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Ban, Fee, Take-Back/Recycle: Which Approach Wins Out in the End?

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BAN, FEE, TAKE-BACK/RECYCLE: WHICH APPROACH WINS OUT IN THE
END?

BY

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B.A. Environmental Planning and Policy, University of Southern Maine, 2013

THESIS

Submitted to the University of New Hampshire in Partial Fulfillment of the Requirements
for the Degree of

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in

Resource Administration and Management

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THESIS COMMITTEE PAGE

This thesis has been examined and approved in partial fulfillment of the requirements for the degree of Master of Science in Resource Administration and Management.

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ABSTRACT

Ban, Fee, Take-Back/Recycle: Which Approach Wins Out in the End?

by

Megan McLaughlin

University of New Hampshire, May, 2016

Plastic bags provide cost-effective, ease of use utility to communities, while also producing disposal and blight costs in the United States. The role of policies to target their usage has not been fully considered, partially due to the state-centric model of waste policy implementation, independent local government actors, and the absence of an overarching model for assessing effectiveness of plastic bag policies. Due to this oversight, this study examines the plastic bag policy process. Existing literature ignores the emergence of plastic bag take-back programs, recycling programs, and much of the action taken in states, other than New York and California, to combat plastic bag pollution. Furthermore, there are no clear lines showing the motivation for plastic bag policy action. The main objectives of this thesis are to 1) understand the effectiveness of bans, levies, take-back programs, and recycling programs; and 2) establish the groundwork for when bans, levies, take-back/recycling programs are useful, so communities can use this information as a framework for plastic bag policies. In order to examine these objectives the following research question will be addressed:

Under what conditions is a ban, fee, or a take-back/recycling program best to address the end of life attributes of plastic bags in the waste stream?

CHAPTER I

Introduction

A. Introduction to Low-Density Polyethylene (LDPE #4) Plastic Bags

The most ubiquitous of all throwaway items, the plastic bag has gained attention in the environmental, economic, and social realms for its overuse and wasteful properties; therefore, it is imperative to research the best policy approach to target usage. The utility of plastic bags can be measured in minutes; however, the externality, waste, lingers longer. Local, state, and some national governments around the world have begun to look at policy approaches to target plastic bag waste (Larsen and Venkova, 2014). Typical policy approaches have been outright bans or a small fee of five to ten cents per bag (USD) to reduce consumption and waste (Larsen and Venkova, 2014). A fee reflects the social costs of plastic bags and generates revenue, yet a ban can more effectively change behavior because consumers do not have the option to pay and use a plastic bag. Recently, improved recycling programs and store take-back programs have been used in place of bans and levies (RIRRC, n.d.). Non-Governmental Organizations (NGO's) and environmental activists pressure local, state, and national governments to act on plastic bag consumption often on the grounds of litter, water pollution, and harm to wildlife. The key questions raised concern: How plastic bags are being used, why they are being used, and most importantly, the question addressed in this thesis: *what do we do with them once they have been used?*

The goals of this thesis are to 1) understand the effectiveness of bans, levies, take-back programs, and recycling programs; and 2) establish the groundwork for when bans, levies, take-back/recycling programs are useful so communities can use this information as a framework for plastic bag policy.

B. Rationale and Significance

Plastic bags fall under the definition of municipal solid waste (Callan and Thomas, 2013). Society sees solid waste disposal as a mundane part of living that does not rank high on the list of environmental problems. With population growth, the size of the municipal solid waste stream grows and Americans are reflective of a “disposable society.” The most iconic disposable item is the plastic bag of which Americans consume 300 billion per year (Freinkel, 2011).

The Environmental Protection Agency (EPA) encourages various practices to reduce the amount of waste disposed such as source reduction, recycling, reusing, and composting. However, due to a limited waste disposal budget, communities target items that weigh the most and take up the most volume in the waste stream. For an equivalent amount of groceries, single use plastic bag production, use, and disposal only produces a net 15.5 pounds of waste while paper bags produce nearly 75 pounds of waste (Villarreal and Feigenbaum, 2012).

The *Resource Conservation and Recovery Act of 1976 Subtitle D (RCRA)* amended the *Solid Waste Disposal Act (SWDA)* to focus on the disposal of municipal solid waste as an identified responsibility throughout the state (*40 CFR § 255.30*). The role of policies to target plastic bag waste have not been fully considered in part due to the state centric model of waste policy implementation, independent local government actors, and the lack of an overarching model for assessing effectiveness of plastic bag policy.

Plastic bags do not represent substantial volume or weight in the waste stream. These aspects raise the question: Why are cities and towns worldwide beginning to ban and tax them? Is it solely an emotional response to the increasing amount of litter and the harmed sea animals, or is there a deeper reason? On a related note, why do some communities fail to get a tax or ban implemented? Is it because they do not make up much of the waste stream, are there arguments

against the policy approaches from key stakeholders, or is it because they are focusing on more pressing waste issues? Answering these key questions will not only benefit communities wishing to look into either a plastic bag ban, levy, take-back program, or recycling program in the future, but will serve as a guiding model communities can follow to see if a plastic bag policy is feasible before putting forth effort and receiving a failed response.

The disposal of plastic bags has effects on infrastructure. For instance, plastic bags clog sewer lines and cause flooding (Badam, 2005). Additionally, plastic bags that make it into the waste stream cause glitches in recycling plants as they become wrapped around conveyor belts and clog the system (Freinkel, 2011). Storm waters carry plastic bags into sewer lines posing harmful impacts to oceans, rivers, lakes, and wildlife that inhabit these water bodies (National Geographic, n.d.). When small particles from photodegraded plastic bags get into water bodies, filter feeding marine animals ingest them. In the particles, Polychlorinated biphenyls (PCBs) travel up the food chain and eventually become ingested by humans (Bushnell, 2010). Developing a model to assist communities' efforts to find the most appropriate policy will aid in the education of individuals regarding proper disposal mechanisms. Educational improvements in communities will aid in the reduction of plastic bag blight seen along highways and in vegetation.

C. Research Question

This thesis is geared toward understanding the effectiveness, defined as a reduction in bags, of policies keeping in mind different communal characteristics with the goal of answering the following research question (See Figure 1):

Under what conditions is a ban, fee, or a take-back/recycling program best to address the end of life attributes of plastic bags in the waste stream?

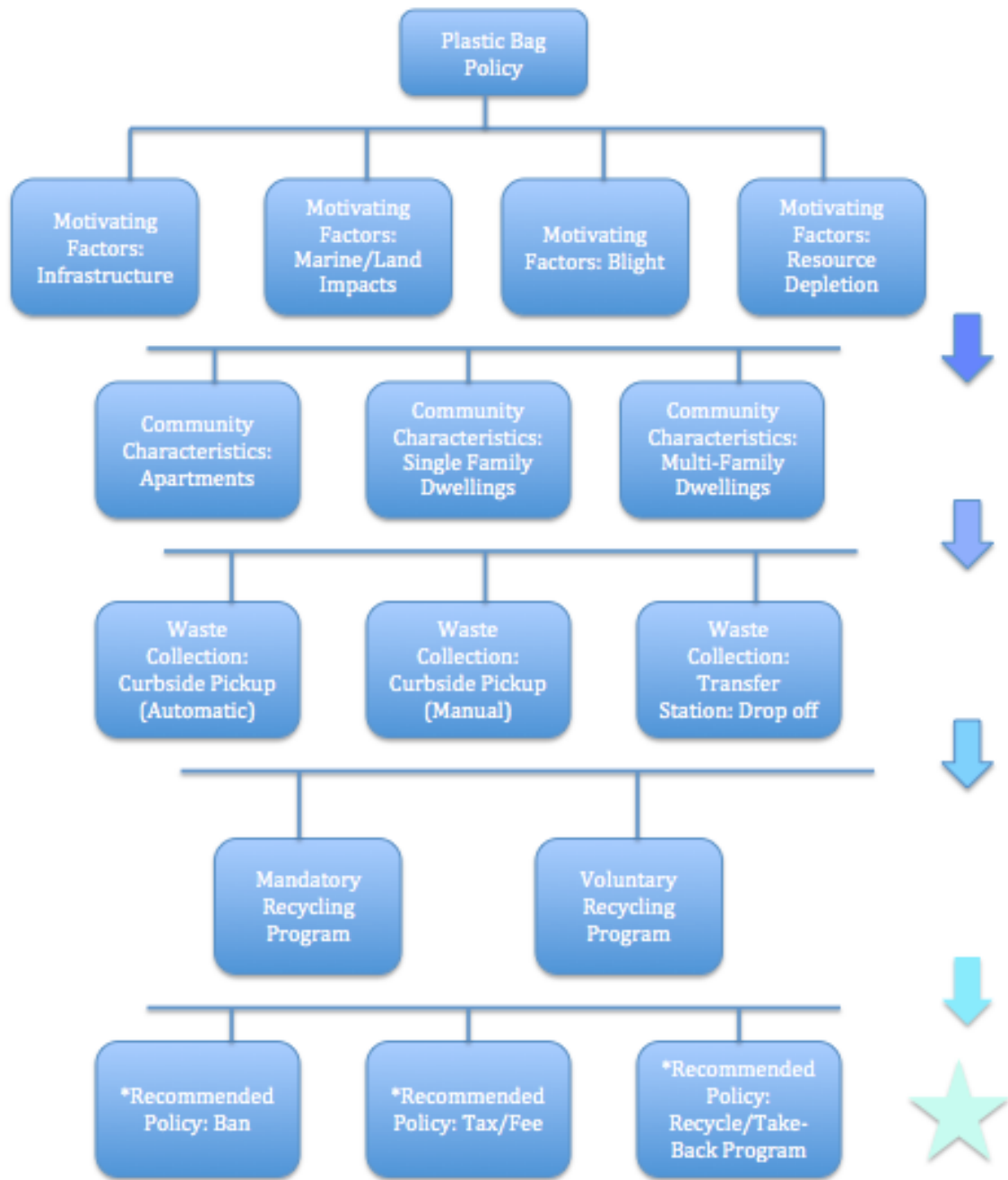


Figure 1: Conceptual Overview showing the ways in which the research question will be addressed. First, motivating factors will be looked at to see why a community is interested in plastic bag action. Second, the community characteristics will be analyzed to help answer the question of plastic bags in the waste stream. For instance, many individuals living in apartments rely on plastic bags as their recycling bins to save space. Third, the waste collection system will be analyzed to give insight into how plastic bags are managed, and to support this we will look into the type of recycling program. If it is mandatory, that will give insight into whether banning a mandatory item is a proper decision. Lastly, the recommended policy is summarized.

