



Plastic Film and Bag Recycling Collection: National Reach Study

April 2012

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Purpose

The purpose of this project is to document the percentage of the U.S. population that has access to plastic retail bags and plastic film (wrap and sack) recycling. This data will provide a better understanding of the progress toward the goal of increased national collection of all plastic. The data will also provide information that will help in efforts to focus resources and programs to increase bag and film recycling in areas clearly underrepresented.

Acknowledgement

Moore Recycling would like to thank the Plastics Division of the American Chemistry Council (ACC) for funding this project.

Methodology

The first step was to locate film and bag recycling sites for the following types of programs: retail drop-off, curbside collection, municipal drop-off, non-profit drop-off and commercial drop-off programs. Once Moore Recycling gathered all publicly available data, we followed up with phone research to determine the accuracy of our initial findings.

Plastic Collection Material Types	Definition
Plastic Bags	Grocery bags, t-shirt bags, retail bags (hard plastic and string handles removed)
Plastic Film	Newspaper bags, produce bags, furniture wrap, electronic wrap, food Storage bags (clean and dry), cereal box liners (if it tears like paper do not include), Tyvek (no glue, labels, other material), diaper wrap (packaging), shipping envelopes (no bubble wrap/remove labels), dry cleaning bags, bread bags, paper product wrap (bathroom tissue, napkins, and paper towels), and case wrap (e.g., snacks, water bottles)

The vetted data were added to our existing database of plastic film and bag collection locations resulting in a spreadsheet containing: location name, address, city, state, zip code, material types collected (*Plastic Bags, Plastic Film*) and the coordinates on Earth (latitude, longitude) as determined by Google Maps.

Zip Code Analysis

Using the center of zip code as an approximation for determining the population covered by a drop-off location, we ran an analysis to determine the access to *plastic film* recycling and *plastic bag* recycling in the U.S. by distance (10 miles).

Moore Recycling purchased, from Zip-Codes.com, a 2010 population by zip code spreadsheet containing: zip code, corresponding population, coordinates for center of zip code on Earth (latitude, longitude), city, state, and other data unrelated to this analysis.

Reach Analysis Process: Algorithm

Step 1. We selected locations from the drop-off locations list given the criteria of available latitude and longitude information (less than .1% of the locations were missing latitude/longitude because google maps could not find them).

Step 2. For each location that met the criteria in step 1, we did the following:

- a. We determined 10 miles north latitude of the location value, 10 miles south latitude value, 10 miles east longitude value, and 10 miles west longitude value—all of these can be calculated using the first two formulae.¹
- b. We determined the distance between the center of the zip code and the location drop-off using formula 3.²
 - ii. If that distance was greater than 10, we threw it out and continued
 - iii. If that calculated distance was less than 10 miles, we set a flag for that zip code row

Step 3. After Step 2 ran, we summed up the population for each row in the zip code list that had a flag checked off for 10 mile radius, to get a total population for center of zip code access to a drop-off location within 10 miles.

We performed all steps for both material scenarios: *plastic bags* and *plastic film*.

¹ Formulae:

1 - 1 degree of latitude = 69.1 miles = $60 * 1.1515$

2 - 1 degree of longitude = absolute value($\text{COS}(\text{latitude position} * 3.14159 * 180) * 69$)

² Formula:

3 - Distance between 2 points = $60 * 1.1515 * ((\text{ACOS}(\text{SIN}(\text{lat1} * 3.14159 * 180) * \text{SIN}(\text{lat2} * 3.14159 * 180) + \text{COS}(\text{lat1} * 3.14159 * 180) * \text{COS}(\text{lat2} * 3.14159 * 180) * \text{COS}((\text{lon1} - \text{lon2}) * 3.14159 * 180))) * 3.14159 * 180)$

Census Data Analysis

In order to double check our findings, we did a second analysis of the data using the software package ArcGIS. Census tract shapefiles were downloaded for each state individually from the 2010 TIGER database on the US Census Bureau's website. The 2010 population data file—ID P1, from the US Census Bureau's Summary File 1 data set—was downloaded for each state at the census tract level³ from American Factfinder2 (the Census Bureau's gateway to census data). The data set Summary File 1 is not an estimate of the population, but is a true census in that it represents 100% of the population. The output of this analysis is based on the assumption that population is evenly distributed throughout each census tract.

Once the data were imported to ArcGIS, all 48 shapefile from the conterminous states plus the District of Columbia were appended together into a single shapefile for ease of analysis. This data layer was projected using the North American Equidistant Conic to minimize the area and distance distortion of converting the earth's cylindrical surface to a two-dimensional space like a map. Although many different types of projection are available, we chose the North American Equidistant Conic because of the necessity to maintain accuracy in area and distance, as those are two of the variables used to calculate the population with access to drop-off recycling points. Exclusive of Hawaii and Alaska, population data were combined into a single file, added to the data frame and then joined to the shapefile using a common field. The area of each census tract was then calculated.

