\text{-score} * \text{standard error of proportion}$. This margin of error was applied to the population group extrapolated from the random sample, thus identifying an upper and lower bound of the population in this group with availability of recycling programs. Finally, the ratio of this band of uncertainty compared to the total population was calculated to determine a margin of error for the entire U.S. population for each of the study variables below.

Table 11: Margin of Error

VARIABLE	MARGIN OF ERROR CI=95%
Population with Recycling Programs Available (All Programs)	1%
Population with Curbside Recycling Programs Available	2%
Population with Automatic/Universal Curbside Programs Available	2%
Population with Opt In Curbside Programs Available	1%
Population with Subscription Curbside Programs Available	2%
Population with Only Drop Off Programs Available	3%

OBSERVATIONS & DISCUSSION

The findings of this study point towards several ways that recycling programs in the U.S. could be made more accessible and easy for residents to use. While recycling programs are available in one form or another to the vast majority of US residents, use of best practices for recycling services are not nearly as widespread.

One barrier to participation in recycling programs is inconvenience. Residents are less likely to recycle if they have to drive to a drop-off location, especially if trash, in contrast, is conveniently picked up at their curb. If residents are provided a large rolling cart for trash and a small bin for recycling, that presents another barrier – both a mental and a physical one.

Inconvenience is also a factor in the low uptake rates for opt-in programs. Simply signing up for a program may not seem like a major hurdle, but studies of numerous services, from retirement programs to health care to organ donation, have found that structuring a program as opt-out rather than opt-in greatly increases participation in the program. In recycling, low uptake rates can be self-perpetuating. When residents don't see their neighbors recycling, they may be less inclined to seek out recycling for themselves, and they may not even realize a program exists, as has been reported in some cities with opt-in programs.

Subscription systems present a diverse range of options for residents, but also require residents to do the leg-work of seeking out service providers, comparing pricing, signing paperwork, and sometimes obtaining containers on their own. In some subscription systems, service offerings are regulated so that all trash haulers must provide recycling services at no extra cost above that for trash service, or for a regulated fee. This makes subscribing to recycling programs more convenient. The prevalence and impact of these regulations is a potential subject for further study.

Cost is another barrier to program success. This study found that fee-based programs can vary widely in the amounts they charge. On a monthly basis fees ranged from less than a dollar a month to a high of \$24/month for single-family curbside collection. Fees required to start recycling or obtain a bin ranged from \$2 to \$60. These fees, especially on the high end, are a barrier to many households' participation in the program, and a great barrier to low-income households. Where programs are funded by tax revenues, in contrast, the costs of operating the program, are somewhat scaled through the tax code by residents' income. (Some programs funded by flat user fees may also have hardship-based rate reduction programs in place.) Residents' willingness to pay for recycling services also reflects how they perceive the value of these services. Raising awareness of the value of recycling can have beneficial consequences in creating demand for new recycling programs as well as increasing participation and uptake rates in existing ones.

All of the above barriers make recycling for residents of multi-family housing a particular challenge. This study added to previous research on recycling availability by considering multi-family recycling programs separately for each community studied. The lack of multi-family recycling programs provided by municipalities is a key reason why even though 93% of residents were found to have some recycling services available, only 53% were found to have curbside recycling provided to their home "automatically". Although some states (e.g. CA, DE) have mandates requiring multi-family recycling collection, notably, 80% of US residents live in communities without a standardized recycling program for both single- and multi-family homes. The resident of a large multi-family complex is not only less likely to receive municipal or contracted curbside recycling services, but they are subject to their property manager's decision as to whether they will choose to subscribe to commercial recycling

services where offered. These residents are also much more likely to be directed to a less-convenient drop-off as their best recycling outlet.

A final barrier to resident participation is the availability and quality of public education on the recycling program and what is and isn't accepted for recycling in the community. For this study, the research team reviewed over 2,000 recycling program guidelines, and the variation in quality was striking. Some programs have full-color print and digital guidelines with photos of every material accepted, informational videos, directories where residents can search whether an item is accepted, and clear and accurate instructions and explanations of recyclability. Other programs have outdated and/or conflicting, limited recycling guidelines with inaccurate terminology and dubious explanations as to why items are not accepted. Terms and images used for particular items are not standardized across communities. The lack of consistency in recycling programs – both in what is actually accepted and the education surrounding recyclability – is repeatedly cited by consumer studies as a barrier to recycling and a cause for resident confusion. For national brands and manufacturers, inconsistencies among programs make it challenging to conduct effective and accurate marketing campaigns around recyclability, especially when it comes to newer packaging formats with more varying levels of acceptance in programs. Higher-quality and more standardized education around recycling programs is a key target for improving program outcomes. This includes improving and standardizing recycling materials across regions and in both home and away-from-home settings, to create the consistent messaging that is key for behavior and culture change.