D. Research Approach

The study will be conducted among states in the United States that have taken or are considering plastic bag action in the form of bans, fees, recycling programs and take-back programs. To understand the main motivating factors behind plastic bag action, the following factors will be analyzed: the influence of outside actors, the main motivating factors behind the action, the types of actors for and against the action, whether or not it was a local effort or a state and national effort, if there were a vote and if it were close, and patterns drawn between communities. To understand the effectiveness of plastic bag policies, the following factors will be analyzed: public participation, monetary flows, industry influence, and environmental impacts before and after the policy.

After answering each of these questions, a capstone piece will be developed framing the question: Should we ban, charge a fee, or recycle/take-back plastic bags? To analyze each of the cases, research from many different spectrums will be used. Specifically, research will be comprised of phone interviews with municipality representatives, news articles and public opinion regarding plastic bag action. Furthermore, local legislation and revenue documents will be analyzed thoroughly to gain insight into how individual actors played a role and the outcomes. Similarly, local articles will be expanded to the state level and national level to see what, if any, overarching policies govern state level action on plastic bags.

CHAPTER II

Literature Review

A. Literature Umbrella

Existing literature on the pervasive single-use plastic bag defined as “...a plastic bag provided at the check stand, cash register, point of sale, or other point of departure for the purpose of transporting food or merchandise out of the establishment” analyzes in depth the emergence of plastic bag bans and taxes around the world and the impacts of plastic pollution on marine life, infrastructure, and landscapes (*See City of Carmel Code of Ordinances, Ch. 8 § 74.020*) (*See Figure 2*). It digs into the environmental impacts, background, law, policy implications, industry backlash and public participation surrounding single-use plastic bags.

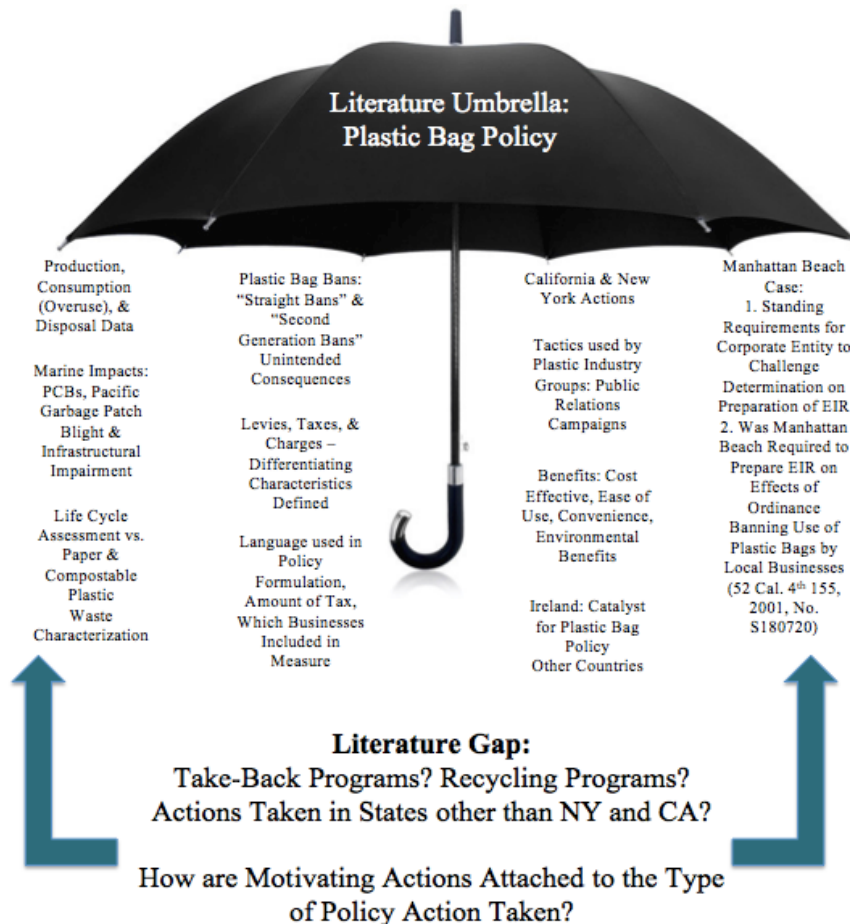


Figure 2: Literature umbrella surrounding plastic bag policy measures and action (Model retrieved from: Alaska Native Tribal Health Consortium, n.d.)

A. Plastic Bag Problems

Attributes of plastic bags from the production and consumption side shows that it takes about 430,000 gallons of oil to produce 100 million plastic bags, the United States consumes 380 billion plastic bags per year, therefore, more than 1.6 billion gallons of oil are used each year for plastic bag production (Food Democracy, 2008). With oil being a high value commodity and plastic bags a low value product, this poses a problem for environmentalists and industry alike. However, in the United States it is estimated that 6.97 billion barrels of petroleum products are used per year, an average of about 19.11 million barrels per day including 0.34 billion barrels of biofuels (U.S. Energy Information Administration, 2014). An estimated 42 gallons of oil comprise one barrel, this means 802,620,000 gallons of petroleum products are used per day in the United States or 292,956,300,000 gallons per year. Plastic bag production makes up 0.55% of this figure.

On the disposal end, much of the literature points to the Great Pacific Garbage Patch. The patch is a slowly spiraling vortex of large amounts of floating plastic debris encompassing a large area, nearly immeasurable in the Pacific Ocean. When small particles from photo degraded plastic bags are present in water bodies, such as the ocean, they are ingested by filter feeding marine animals. Polychlorinated biphenyls (PCBs) for example, are in the particles and are passed up the food chain eventually ingested by humans (Bushnell, 2010). According to Susan Dautel (2009), plastic bags are ubiquitous in the patch and consumption ratios should be one of the separate factors in determining contribution rates to the patch. Furthermore, Murray Gregory (2009) emphasizes that floating plastic bags are often mistaken for jellyfish, which block the esophagus of sea animals consuming them (P. 2017). Turtles specifically rely on jellyfish as a

primary food supply and researchers commonly find plastic bags in the digestive tracks of deceased sea turtles (Romer and Tamminen, 2014, P. 261).

In addition to marine impacts, strong on-shore winds catch shredded plastic bags and sheeting and deposit them far inland causing blight along coastal vegetation, which could be a contributor to environmental degradation of dune fields behind the beach (Gregory, 2009, P. 2018).

Furthermore, plastic bags damage recycling systems and infrastructure. According to Godman, plastic bags blow out of garbage cans, out the back of garbage trucks, off transfer stations and off the face of landfills affecting farmers in Virginia who must deal with plastic bags floating into fields and potentially having lethal effects on livestock or damaging crop production (Godman, 2013, P. 571). In New York, consumers use 5.2 billion carryout bags per year and as of 2008 plastic bags accounted for more than 1.7 million tons of residential garbage per week in the United States, and New York City pays roughly 10 million each year to transport 100,000 tons of plastic bags to landfills in other states (Romer and Tamminen, 2014, P. 22).

A.1. Plastic Bag Life Cycle Assessment and Waste Characterization

Chaffee and Yaros (n.d.) prepared a life-cycle-assessment for the American Progressive Bag Alliance looking at three types of grocery bags: a traditional grocery bag made from polyethylene; a grocery bag made from compostable plastics (a blend of 65% EcoFlex, 10% polylactic acid or PLA, and 25% calcium carbonate); and a paper grocery bag made from at least 30% recycled fibers (Chaffee and Yaros, n.d., P. 3). The firm used the “Boustead Model” software to prepare a life cycle assessment and calculate the consumption of energy, fuels, and raw materials, as well as the generation of solid, liquid, and gaseous wastes from the extraction of raw materials. The study takes into account the carrying capacity differences of both bags. A 1:5:1 ratio equates to 1500 plastic bags for every 1000 paper bags (Chaffee and Yaros, n.d. P. 7).

Table 1: Life Cycle Assessment prepared by Boustead Consulting & Associates. When compared to paper and one type of compostable plastic bag, plastic bags from polyethylene use less energy, produce less fossil fuels, municipal solid waste, greenhouse gas emissions, and use less potable water. (Retrieved directly from Chaffee and Yaros, n.d., P. 4).

	Impact Summary of Various Bag Types		
	(Carrying Capacity Equivalent to 1000 Paper Bags)		
	Paper (30% Recycled Fiber)	Compostable Plastic	Polyethylene
Total Energy Usage (MJ)	2622	2070	763
Fossil Fuel Use (kg)	23.2	41.5	14.9
Municipal Solid Waste (kg)	33.9	19.2	7.0
Greenhouse Gas Emissions (CO2 Equiv. Tons)	0.08	0.18	0.04
Fresh Water Usage (Gal)	1004	1017	58

A life cycle assessment report of plastic and paper bags was also conducted by Greene (2011) and cited the Boustead report which was funded by the American Chemical Council Plastics Division and showed that paper bags use considerably more resources per gram (See Table 2).

Table 2: Life Cycle Inventory of 1500 Plastic Bags and 1000 Paper Bags in the Boustead Report.

	1500 Plastic Bag Industry Average	1000 Paper Bag (30% Recycled Content)
Total Energy, MJ	763	2622
Fossil Fuel used, lbs	33	50
Municipal Solid Waste, lbs	15	75
Greenhouse Emissions,	0.04	0.08

Tonnes CO2		
Freshwater Usage, Gal	58	1004
Mass, g, per paper	6	52

While the data from the life cycle inventory shows the large amount of resources consumed by paper bags, the number of trips per type of bag is largely different with 7 trips with an HDPE single-use bag and 43 trips with a kraft paper single-use bag (Greene, 2011).

Greene (2011) performed a process flow chart of inputs and outputs for plastic bag manufacturing, use, and end-of-life attributes (See Figure 3). The end of life attributes of plastic bags are important in terms of environmental consequences and that is what this paper seeks to address. The options for plastic bag disposal are: recycled, incinerated for energy, sent to landfill, or discarded as litter (Greene, 2011). The recycling rate of plastic bags is 5% in the United States with the rest sent to a landfill (94.5%) and discarded as litter (0.5%) (Greene, 2011).