The latitude and longitude coordinates of drop-off locations were added to the map, converted to a shapefile and projected using the same projection as the combined state shapefile. Two queries were completed to identify the locations that accepted *plastic bags* and *plastic film*. Each query was then exported to individual shapefiles and 10 mile radii were generated around these points using the buffer function in ArcGIS. Selecting the dissolve option enabled us to eliminate any overlapping areas between two or more radii. This step insured that populations with access to more than one facility were not double counted in the analysis. **Figure 1** shows the radii layer in bright green with dissolved boundaries transposed on top of the census tract layer.

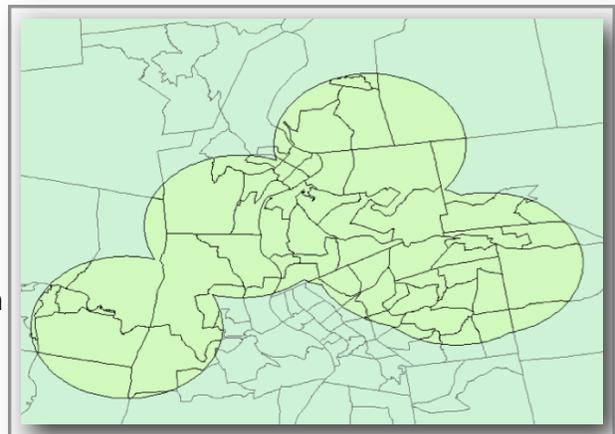
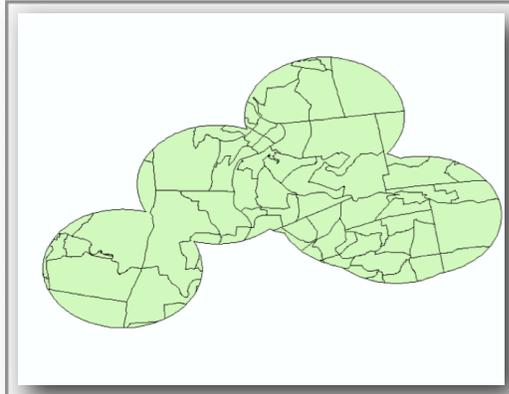


Figure 1. Three mile radii with dissolved boundaries

³ Census tracts are small, statistical subdivisions of a county, which usually have between 2,500 and 8,000 persons. They are designed to be homogeneous with in population characteristics, economic status, and living conditions.

Figure 2 New data layer created with intersect operation



An intersect was performed to combine the features of the two layers into a single output shapefile. The radii layer essentially cut through the census tract layer, preserving only the areas that the two layers had in common as shown in **Figure 2**.

Since the majority of census tracts were only partially represented within the boundaries of the radii, a new area was calculated for each. The original area of the parent census tract was divided into the new area to determine the percent of of the parent census tract

included within a 10 mile radius of a drop-off location. This value was then multiplied by the original population to calculate the new population of each portion of census tract within the area covered by the radii.

The same procedures were followed for Hawaii and Alaska. However, the Universal Transverse Zone (UTM) zone 5 and 6, respectively, were used.