Through a unique level of multi-stakeholder collaboration, this study was able to research the availability of recycling at a high level of detail, accounting for the differences between program types and the level of services available to residents even within the same region or municipality. This study also provided stakeholders granular detail on the availability of recycling programs for 49 material types for their own internal use. The findings of this study point the way to additional research areas, potential recycling program improvements, as well as the option to repeat all or parts of the study to track change over time. Given the continuous evolution underway in recycling programs across the country, and the increased interest of brands and manufacturers in the availability of recycling for their products and packaging, let alone the quality of that availability, there is a case to be made for more frequent tracking of recycling program features and performance nationwide. The positive experience of participants in the multi-stakeholder collaboration that made this study possible is a foundation to build on, in order to bring the goal of increasing our country's recycling rate to global best practice performance within sight.

APPENDIX I: SUMMARY OF COMMUNITIES SURVEYED

STATE	NUMBER OF COMMUNITIES SURVEYED	POPULATION SURVEYED	PERCENT OF STATE POPULATION INCLUDED IN SURVEY	TOTAL POPULATION OF STATE
AK	9	375,869	53%	710,231
AL	56	2,588,924	54%	4,779,736
AR	48	1,566,842	54%	2,915,918
AZ	32	3,370,535	53%	6,392,017
CA	113	18,832,743	51%	37,253,956
CO	24	2,657,701	53%	5,029,196
CT	30	1,888,521	53%	3,574,097
DC	1	601,723	100%	601,723
DE	4	517,821	58%	897,934
FL	76	9,466,025	50%	18,801,310
GA	62	5,046,948	52%	9,687,653
HI	15	704,574	52%	1,360,301
IA	50	1,537,519	50%	3,046,355
ID	18	795,670	51%	1,567,582
IL	89	6,526,337	51%	12,830,632
IN	46	3,270,590	50%	6,483,802
KS	20	1,482,124	52%	2,853,118
KY	55	2,270,539	52%	4,339,367
LA	36	2,317,989	51%	4,533,372
MA	47	3,340,432	51%	6,547,629
MD	44	2,928,997	51%	5,773,552
ME	59	672,364	51%	1,328,361
MI	107	4,989,720	50%	9,883,640
MN	80	2,694,132	51%	5,303,925
MO	61	3,046,520	51%	5,988,927
MS	54	1,515,280	51%	2,967,297
MT	17	502,970	51%	989,415
NC	61	4,849,891	51%	9,535,483

STATE	NUMBER OF COMMUNITIES SURVEYED	POPULATION SURVEYED	PERCENT OF STATE POPULATION INCLUDED IN SURVEY	TOTAL POPULATION OF STATE
ND	11	341,166	51%	672,591
NE	10	926,618	51%	1,826,341
NH	27	667,655	51%	1,316,470
NJ	86	4,530,939	52%	8,791,894
NM	13	1,027,733	50%	2,059,179
NV	12	1,524,518	56%	2,700,551
NY	53	9,883,864	51%	19,378,102
OH	195	5,864,394	51%	11,536,504
OK	50	1,952,142	52%	3,751,351
OR	26	1,971,615	51%	3,831,074
PA	211	6,432,364	51%	12,702,379
RI	8	561,972	53%	1,052,567
SC	37	2,411,609	52%	4,625,364
SD	18	414,922	51%	814,180
TN	39	3,248,248	51%	6,346,105
TX	90	13,286,343	53%	25,145,561
UT	23	1,411,818	51%	2,763,885
VA	53	4,110,361	51%	8,001,024
VT	36	320,202	51%	625,741
WA	43	3,376,628	50%	6,724,540
WI	91	2,881,529	51%	5,686,986
WV	38	990,935	53%	1,852,994
WY	13	291,841	52%	563,626