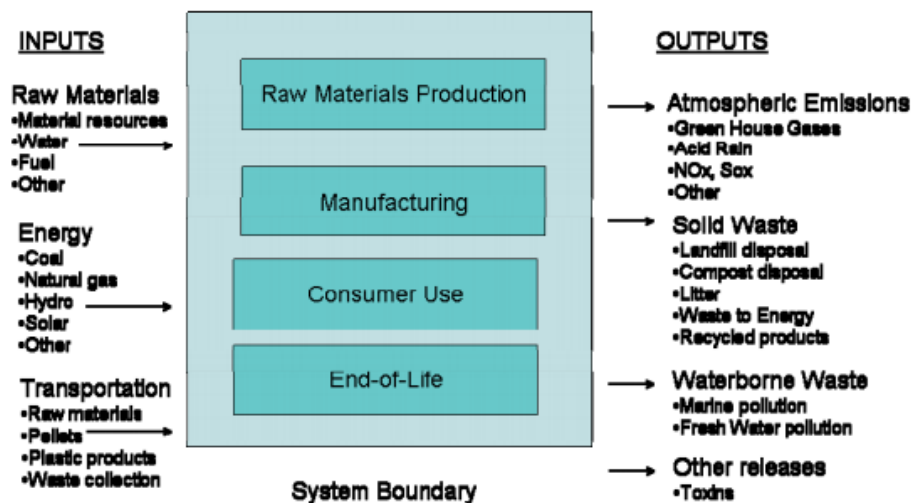


Figure 3: Process flow of inputs and outputs for plastic bag manufacturing, use, and end-of-life attributes. Retrieved directly from Greene, 2011.

In the California 2008 Statewide Waste Characterization Study, a detailed sorting of plastic bags was conducted to determine sources, in relation to a statewide recycling program (Cascadia

Consulting Group, 2009, P. 9). Plastic grocery and other merchandise bags were sorted to identify bags from grocery stores, pharmacies, and other sources (Cascadia Consulting Group, 2009, P. 17). The results show that out of one-hundred randomly chosen samples from the residential sector and commercial sector, 44% of plastic bags were from grocery stores, 14% were from retailers with large pharmacies, 23% were from retailers other than grocery stores and retailers with large pharmacies, and 19% were from sources that could not be determined (Cascadia Consulting Group, 2009, P. 66).

B. Benefits of Plastic Bags

Also cited in the literature are benefits of plastic bags. For instance, Sandra Ketcham (n.d) shows the cost-effective, ease of use, and convenience attributes of plastic bags. Plastic bags cost much less than paper bags (which cost five cents or more per bag), open quicker, pack and double up easier than paper bags, and also require considerably less storage space than paper bags (Ketcham, n.d.). Furthermore, plastic bags are more durable in inclement weather. According to an estimate by the American Forest and Paper Association, Americans use 10 billion paper shopping bags per year while using 380 billion plastic shopping bags (Ketcham, n.d. and *See* Ch. 2A).

Plastic bags are advantageous over paper bags in terms of environmental impacts because they weigh significantly less, cover less volume, and contribute far less solid waste to landfills when not recycled. The Environmental Protection Agency estimates that paper bag production requires 40 percent more energy than the production of plastic bags (Ketcham, n.d.). Similarly, paper bag manufacturing also results in 50 percent more water pollution and 70 percent more air pollution than plastic bag manufacturing (Ketcham, n.d.).

C. Theoretical Foundation for Regulation

Plastic bag regulation is governed by a number of economic principles. For instance, when deciding on an appropriate level of tax on plastic bags a community must consider what they hope to accomplish, whether it be cleanup of plastic bag pollution or to warrant a behavior change such that individuals no longer use plastic bags. Both benefits and costs of abatement (the total reduction in emissions) have to be examined. A Marginal Abatement Cost reflects the cost of one additional unit of pollution that is abated; in this case one unit would be one plastic bag (See Figure 4).

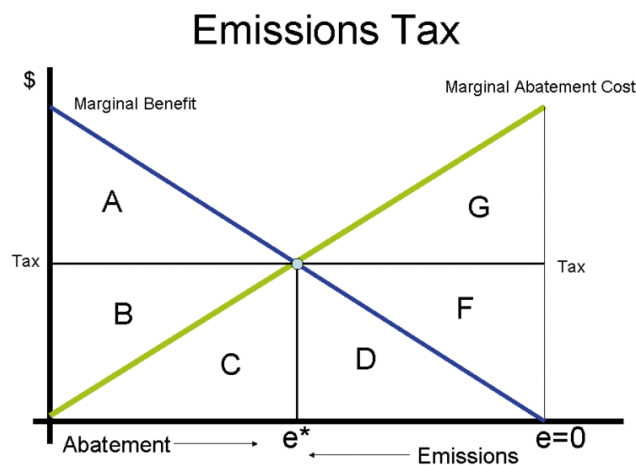


Figure 4: Marginal abatement cost curve (Environmental Economics, n.d.).

One consideration to make is that the marginal abatement cost of each additional plastic bag is always increasing. One way to achieve an optimal level of abatement is to set a tax where marginal benefit is equal to marginal abatement cost (Environmental Economics, n.d.). (See Figure 4). Left unregulated, individuals will choose to still use plastic bags represented by the area underneath the marginal abatement cost curve ($C+D+F+G$) (Environmental Economics, n.d.).

Interestingly with plastic bags it is relatively easy to achieve abatement using the appropriate level of a tax and this can be a twofold process. For instance, if the tax is set below

the optimal level, the revenue generated from the tax could be used to cleanup plastic bag pollution. However, if the tax is at the optimal level, there will be a reduction in plastic bags in the environment as individuals will choose not to purchase them, thus the goal is achieved at the same cost in two different manners.

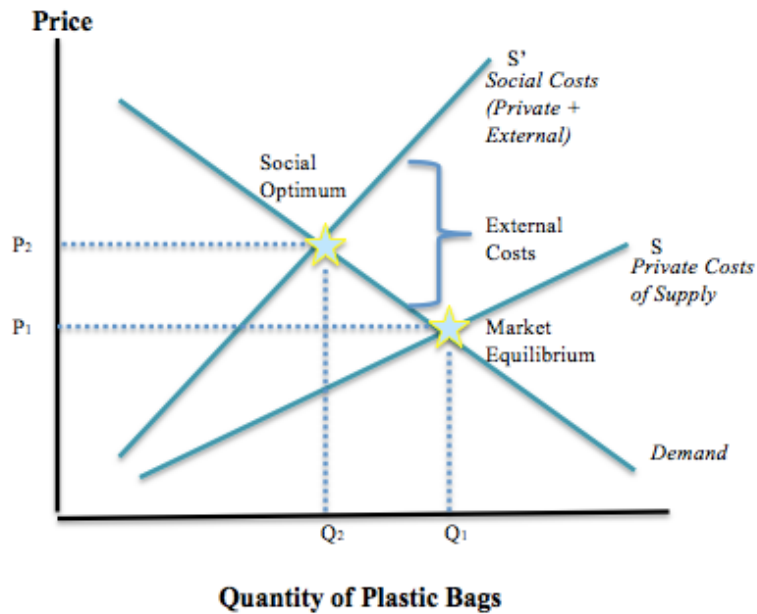


Figure 5: Plastic Bags as an Environmental Externality (Harris, 2006)

Another concept to consider is the social and private cost differences (Figure 5). Marginal social cost (marginal private cost + the marginal external cost) is the total cost to society as a whole for “...producing one further unit, or taking one further action, in an economy. This total cost of producing one extra unit of something is not simply the direct cost borne by the producer, but also must include the costs to the external environment and other stakeholders” (Investopedia, n.d.) (See Figure 6). With perfect information, this framework could be used for evaluating plastic bag pollution.

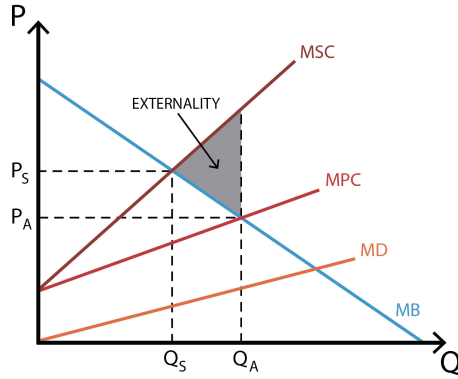


Figure 6: Graph depicting externality (Policonomics, n.d.).

A Pigouvian tax is one way to correct an externality, in this case plastic bag pollution. This tax is levied on each unit of output an externality-generator agent produces (plastic bag litter in this case). The tax is equal to the marginal damage at the efficient level of output (Policonomics, n.d.). (See Figure 7). If revenue was used as a measure of reduction and the tax was used as “price,” this would lead to the optimal pricing level needed on plastic bags and will provide the adequate level of reduction needed and the benefits of this reduction. If the optimal level is \$0, then this means a ban is the best measure to use and the least harmful solution is a ban where consumers have no choice. This will help determine the best policy measure to use if the information is available.

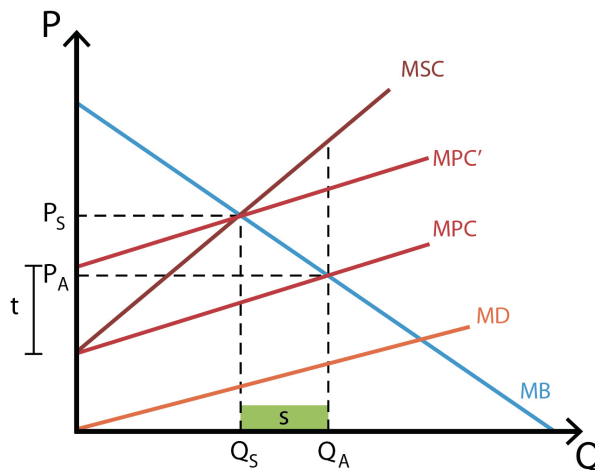


Figure 7: “t” on the chart shows the marginal damage at the efficient level of output (Policonomics, n.d.).

Plastic Bag Policy Measures

A. Plastic Bag Ban

Plastic bag bans that do not address any other type of carryout bag, known as “straight” bans, often seem more popular than charges among American legislators because

(1) Most plastic bag ordinances adopted to date in the United States were in California where bans are more prevalent due to the advent of AB 2449, (2) the concept of a ban is more straightforward than an ordinance with charges, and (3) many people are concerned with the myriad of impacts associated specifically with plastic bags (Romer and Tamminen, 2014, P. 241-242).