PlasticBagRecycling.org

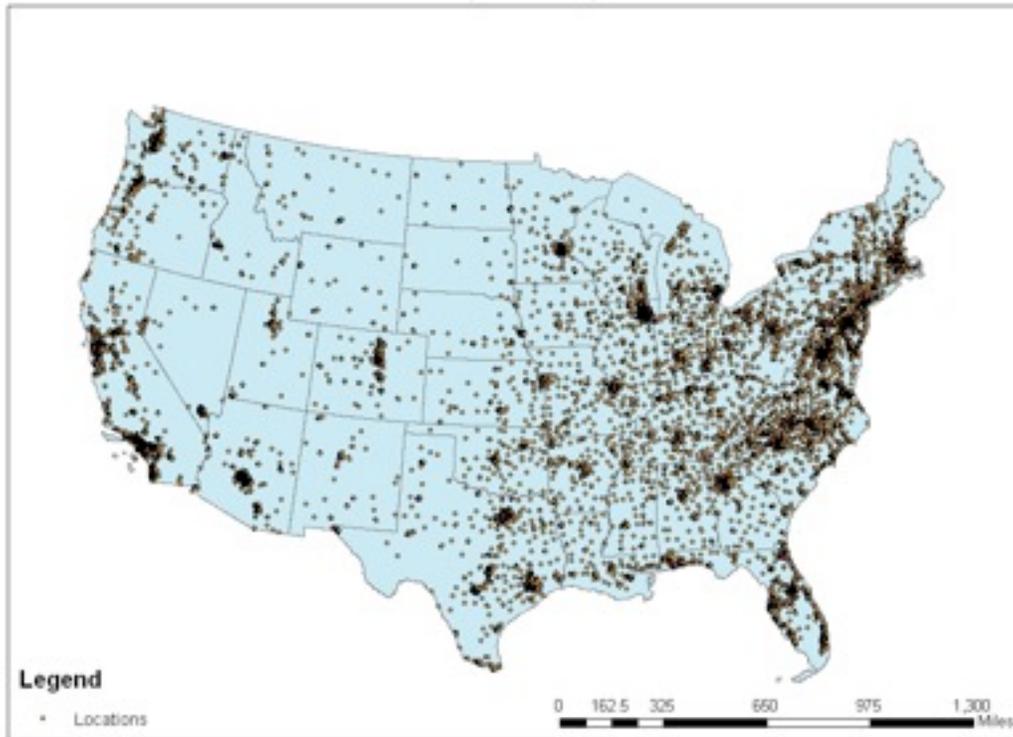
Finally, we uploaded the drop-off data onto PlasticBagRecycling.org. Once activated, the data will provide the public with the ability to search for locations to recycle plastic bags, film and wrap. The drop-off data in PlasticBagRecycling.org will also provide state and regional information about plastic bag, film and wrap recycling access whenever needed. The data upload to PlasticBagRecycling.org will be activated in April 2012.

Findings

The results of the two methodologies are very consistent. The results show that 91% to 93% of the U.S. population has access to *plastic bag* recycling and 72% to 74% also have access to *plastic film* recycling via curbside collection or because they live within 10 miles of a drop-off facility. Moore Recycling identified 15,023 drop-off locations that accept film for recycling. The majority of locations are retail drop-off.

Percentage of US Population with Recycling Access within 10 miles		
Plastic Collection Program	Using Zip Code Analysis	Using Census Analysis
Plastic Bags	91%	93%
Plastic Film	72%	74%

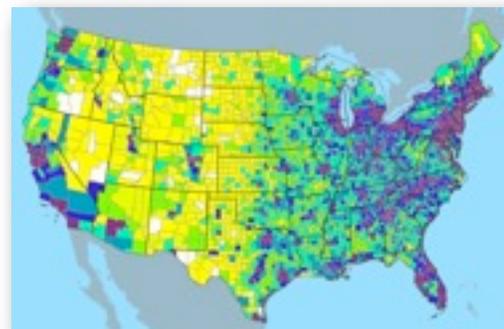
United States Map of All Drop-Off Facilities



The 2010 survey of curbside programs (using the 2008 census data available at the time) showed that 10.8% of the US population had curbside access to bag and film recycling. In cross referencing our findings from the two studies, the majority of cities where residents have curbside access to film recycling also have drop-off access to bag recycling within 3 miles. About 75% of the drop-off locations where curbside collection is offered, also take film and wrap, thus curbside collection programs did not materially affect the population with film, bag and wrap recycling access.

Regional Differences

There were no specific regions that did not have access, as shown by comparing the U.S. Census population density map at the right with the drop-off facilities map above, but there is more access in the highly populated areas and less in the rural areas; this is true for other types of recycling.



Collection

Drop-off and Commercial

Most retailers that offer bag recycling to customers do so voluntarily. Many large chains have recovered film and bag material for over two decades—because often they benefit from revenue generated by selling scrap material, avoided disposal costs, and the extended goodwill with their customers. The scrap value for Mixed Film⁴ has been stable and high enough that some retailers are willing to accept film and bag material from smaller, neighboring businesses, in addition to their own customers. Large retailers have efficient reverse logistics. As their trucks return to distribution centers, they back haul scrap film, cardboard and other materials. Most small to medium generators do not have their own fleet of trucks and warehouses for storage. Thus, recovery is less common in smaller generators.

Commercial film recovery methods include: co-collection with cardboard, most commonly by private haulers; drop-off at a recycling center, and utilizing existing reverse logistics.

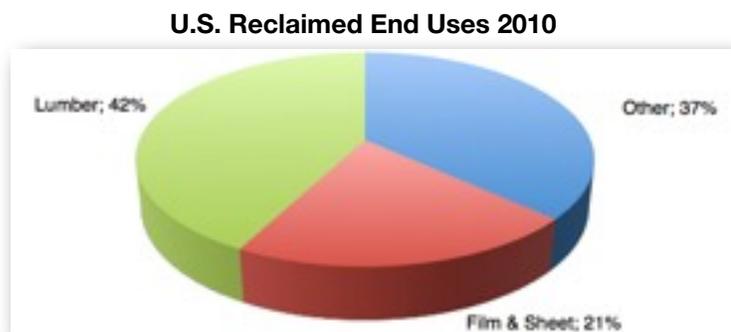
Curbside

Film collected curbside is often costly to process, at MRFs and subsequently by reclaimers. This is because residential film collected curbside—especially in a single stream program—usually is more heavily contaminated and the resulting bales are less valuable. There are very limited markets for these curbside bales because the material requires significantly more cleaning and handling to make it usable. Collecting film curbside can also create efficiency problems at the MRF, because many facilities rely on rotating screens to sort containers from fiber. Film often wraps around the screens, clogging equipment.