With plastic bag bans, it is important to address other types of carryout bags in addition to plastic, and encourage the switch to reusable bags so that customers do not switch from plastic to paper (Romer and Tamminen, 2014, P. 242). Furthermore, banning bags may lead individuals to purchase bags for purposes such as lining small trash cans and picking up after dogs.

B. Plastic Bag Tax/Levy/Charge

Charging, assessing a levy, or a tax on plastic bags leads to large reductions in single-use bag consumption while also allowing customers to choose if they want a plastic bag. According to Romer and Tamminen (2014), charging for plastic bags has a greater impact on overall reduction because it incentivizes behavioral change and forces customers to make a conscious decision to purchase a plastic bag (P. 246).

While plastic bag tax, levy, fee, and charge are seemingly used interchangeably, there are identifiable differences between the terms, as identified by Romer and Tamminen (2014). For instance, a tax goes in whole or in part to the government and the power at the local level is generally limited to state government (Romer and Tamminen, 2014, P.247). Occasionally municipalities can collect taxes A charge refers to a situation in which a customer is required to pay for an item irrespective of where the revenue is allocated (Romer and Tamminen, 2014, P.

247). Lastly, a fee is sometimes referred to as charges in which the money collected goes in whole or in part to the government (Romer and Tamminen, 2014, P. 247).

C. The Most Successful Tax in Europe: Ireland

The plastic bag “levy” in Ireland was so popular with the Irish public that it would be “...politically damaging to remove it” (Convery et al., 2007, P. 2). In March of 2002, Ireland instated a tax of 19 cents USD later raised to 22 euro cents in an effort to change consumers’ behavior to reduce the presence of plastic bags in rural areas and to increase public awareness of littering (Convery et al., 2007, P. 2). Interestingly, prior to the implementation of the levy, plastic bags were not the most prevalent litter seen in the country; they only constituted 5% of the national litter production (Convery et al., 2007, P. 3). Nevertheless, the prevalence of plastic bags along the countryside and coastline caused the action. Since the introduction of the levy, the number of bags consumed declined by approximately 94% in one year (Convery et al., 2007, P. 7). Measurements of plastic bag litter revealed that between January 2002 and April 2003 the number of clear areas (areas without plastic bags) increased by 21% while the number of areas without “traces” of plastic bags increased by 56% (Convery et al., 2007, P. 7).

Annual revenue of 12-14 million euros (15-17 million USD) was generated from the plastic bag tax, greatly offsetting the implementation costs (Convery et al., 2007, P. 9). However, while a majority of bags were imported from other countries, 11% were produced by the four manufacturing firms operating in Ireland (Convery et al., 2007, P. 9). Since the tax went into effect, one of the firms has gone out of business causing the loss of 26 jobs, however, it is unknown whether or not this would have happened without the tax (Convery et al., 2007, P. 9).

D. Important Considerations when Implementing Plastic Bag Policy

When instating a plastic bag policy, it is important to consider the types of businesses that should be included. While this study will be focusing on single-use plastic grocery bags, it is essential to address other aspects of ordinances geared toward plastic bags. For instance, Romer and Tamminen (2014) highlight the political will of a city and say that ordinances can go as far as to cover only city vendors, large pharmacy chains, all stores selling food, retailers and restaurants in addition to just grocery stores (P. 249). However, most bans do not include restaurants because of concerns regarding food delivery (Romer and Tamminen, 2014, P. 249).

Godman, 2013, assesses the language of plastic bag policies, specifically Virginia's proposed ban HB 1498 which states: "no retailer...shall provide customers with plastic bags at the point of sale unless such bags are (i) durable plastic bags with handles, (ii) at least 2.25 mils thick, and (iii) specifically designed and manufactured for multiple reuse" (P. 574). The main issue with the proposed bill is that it does not identify where the point of sale is or where it occurs. Retailers could place bags elsewhere around the store if "point of sale" refers to where money is exchanged (Godman, 2013, P. 575). Furthermore, durable needs to be properly defined and most bags have handles and plastic bags that are "specifically designed and manufactured for multiple reuse" could be misconstrued. For example, a clever producer could place a notice on the side of a bag stating "this bag is specifically designed and manufactured for multiple reuse without changing any production methods (Godman, 2013, P. 576).

When assessing a charge/levy/tax for plastic bags, it is most common to see a minimum of 10 cents however; current charges per single-use plastic bag range from 5 cents in Washington DC to one dollar in Brownsville, Texas (Romer and Tamminen, 2014, P. 251). Furthermore, a loophole exists where municipalities charge for plastic and paper, but do not charge for reusable

bags. A more durable, thicker plastic bag can essentially be given away for free because it can pass as a reusable bag. Therefore, a minimum charge for all types of bags can fill this loophole. Charges for reusable bags are typically a minimum charge, meaning they are setting a price floor, not a ceiling so retailers are not forced to provide cheap reusable bags for 10 cents, rather, they can provide higher quality reusable bags at a higher price point (Romer and Tamminen, 2014, P. 253).

E. Plastic Bag Policy in California and New York

Jennie Romer, Esq., is the founder and director of plasticbaglaws.org, the go to website for a synthesis of plastic bag information. Romer investigates the emergence of plastic bag legislation in California and tracks the movement across other states. Most recently, in *Plastic Bag Reduction Ordinances: New York City's Proposed Charge on All Carryout Bags as a Model for U.S. Cities*, Romer and Tamminen (2014) published an article focusing on New York City's proposed carryout bag ordinance as a model ordinance for cities in the United States (P. 239). In the article, Romer and Tamminen (2014) point out that plastic bags represent 1.2 billion of the 374 billion dollar American plastics market (P. 240). Even so, industry groups and manufacturers spend over one million on campaigns against plastic bag bills annually (Romer and Tamminen, 2014, P. 240).

There are two main tactics used by plastic industry groups: “public relations campaigns opposing the adoption of bag ordinances and lawsuits against cities that adopt such ordinances” (Romer and Tamminen, 2014, P. 240). Bagtheban.com, a website run by Hilex Poly (the largest plastic bag manufacturer in the United States) claims that bans and fees threaten jobs in the plastic bag manufacturing and recycling industry (P. 590). However, they do not explain why a reduction in plastic bags would severely hinder recycling of other plastics. The main argument

by industry proponents is that they fear a ban or fee on plastic or paper will have negative impacts on lower-income families and individuals who will have to find additional money to purchase reusables or pay fees. Second consumers are unwilling to back bag reduction regulation because they are used to the convenience of receiving plastic bags when making purchases for “free” (Godman, 2013, P. 590).

F. Industry Group Opposition

Plastics industry groups, specifically the Save the Plastic Bag Coalition (SPBC) have filed numerous lawsuits on the grounds that a municipality is required to complete a full Environmental Impact Report (EIR) under the California Environmental Quality Act (CEQA) before a ban can be adopted (Romer and Tamminen, 2014, P. 242).

In July of 2008 the City of Manhattan Beach adopted an ordinance to ban the use of plastic bags with the intentions of protecting the marine environment of Manhattan Beach. However, the ban was met with opposition and two specific factors of plastic bag bans were addressed in a court case: 1. What are the standing requirements for a corporate entity to challenge a determination on the preparation of an EIR and 2. Was the city of Manhattan Beach required to prepare an EIR on the effects of an ordinance banning the use of plastic bags by local businesses, these effects specifically being the increased use of paper bags (52 Cal.4th 155, 2001 No. S180720). Following a rigorous process of court hearings and industry opposition, the City of Manhattan Beach determined that impacts from the plastic bag ordinance would be insignificant because of the small size of the city.

A similar situation occurred in New York where several nearby cities and towns were planning to adopt bans until the Food Industry Alliance (FIA), a New York statewide grocery

industry association took action and threatened to sue (Romer and Tamminen, 2014, P. 244). In a letter by the FIA claims were made that a proposed plastic bag ban would:

(1) be preempted by the state plastic bag recycling law in New York, (2) be arbitrary and unconstitutional, and (3) require a full Environmental Impact Statement (EIS) under New York's State Environmental Quality Review Act (SEQRA) (Romer and Tamminen, 2014, P. 244).

One of the main proponent arguments is that ordinances should address the unintended consequences of consumers switching to paper bags as the cost of paper bags is much higher than the cost of plastic bags, and "...ordinances that do not regulate all single-use bag types...do not maximize environmental gain and can cost each store well over \$50,000 a year in increased costs" (Romer and Tamminen, 2014, P. 244). Furthermore, requiring a minimum of 40% postconsumer recycled content in paper bags is often included in plastic bag legislation (Romer and Tamminen, 2014, P. 250).

The San Francisco Commission on the Environment following Ireland's lead recommended that the city charge a 17-cent fee for each single-use plastic or paper bag use, however, prior to the introduction of the ordinance, opposition groups were able to pass a plastic bag recycling bill (AB 2449) which specifically preempted all local plastic bag fees in California (Romer and Tamminen, 2014, P. 241). Nevertheless, San Francisco made the decision to ban plastic bags as a way to circumvent the bill. Interestingly, AB 2449 expired in January of 2013, so California municipalities have the charge option available, however, none have opted for a charge over a ban which is why we see the prevalence of bans in California (Romer and Tamminen, 2014, P. 242).

"Second-generation" plastic bag bans are becoming more prevalent in California due to the litigation surrounding plastic bags. These bans address paper bags by imposing a minimum 10-cent charge on all paper bags (Romer and Tamminen, 2014, P. 245). Specifically in San

Francisco, the original plastic bag ban law was expanded to cover all retailers and restaurants and added a minimum 10-cent charge on all other carryout bags provided at the register (Romer and Tamminen, 2014, P. 245).

G. Literature Gap

The identified gap in the literature is that while bans and taxes are often sought out and researched, other methods of plastic bag policy and their success or failure also warrant attention such as take-back and recycling programs. To fill this gap, it is important to address the following research question:

Under what conditions is a ban, fee, or a take-back/recycling program best to address the end of life attributes of plastic bags in the waste stream?

CHAPTER III

Methods

A. Defining Effectiveness

In the scope of the research question: which plastic bag policy is most *effective* at addressing the influential characteristics of plastic bag use, effectiveness will be defined using Kate O’Neill’s framework laid out in *The Environment and International Nations*, among other sources. Effectiveness is defined as “the extent to which the measure has achieved its intended objective, in relation either to outcomes (i.e. changes in the behavior of socio-economic actors, and/or impacts (on the state of the bio-physical environment) (EEA, n.d.).