U.S. End Uses 2010

According to the 2010 National Postconsumer Plastic Bag & Film Recycling Report, composite decking industry continues to be the lead U.S. market for recovered film. The amount of recycled film used to manufacture new film increased significantly in 2010, primarily due to an increased supply of postconsumer film resin used to manufacture agricultural film.

Nearly 37 % of the recovered film reported went into other miscellaneous applications, such as garden products, crates, buckets, pallets, and piping.



⁴ The film, bags and wraps generated at retail drop off locations usually is sold as the category “Mixed Film”

Observations

Moore Recycling contacted many of the retail drop-off locations to confirm which materials they accepted. We were very specific in asking if the retailer accepted plastic bags, and plastic film and wrap. We found that many did not understand what plastic film and wrap meant, thus would tell us that they did not accept it. Some would say yes, they would accept wrap material after we explained specifically what was meant, i.e. the wrap around toilet paper and paper towels. Whether or not they accepted the wrap was capricious and largely dependent upon who was staffing the customer service desk at any particular moment. There were significant gaps in awareness about collecting various types of film. Given these findings, we consider our access to Film recycling data to be conservative.

This process has confirmed that there is not enough education regarding plastic bag recycling and even less knowledge about film recycling beyond bags, even among those locations that accept the material. People want to do the right thing, but they don't know what the right thing is.

Conclusions / Next Steps

Clearly the results show that there is widespread access to plastic bag and wrap recycling, yet the access is not being used to its full potential. This is largely due to a lack of education and outreach promoting film, wrap and bag recycling, and very limited understanding about the connection between bag recycling and wrap and film recycling.

This research is an important first step because documenting widespread access enables manufacturers to label bags and wraps as recyclable consistent with Federal Trade Commission requirements.

There are signs that this level of understanding may be about to change: a number of groups, including the newly formed Flexible Film Recycling Group at ACC, the Association of Postconsumer Plastic Recyclers (APR), and GreenBlue's Sustainable Packaging Coalition (SPC) are embarking on a campaign to educate consumers about recyclable film beyond bags using, among other things, the new How2Recycle label for bags, wraps and film developed by SPC. With "Design for Recycling Guidelines" from APR, the How2Recycle "Store Drop-off" label will only be made available to packages that



are recyclable at retail locations: defined by the demand for the material from recyclers as well as significant access to recycling for the general public.

Measuring Progress

The annual National Postconsumer Recycled Plastic Bag & Film Report determines the amount of film and bag material recovered nationally and is a critical measurement tool.

Performing this survey on an on-going basis will provide another dimension in the overall effort to increase the recycling of plastic bags, film and wraps. Access is essential to consumer participation. Knowing where the public does not have access is particularly critical in that it allows us to focus our efforts on the areas of greatest need for improvement.

Finally, recovery data from retailers in specific regions would also provide valuable information in determining the most effective efforts to increase participation and recovery of plastic film.

All of these studies are resource intensive but important in developing the most effective recovery strategies and encouraging a stronger domestic recycling industry.

Resources

2010 National Postconsumer Plastic Bag & Film Recycling Report:

<http://www.plasticbagrecycling.org/08.0/2010FilmReport.pdf>

Plastic film recycling information:

www.PlasticBagRecycling.org

Additional Information

The Plastics Division of the American Chemistry Council provides resources to communities, businesses and consumers to assist them in increasing awareness and education of the recycling of plastic bottles, containers, and plastic bags and film. For information about plastic bag and film recycling visit www.plasticbagrecycling.org. Also, visit www.plasticsmarkets.org for information about how to locate buyers or sellers of recovered plastic film or for handling guidelines.

The 2011 Film and Bag Recycling Collection: National Reach Study has been prepared to provide information to parties interested in the recycling of plastics, in particular film plastic. Facilities developing a recycling process and all entities involved in the chain of collection, processing, distribution, and sale of recycled products have an independent obligation to ascertain that their plans, actions, and practices meet all relevant laws and represent sound business practices for their particular operations. Facilities may vary their approach with respect to particular operations, products, or locations based on specific factual circumstances, the practicality and effectiveness of particular actions and economic and technological feasibilities. This report is not designed or

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