O’Neill highlights a leading scholar in international relations, Thomas Bernauer, who defines effectiveness as an action that 1. Changes the behavior of states and other actors in the direction intended by the cooperating parties; 2. Solves the environmental problem they are designed so solve; and 3. Does so in an efficient and equitable manner (Bernauer, 1995, P. 338). In the scope of this research a successful plastic bag policy is one that leads to a behavioral change among consumers, solves the plastic bag problem (i.e. blight, marine impacts, or infrastructural impairment) and does so in the most efficient way (i.e. with the least amount of opposition).

Along these lines, another scholar, Oran Young identifies six dimensions of regime effectiveness which could also be applied to plastic bag policies: problem solving, goal attainment, and behavioral, process, constitutive and evaluative effectiveness, each of these take into account how regimes solve problems or reach their goals, change participants’ behavior in meaningful ways and whether their results meet the equity or efficiency criterion (Young, 1995, P. 143-9).

According to O’Neill, the two main dimensions of regime effectiveness are compliance and problem solving (O’Neill, 2009, P. 106) (See Table 3).

Table 3: The dimensions of problem-solving effectiveness are laid out. The regimes are synonymous with plastic bag policy. This criterion will be used to assess how plastic bag policies addressed the influential characteristics they were intended to address and to what extent. Table obtained directly from O’Neill, 2009, P. 108.

<p style="text-align: center;">Dimensions of problem-solving effectiveness:</p> <ol style="list-style-type: none">1. Goal Attainment<ol style="list-style-type: none">a. <i>Specific regime targets</i><ul style="list-style-type: none">• Are they met in a timely fashion?• To what extent?• Do they satisfy criteria of equity or cost-effectiveness?b. <i>Overarching goals</i><ul style="list-style-type: none">• Do specific treaty obligations meet regime goals laid out in preamble?2. Problem-solving<ol style="list-style-type: none">a. <i>Absolute change in environmental quality</i><ul style="list-style-type: none">• Has the problem been eliminated?• If not, has relevant environmental quality improved to a measurable degree?• Has the overall pace of environmental degradation slowed?• To what extent can these changes be ascribed to the regime?b. <i>Relative change in environmental quality</i><ul style="list-style-type: none">• Is the problem better than it would have been in the absence of the regime?• If there is no overall change, can absence of deterioration be ascribed to the regime?• If environmental quality has deteriorated, would it have deteriorated further in the regimes absence?

A. Case Development

A random sample of states was selected in the United States based on the availability of information. The case study approach uses exploratory data and makes inferences from what was found. Each case was treated as a unit of analysis. While the literature review highlighted instances in which communities and states were compared to one another, this study will primarily focus on communities and states and their successes and failures with initiating plastic bag policy. The goal of this thesis was to obtain 50 samples, one from each state in the United

States. However, thirteen were identified with information supplemented by online data. Data obtained online is secondary data and are treated as such. Table 4 highlights the cases chosen based on their type of plastic bag policy.

Table 4: Selected cities and towns with plastic bag policy experience, reason for action, the policy approach taken and the date, along with the type of data collection method (i.e. phone interview, face to face interview, or email and the occupation or organization from which the representative of each city/town comes.

City/Town/State	Reason for Action	Policy Approach & Date	Type of Interview/Data Collection Process	Representative Occupation/Organization
1. Austin, Texas	Citizen Welfare, Enviro. Impacts, Wildlife Impacts	March 1, 2013 – Ban	Online	N/A
2. Alameda County, California	Waterways, Oceans, Marine Life, Litter	January 1, 2013 – Ban	Online	N/A
3. Portland, Oregon	Pacific Ocean Impacts, Neighborhood protection, Nature	October 1, 2013 – Ban	Online	N/A
4. Westport, Connecticut	Waterway Impacts, Sewers, Marine life, Landfill-Chemicals, Litter	September 2, 2008 – Ban	Online	N/A
6. Hawaii	Wildlife Impacts, Litter, Landfill-Chemicals	2015 – Ban	Online	N/A
5. Delaware	Litter, Coastlines/Forests, Clog Storm Drains	December 1, 2009 – Take-Back Program	Online	N/A
7. Rhode Island	Enviro. Impact, Litter	2005 - Take-Back Program	Phone Interview	Sarah Kite, RIRRC
8. Arizona	Litter (fences)	2008 - Take-Back Program	Phone Interview	Tim McCable, Arizona Food Marketing Alliance
9. Brooklyn, New York	Equipment/Labor \$\$	2013 - Recycling Program	Phone Interview	Eadaoin Quinn, Sims Municipal Recycling
10. Washington DC	Anacostia River Impacts/Cleanup	September 23, 2009 - Tax	Online	N/A
11. Portland, ME	Litter (trees), Storm Drains, Wildlife, Waterways, Machinery	April 15, 2015 – Tax	Online	N/A
12. Breckenridge, Colorado	Excessive Plastic Bag Use	April 9, 2013 – Fee	Online	N/A
13. Montgomery County, Maryland	Waterway (most common form of litter) – Potomac River	January 1, 2012 – Fee	Online	N/A

B. Case Analysis

While conducting interviews, narrative material was stored in a word document sorted by state to help organize the materials. Furthermore, a chain of evidence was maintained that cited the sources used to arrive at specific findings (i.e. documents, interviews, and observations). In addition, the time and location of interviews were documented (Yin, 2014, P. 127).

Case study data was analyzed by starting with the main question the research is trying to answer and then identifying evidence that addresses the question. For example, one question this research is trying to answer is why are plastic bag policies occurring; without influencing or biasing the interviewee it will be necessary to find evidence that answers that question in each of the cases. For online research, data was put into an online word document and organized using tables for each piece of information (case, waste collection attributes, policy measure, and community characteristics).

C. Case Description

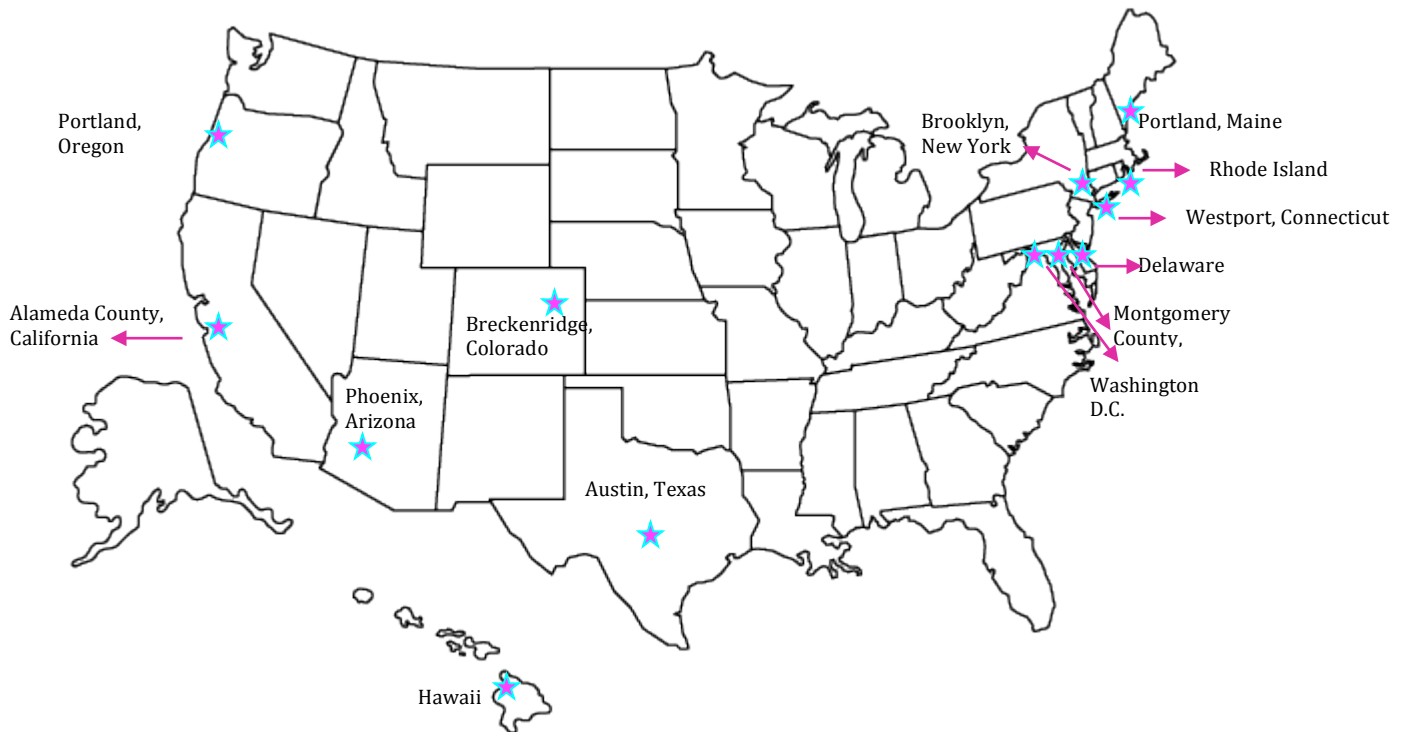


Figure 8: Visual depiction of the thirteen cases chosen.

1. Austin, Texas

Austin is the capital of the State of Texas. The population is 912,791. On March 1, 2013 the City initiated a plastic bag ban due to concerns regarding citizen welfare, environmental impacts and wildlife impacts.

Trash and recycling pickup is an automated curbside system. There are two local Materials Recovery Facilities in Austin which sort, bale and sell recycled materials to manufacturers. The cost of this is covered by a monthly utility bill paid by residents for trash carts. There are 182,000 households served by curbside pickup. The types of carts are 96 gallon wheeled carts used as single stream recycling.

The types of households in Austin, Texas are as follows (Note: These percentages are out of 373,473):

- Single Unit Structure: 191,061 (51.16%)
- Multi-Family/Unit Structure: 177,118 (47.42%)
- Mobile Homes/Other Housing Units: 5,024 (1.35%) (U.S. Census Bureau, 2014)

2. Alameda County, California

Alameda County is a County in the State of California located in the western portion of the United States. The population is 1,510,271 million. The County issued a ban on all plastic bags in the County due to impacts to waterways, oceans, marine life, and unsightly litter. Households in Alameda County are served by a fully automated curbside pickup system. The trash is hauled to Alameda County Industries where it is landfilled. Recycled materials are sent to a Materials Recovery Facility where they are baled and shipped to recyclers. The types of carts used for garbage disposal are 20 gallon (costing \$91.94/cart quarterly), 32 gallon (\$116.05), 64 gallon

(\$190.68), and 96 gallon (\$266.32). The collection program is funded by this quarterly cost for trash bins. Recycling carts are 32 gallon, 64 gallon or 96 gallon bins. This system serves 891,000 households.

The types of households in Alameda County, California are as follows (Note: These percentages are out of 587,071):

- Single Unit Structure: 356,392 (60.71%)
- Multi-Family/Unit Structure: 223,159 (38.01%)
- Mobile Homes/Other Housing Units: 7,168 (1.22%) (U.S. Census Bureau, 2014)

3. Portland, Oregon

Portland is the largest City in the State of Oregon, in the northwestern United States. The population is 609,456. By October 1, 2013 all retailers in Oregon were to be covered by the plastic bag ban ordinance which expanded on the 2011 ordinance. This ordinance was put into place due to concerns of ocean pollution and protecting the pacific while also protecting neighborhoods and natural areas in the City.

In Portland, trash and recycling are picked up curbside biweekly with an automated system and taken to Metro Central. This program is funded by taxpayer levies based on thorough evaluation of what it costs to provide services to residents. The sizes of trash carts range from 20 gallon to 90 gallon carts. Residents may set out an extra can or bag of garbage on collection day for a one-time \$5 fee or increase to a larger garbage container for an additional \$5 - \$7 per month. There are 129,698 households served by this program.

The types of households in Portland, Oregon are as follows (Note: These percentages are out of 267,514):

- Single Unit Structure: 160,268 (59.91%)

- Multi-Family/Unit Structure: 102,959 (38.49%)
- Mobile Homes/Other Housing Units: 3813 (1.43%) (U.S. Census Bureau, 2014).

4. Westport, Connecticut

Westport is a coastal Town located along Long Island Sound in Connecticut. The population is 26,391. On September 2, 2008 the Town initiated a ban on plastic bags due to concerns regarding waterway impacts, sewer impacts, marine life, leeching of chemicals from landfills and unsightly litter.

In Westport, trash and recycling are collected at a Transfer Station and Recycling Center. From there, the trash is landfilled. The number of households served by this program are 9,573 and it is funded by taxpayer dollars.

The types of households in Westport, Connecticut are as follows (Note: These percentages are out of 10,413):

- Single Unit Structure: 9521 (91.43%)
- Multi-Family/Unit Structure: 829 (7.96%)
- Mobile Homes/Other Housing Units: 63 (0.61%) (U.S. Census Bureau, 2014)

5. Hawaii

Hawaii is an isolated volcanic archipelago in the Central Pacific of the United States. The population is 1.42 million. In 2015 the State implemented a plastic bag ban due to concerns of wildlife impacts, litter, and chemicals leaching from landfills. Due to the size of the entire State of Hawaii, a subset of the population was looked at for parameters regarding trash collection. In Honolulu, trash and recycling are collected curbside once per week. The system is both manual and automated depending on a household's location. The trash is landfilled, while recycling is taken to RRR Recyclers Services Facility in Campbell Industrial Park. The program is funded

using taxpayer dollars and covers 180,000 households. The carts used are wheeled carts, with some households using 35-gallon containers.

The types of households in Hawaii are as follows (Note: These percentages are out of 524,852):

- Single Unit Structure: 325,421 (62%)
- Multi-Family/Unit Structure: 198,542 (37.83%)
- Mobile Homes/Other Housing Units: 781 (0.15%) (U.S. Census Bureau, 2014)

The types of households in Honolulu, Hawaii are as follows (Note: These percentages are of the total number of households, 339,830):

- Single Unit Structure: 190,286 (55.99%)
- Multi-Family/Unit Structure: 149,203 (43.91%)
- Mobile Homes/Other Housing Units: 269 (0.08%) (U.S. Census Bureau, 2014).

6. Delaware

Delaware is a small mid-Atlantic State in the United States bordering the Atlantic Ocean, Delaware River, and Delaware Bay. The population is 935,614. On December 1, 2009 the State initiated a plastic bag Take-Back Program due to concerns regarding litter, coastline and forest degradation and clogged storm drains. Due to the size of the entire state of Delaware, a subset of the population was looked at for parameters regarding trash collection. Trash and Recycling is picked up curbside weekly in Wilmington by rear loader, semi-automated trucks with cart tippers. The materials are brought to a single-stream processing facility, which is funded by the general fund (taxpayer dollars). This system serves 22,000 households and the bins are 64 gallon carts that must be less than 50 lbs. There is a program in place called a “Recycle Bank” where residents can earn up to \$25 per month in credits and coupons to use at grocery store and retail chains around Town.

The types of households in Delaware are as follows (Note: These percentages are out of 411,250):

- Single Unit Structure: 300,923 (73.17%)
- Multi-Family/Unit Structure: 73,024 (17.76%)
- Mobile Homes/Other Housing Units: 37,202 (9.05%) (U.S. Census Bureau, 2014)

The types of households in Wilmington, Delaware are as follows (Note: These percentages are of the total number of households, 34,635):

- Single Unit Structure: 22,193 (64.08%)
- Multi-Family/Unit Structure: 12,326 (35.59%)
- Mobile Homes/Other Housing Units: 116 (0.33%) (U.S. Census Bureau, 2014).

7. Rhode Island

Rhode Island is a New England State in the United States. The population is 1.05 million. In 2005 the State implemented a plastic bag Take-Back Program, “Restore,” due to concerns of plastic bag litter and environmental impacts. Due to the size of the entire state of Rhode Island, a subset of the population was looked at for parameters regarding trash collection. In Middletown, trash and recycling are collected curbside once a week using an independent contractor and a fully automated, compacting truck. The garbage is taken to Central Landfill and recycling is taken to Materials Recycling Facility, which is a dual stream processing facility. This program is funded using a pay-as-you-throw program and a flat fee and serves 4,500 households. The size of the trash carts are 65 gallons and two 64 gallon recycling carts.

The types of households in Rhode Island are as follows (Note: These percentages are out of 462,930):

- Single Unit Structure: 269,637 (58.25%)

- Multi-Family/Unit Structure: 188,541 (40.73%)
- Mobile Homes/Other Housing Units: 4469 (0.97%) (U.S. Census Bureau, 2014)

The types of households in Middletown, Rhode Island are as follows (Note: These percentages are of the total number of households, 7,456):

- Single Unit Structure: 4702 (63.06%)
- Multi-Family/Unit Structure: 2503 (33.57%)
- Mobile Homes/Other Housing Units: 251 (3.37%) (U.S. Census Bureau, 2014).

8. Phoenix, Arizona

Phoenix is the capital of the Southwestern State of Arizona in the United States. The population is 1.513 million. In 2008 the State implemented an at-store plastic bag Take-Back Program due to concerns of visible litter, especially in fences. Due to the size of the entire state of Arizona, a subset of the population was looked at for parameters regarding trash collection. In Phoenix, trash and recycling are collected curbside using an automated system and brought to a single stream processing facility. This program is funded by a monthly user fee and serves 389,000 households. Each household is provided with two 90 gallon rolling carts.

The types of households in Phoenix, Arizona are as follows (Note: These percentages are out of 598,176):

- Single Unit Structure: 388,213 (64.90%)
- Multi-Family/Unit Structure: 191,369 (31.99%)
- Mobile Homes/Other Housing Units: 18,255 (3.05%) (U.S. Census Bureau, 2014).

9. Brooklyn, New York

Brooklyn is a Borough in New York City, sitting on the western end of Long Island in the United States. The population is 2.59 million. In 2013 the Borough implemented a recycling

program due to concerns of equipment and labor costs of plastic bags clogging recycling infrastructure. In Brooklyn, trash is collected curbside using a manual system and is taken to Sunset Park Material Recovery Facility. This is paid for by the General City Revenue. In Brooklyn, no charges are imposed on customers aside from trash tickets. This program serves 2,201,500 households. The bins can be no larger than 44 gallons with a maximum weight of 60 lbs.

The types of households in Brooklyn, New York are as follows (Note: These percentages are out of 1,012,536):

- Single Unit Structure: 142,044 (14.03%)
- Multi-Family/Unit Structure: 868,481 (85.77%)
- Mobile Homes/Other Housing Units: 1502 (0.15%) (U.S. Census Bureau, 2014)

10. Washington, DC

Washington, DC is the Capital of the United States and is a compact city on the Potomac River. The population is 658,893. On September 23, 2009 the City implemented a tax on plastic bags due to the condition of the Anacostia River and cleanup costs. In D.C. trash is collected curbside using a manual system and is taken to the transfer station and then Fairfax County's Energy Resource Recovery Facility. Recycling is taken to Maryland. The program is funded through the cost of the cans and taxpayer dollars and covers 105,000 households. The cost of a "Supercan" for trash is \$62.50 for a 32 gallon cart or \$45 for a recycling cart.

The types of households in Washington, DC are as follows (Note: These percentages are of the entire population of, 300,798):

- Single Unit Structure: 112,414 (37.37%)
- Multi-Family/Unit Structure: 188,166 (62.56%)

- Mobile Homes/Other Housing Units: 123 (0.04%) (U.S. Census Bureau, 2014)

11. Portland, Maine

Portland is the largest City in the State of Maine, located in New England. The population is 66,235. On April 15, 2015 the City initiated a tax on plastic bags due to concerns over plastic bag litter (especially in trees), clogged storm drains, wildlife impacts, waterway impacts, and impacts to infrastructure and machinery. Trash and recycling are collected curbside using an automated system and transported to EcoMaine trash and recycling facility in Portland. The program is funded by residents using a Pay-Per-Bag program. The cost is \$13.50 per 10 bags and the program applies to 23,000 households. Recycling is put into carts and trash is in any blue or purple city trash bag.

The types of households in Portland, Maine are as follows (Note: These percentages are of the total number of households, 33,157):

- Single Unit Structure: 14,793 (44.62%)
- Multi-Family/Unit Structure: 18,269 (55.10%)
- Mobile Homes/Other Housing Units: 82 (0.25%) (U.S. Census Bureau, 2014)

12. Breckenridge, Colorado

Breckenridge is a small town in the State of Colorado located in the Western United States. The population is 4,648. On April 9, 2013 the Town initiated a fee on plastic bags due to their excessive use which negates their “Sustainable Breck” plan. In Breckenridge trash and recycling are collected curbside with a manual system and brought to Summit County Recycling Drop-off Centers. This program is funded by taxpayers and covers 1,081 households. The containers used are any recycling containers under 50 pounds. Households may use their own garbage cans or rent a 64-gallon can from the town.

The types of households in Breckenridge, Colorado are as follows (Note: These percentages are of the total number of households, 6,939):

- Single Unit Structure: 1959 (28.23%)
- Multi-Family/Unit Structure: 18,269 (55.10%)
- Mobile Homes/Other Housing Units: 0 (0%) (U.S. Census Bureau, 2014)

13. Montgomery County, Maryland

Montgomery County is a County in the State of Maryland. The population is 1,030,447. On January 1, 2012 the County initiated a fee due to waterway impacts – plastic bags are the most common form of litter seen in the Potomac River. In Montgomery County trash is collected curbside using a manual system and is taken to the Montgomery County Recycling Center, baled and sent to processors. There is a refuse collection charge of \$48.75 per year included in their tax bill. The program serves 90,000 households and private haulers cover additional households. The containers must be 45 gallons or less and weigh less than 45 pounds.

The types of households in Montgomery County, Maryland are as follows (Note: These percentages are of the total number of households, 380,250):

- Single Unit Structure: 253,143 (66.57%)
- Multi-Family/Unit Structure: 126,484 (33.26%)
- Mobile Homes/Other Housing Units: 541 (0.14%) (U.S. Census Bureau, 2014)

D. Types of Documents

The types of documents to be analyzed include news articles and public opinion about plastic bag policy, local legislation and revenue documents, and local articles. Phone interviews with municipality representatives will also comprise a large portion of the research. Local legislation documents will provide much of the insight into the problem the policy is trying to address, who

is responsible for implementation, and the specific details of the policy approach. Revenue documents will provide insight into the question of cost effectiveness of each policy approach and how much each approach costs to implement and enforce. Local news articles will provide information on the public atmosphere regarding plastic bag policy and will provide information on the backlash regarding policy implementation and enforcement.

A majority of the thesis will be comprised of phone interviews with municipality representatives, individuals involved in the policy making process on both sides, and NGOs. These representatives will be able to provide first hand insight into the policy problem and approach taken and will be able to provide a timeline of events and key factors to search for in the research process.

CHAPTER IV

Case Studies

Plastic Bag Bans

1. Austin, Texas

Proposed Legislation/Reasoning

Effective March 1, 2013, Austin, Texas banned all single-use plastic bags with thicknesses under 4.0 mil from being provided by business establishments to their customers (Ordinance 20120301-078). At that date, paper bags had to consist of at least 40% recycled material, which increased to a minimum of 80% starting March 1, 2014 (BagLaws, n.d.). Furthermore, establishments contained within city limits must promote, through signage on their property, the ideas of reducing, reusing, and recycling. Failure to comply may result in a fine not exceeding \$2,000 or \$500 (for a misdemeanor).

The ordinance does not apply to restaurant bags whose purpose is to prevent moisture damage, or pharmaceutical or veterinarian bags used for medical purposes, only if such bags are recyclable within Austin. Other exemptions include bags used by business establishments that contain bulk items, frozen foods, unwrapped prepared foods, or items that need to be shielded from moisture, as well as bags used by non-profit organizations for charitable purposes.

Justification for the bag ban includes the welfare of citizens, environment, and wildlife. A reduction of single-use plastic bags means fewer enter the waste stream, vital for reaching a city goal of zero waste by 2040. Voluntary programs were established in 2009, leading to a reduction of plastic bag use by 20% (ordinance 20080410-048). Preemptive research by the city manager determined the cost to taxpayers for recycling plastic bags through ordinance 20100624-079 in 2010, which further increased the necessity to reduce the number of plastic bags.

Outcome:

Public and private reaction has been mixed regarding the success of the bag ban. A report by the Austin Resource Recovery organization, acting on the recommendation by the city, found that the initial ordinance reduced the number of plastic bags entering the waste stream, but the city saw an increase in larger 4 mil or greater plastic bags (Waters, 2015). This replacement resulted in the reusable bag being “left at home.” In general, the 4 mil or greater plastic bags have a higher carbon footprint due to their production methods as well as being shipped from overseas.

Others object on the grounds that the violation penalties are too harsh, or the definition of “reusable” does not make sense in the context of the ban, since regular plastic bags can be reused (Levin, 2012). Moreover, single-use plastic bags make up a mere 0.03% of litter collected in 2015.

To alleviate some of the waste, suggestions have been made to eliminate the wide-spread availability of the 4 mil plastic bags, which would result in a reduction of approximately 23 tons of plastic film entering the waste stream, or an approximate decrease of 75% annually (Waters, 2015). Other suggestions include better public education regarding recycling and reusing programs and encouraging retail establishments to take back plastic bags.

2. Portland, Oregon

Proposed Legislation/Reasoning

On November 15, 2012 city council in Portland, Oregon voted to approve the expansion of the City’s plastic bag ban to include all retailers and restaurants by October 2013 (City of Portland, n.d.). The expansion builds on the 2011 ordinance that banned plastic bags in grocery stores and large pharmacies and is going to be a phased approach (City of Portland, n.d.). Phase

one of the expansion went into effect March 1, 2013 including all retail establishments and food providers greater than 10,000 square feet (City of Portland, n.d.). By October 1, 2013 all other retail establishments or food providers will be required to provide only recycled paper bags or reusable bags at the checkout by October 1, 2013 (City of Portland, n.d.).

The reason behind this ordinance is so that fewer unnecessary plastic checkout bags will litter Portland's neighborhoods and natural areas (City of Portland, n.d.). The ordinance required the Bureau of Planning and Sustainability (PBS) return to the Portland City Council with a one-year progress report and recommendations for refinement and expansion (Bureau of Planning and Sustainability, 2012). The ordinance applies to 167 mostly grocery stores and pharmacies with gross annual sales of \$2 million and large retailers over 10,000 square feet that have a pharmacy (Bureau of Planning and Sustainability, 2012). The City also distributed reusable bags and educational materials to low income residents and seniors in five different languages (Bureau of Planning and Sustainability, 2012).

Outcome

Since the initial ban went into effect, there has been a 300 percent increase in reusable bag use (City of Portland, n.d.). The Bureau of Planning and Sustainability received fewer than five consumer complaints regarding non-compliance but found no cause to issue penalties (Bureau of Planning and Sustainability, 2012). Furthermore, reusable checkout bag use increased 304 percent while paper checkout bag use increased 491 percent (Bureau of Planning and Sustainability, 2012). The Bureau of Planning and Sustainability recommends the following policy options to help curtail bag use even more:

1. Maintain ban of single use plastic check out bags (current policy)
2. Expand current policy to include all retailers (has been implemented):

- Pro: Decreases consumption of single use plastic bags
 - Con: Does not necessarily reduce single use bag consumption, as there would be a significant shift to recycled paper bags. This option would also increase cost to retailers and/or customers as customers shift to paper bags.
3. Expand current policy to include all retailers and require a five-cent charge on paper bags:
- Pro: Promotes use of reusable bags, decreases consumption of single use bags and decreases consumption of recycled paper bags. This option would also offset the increases cost to retailers.
 - Con: Five-cent cost for customers who do not bring their own bag (Bureau of Planning and Sustainability, 2012).

3. Westport, Connecticut

Proposed Legislation/Reasoning

On September 2, 2008, Westport was the first city in Connecticut to ban plastic bags. The ordinance intended to improve the environment in Westport by "...encouraging the use of reusable checkout bags and banning the use of plastic bags for retail checkout of purchased goods. Retail establishments are encouraged to make reusable bags available for sale" (Strauss, 2008 Pg. 1). The reasoning for the ordinance is that non-biodegradable plastic bags are often discarded into the environment and end up polluting waterways, clogging sewers, endangering marine life in Long Island Sound and causing unsightly litter. The bags last hundreds of years in landfills and are a potential source of harmful chemicals when they do not break down (Strauss, 2008). The Conservation Department is in charge of enforcement of the ordinance including issuing citations for offenders, \$150.00 per violation and payable to the town.

One of the reasons the ordinance was successful was that local politicians staged a door-to-door campaign to convince local businesses that the ban would work. The town also gave consumers and store owners six months to get used to the idea before the ban took effect (Hladky, 2014). Furthermore, city officials took a gentle approach with businesses who may have just ordered a big supply of plastic bags prior to the ordinance passing, there were a few instances where an individual store was allowed to keep using bags past the official deadline (Hladky, 2014).

Outcome

Businesses and customers have grown accustomed to life without plastic. According to Alicia Mozian, the Conservation Director for Westport "...businesses have adjusted well, consumers took to the ban with only a bit of early grumbling, and the amount of loose bag trash has definitely dropped" (Hladky, 2014). In addition, Mozian estimates around 95% of retail businesses in town are complying. Arlene Putterman, the spokeswoman for the local Super Stop and Shop says the community received the ban well and it is business as usual (Hladky, 2014).

4. Hawaii

Proposed Legislation/Reasoning

The reasoning behind plastic bag ordinances is that plastic bags are responsible for choking fish, turtles, birds and other animals that mistake plastic for food. Plastic bags contribute to litter, especially when carried by the wind. The bags may degrade into unsafe chemicals and single use plastic bags were not consistent with the County's goal to reduce the quantity of materials going into landfills (County of Hawai'i, n.d.). Chapter 14 Hawai'i County Code 1983 introduced in February of 2011 is the ordinance put in place to reduce the use of plastic bags and

to encourage the use of environmentally preferable alternatives such as reusable cloth or paper bags. Oahu was the last Hawaii Island to ban plastic bags.

Chapter 9, Article 9 of the Revised Ordinances of Honolulu regulates plastic bag use in Oahu effective July 1, 2015 (Env, n.d.). As of July 1, 2015, businesses are prohibited from providing plastic checkout bags and non-recyclable paper bags to customers at the point of sale for the purpose of transporting groceries or other merchandise. Businesses are still able to make available reusable bags, compostable plastic bags, recyclable paper bags for the purpose of transporting groceries or other merchandise and non-recyclable paper bags to protect or transport prepared foods, beverages, or bakery goods (Env, n.d.).

In February of 2015 notices were sent to the affected businesses reminding them of the ban and requesting the return of a compliance form indicating how the business plans to address the ban. If a business provides customers with a checkout bag, the ordinance applies. On July 1, 2015 businesses were required to submit annual compliance forms. Oahu's Department of Environmental Services is in charge of implementing and enforcing the ban.

Outcome

The definition of reusable plastic bags “a bag with handles that is specifically designed and manufactured for multiple reuse...that is made of durable materials...including plastic that is at least 2.25 mils thick” allows for thicker, heavier plastic made of the same material as the banned bags to become an alternative which is worse for the environment (Huston, 2015).

Environmentalists are now trying to amend the ordinance to also ban heavier plastic.

5. Alameda County, California

Proposed Legislation/Reasoning:

On January 1, 2013 grocery stores and other food retailers can no longer provide single-use plastic bags at checkout under the StopWaste ordinance which effects 1,300 stores countywide. The Alameda County Waste Management Authority adopted the Reusable Bag Ordinance in January 2012 to reduce the use of single-use carryout bags and promote the use of reusable bags (ACWMA, n.d.). The reasoning behind the ordinance was the prevalence of litter in waterways, and plastic pollution threatens oceans and marine life. In 2007 the San Francisco Regional Water Quality Control Board declared five waterways in Alameda County including Strawberry Creek and Codornices Creek in Berkely, Sausal Creek and Damon Slough in Oakland, and San Leandro Creek in San Leandro so polluted with trash that they violated the federal Clean Water Act (StopWaste, 2014). The County Authority maintains that shopping with reusable bags helps to reduce litter and waste, protects creeks and the bay, and conserves natural resources (ACWMA, n.d.).

Stores affected by the ordinance are required to charge a minimum of \$0.10 for each paper bag or reusable bag, the ordinance does not regulate the use of single-use bags used to protect and transport produce, bulk food or meat from within a store to the checkout or cash register (ACWMA, n.d.). The County estimates that 764 million single-use plastic bags are distributed annually in the county and 100 million paper bags (ACWMA, n.d.). Additionally, plastic bags cause equipment problems at recycling facilities (ACWMA, n.d.).

Outcome:

Some owners have noticed the changes first-hand according to a manager at 7-11 website: “People used to ask for two bags now they don’t even want one” (StopWaste, 2014). Furthermore, a gas station operator said “I’ve been the owner for over years – it’s been a big change. It’s changed people’s habits because they don’t want to pay 10 cents.” (StopWaste,

2014). Other stores claimed their bag purchases decreased between 50 and 90 percent (StopWaste, 2014).

Of the 13 billion plastic bags used in California per year, less than 5% are recycled. In California, local cities and counties have enacted over 75 plastic bag bans. A bill was approved, Senate Bill 270, banning single-use plastic bags, on September 30, 2014 in the state of California. The bill intended for a fee of \$0.10 per recyclable or reusable bag to be enforced in supermarkets and drug stores. In order for a bag to be classified as reusable, it has to meet a number of criteria: The bag has to have a handle with a volumetric capacity of greater than 15 liters, designed for at least 125 uses, be machine washable, contains information regarding the manufacturer and the country in which it was manufactured, does not contain toxic material. Bags considered recyclable must contain at least 20 percent recycled material if they are eight or fewer pounds, otherwise they have to be comprised of 40 percent recycled material. Furthermore the bill includes \$2 million to be apportioned towards helping businesses for a smooth transition to using reusable bags. Exclusions to the bill include bags used for pharmaceutical and food purposes. Violations to the proposed bill would be \$1,000 per day for the duration of the first violation, \$2,000 per day for the second, and \$5,000 per day for the third. The law was set to go into effect in July of 2015, however, the plastics industry and bag manufacturers secured enough signatures to put the ban into a referendum in November 2016 meaning the ban is on hold until then (Rooney, 2015).

Plastic Bag Take-Back Programs/Recycling

1. Delaware

Proposed Legislation/Reasoning

Effective December 1, 2009 retail stores are required to set up a plastic carry-out bag recycling program for customers (House Bill No. 202 an Act to Amend Title 7 of the Delaware Code relating to Recycling and Waste Reduction)(State of Delaware, n.d.). Stores with 7,000 square feet or more of retail space, or that have three or more stores of at least 3,000 square feet of retail sales space which provide plastic carryout bags to customers are required to comply (State of Delaware, n.d.). Stores are required to establish “at-store” plastic bag recycling programs. They must make bins for plastic bag recycling and collection that are both visible and in an easily accessible location. Stores are prohibited from disposing of plastic bags as solid waste (State of Delaware, n.d.).

Effective August 1, 2010, all plastic bags must be labeled “Please Return This Bag To A Participating Store For Recycling” or something similar that encourages the reuse and recycling of plastic bags (State of Delaware, n.d.). Stores are also required to maintain records describing the collection and recycling of plastic bags and make them available to the Delaware Department of Nature Resources and Environmental Control upon request (State of Delaware, n.d.). Furthermore, stores are required to offer reusable bags to customers for purchase and allow the use of reusable shopping bags (State of Delaware, n.d.).

Failure to comply with the law results in a penalty of \$500 for the first violation, up to \$1,000 for a second violation and up to \$2,000 for a third and each subsequent violation (State of Delaware, n.d.).

The reasoning behind the legislation was the prevalent nature of plastic bag litter across communities, roadsides, parks, forests, rivers and coastlines. The bags also clog stormwater management systems, which result in increased cleanup costs (HB 202). Furthermore, 4,131 bags were picked up on Delawares Coastal Cleanup Day along state beaches (State of Delaware, n.d.).

Outcome

Delaware is currently considering imposing a fee for plastic bags. The fee would not be to raise revenue but rather to encourage the use of reusable bags and discourage the use of plastic bags (Willing, 2015). Any revenue generated from the bag fee would help stores fund the all ready in place recycling programs. According to Willing

“...bags aren’t free now, you don’t have to be an economist to understand that the cost of bags (and the recycling program, which is currently under funded by the law requiring it) are worked into the cost of your groceries and retail items. [Internalizing] the cost to charge only those who actually use the bags is the fair and logical thing to do.

Additionally this can help stores fund recycling efforts and make people think, rather than mindlessly consume plastic bags which ultimately end up cluttering our landscapes, beaches and waterways, or clogging up our water treatment infrastructure – thus saving even more in taxpayer clean-up costs” (2015).

The voluntary recycling program is not doing enough on its own. The societal costs of single-use bags is even higher than the built in financial costs, resulting in negative health impacts and taxpayer costs to clean up waterways, clear clogs at wastewater treatment plants, rehabilitate animals and ecosystems (Sierra Club, n.d.) (Figure 9).



Figure 9: Visual depiction of plastic bag litter (Retrieved from Delaware Sierra Club, n.d.).

2. Rhode Island

Proposed Legislation/Reasoning

On February 12, 2015 at 3:30PM I spoke with Sarah Kite at the Rhode Island Resource Recovery Center. The following questions were asked about their plastic bag program:

Are there less plastic bags in the waste stream now?

Did you specifically choose this over a ban or a tax?

Has it been useful and effective?

How did you educate people about the program?

One thing I've noticed in Maine is that the bins are constantly overflowing at grocery stores, do you encounter this problem in Rhode Island?

Rhode Island developed a ReStore program in 2005, over ten years ago and it was the first in the country. Fifteen years ago Rhode Island saw a lot of plastic bags flying around the landfill property, bordered by neighbors. In the winter you would see a number of bags littering the trees. A permanent litter fencing about 35 feet tall was constructed to contain bags, but the bags would litter the fence. All items accepted in ReStore containers must be clean and dry and

include: Shopping Bags, Dry Cleaning Bags, Newspaper bags, bread/bagel bags, produce bags mattress bags, shrink wrap from cases of beverages, electronic overwrap, paper towel and toilet paper overwrap, airpacks (from shipped packages), bubble wrap, pellet/firewood bags

The initial thought for Rhode Island was to put a fee on bags, however, since people perceive fees as a tax, they decided against it. They then considered a ban but declined that as they felt it would be difficult to enforce. They also believed that a ban would not eliminate the problem as people would shop in Mass and Connecticut and yet still have bags in Rhode Island and need to dispose or reuse them.

The Take-Back Program called Restore was very well received and was initially voluntary for the consumer, and mandatory for commercial facilities to participate. It was hard to get the number of bags distributed in Rhode Island because retailers did not want it to seem like 5 million bags were distributed each year because those bags are not all in the environment and they did not want to release that information.

It took 4-5 years for the ReStore program to move through the general assembly. The program initially started as a “Promotion of Paper Bag” usage program and the initial parameters did not include pharmacies and the CVS headquartered in Rhode Island. In addition, they were not concerned about small stores. Furthermore, grocery stores Stop and Shop and Shaws could not agree on the color of the bin. In addition, prior to a recycling campaign, there was a campaign by grocery stores called the “Why-not campaign” advertising how wind blown bags could be tied in a knot so they do not get picked up by the gusts.

Outcome

The corporations were charged with outreach and education, encouraging consumers to bring bags with them to the supermarket and the markets were overwhelmed with the response.

They worked on getting pharmacies and big box retailers involved. CVS wanted to design their own container, Wallgreens, Rite Aid, Walmart, Target, Old Navy, and Macys had no problem using the containers provided. Bags are taken back essentially everywhere in Rhode Island and the program has been a “phenomenal” success. The biggest piece of the puzzle is the accessibility which makes it easy for everyone to comply.

One problem seen with the Take-Back program is that it is difficult keep up with the containers and follow up. So when the cardboard container is picked up to be sent to the recycler, managers do not order a backup container. The compliance with the program is excellent, the litter fencing used to be completely covered with plastic bags and now it is almost bare. According to Kite, you are almost hard pressed to ever see a bag on a fence. Rhode Island hopes to eventually expand the program to cover bubble wrap, etc. Major retailers such as Target and Walmart collect bags and large sacks and bring them back to distribution centers, they collect all materials and bundle them into a bale and sell them to Trek the recycler.

3. Phoenix, Arizona

Proposed Legislation/Reasoning

On March 20, 2015 at 11:00AM I spoke with Tim McCabe at the Arizona Food Marketing Alliance. The following questions were asked about their plastic bag program:

What is your main viewpoint from a grocer standpoint regarding plastic bag policies?

*What do you see as the main motivating factors for plastic bag bans?
How do we handle plastic bag litter?*

How do you handle take-back programs at the grocery level?

Who are the major actors involved? How are you involved?

How do you educate people on plastic bag programs in the grocery store?

The plan to recycle plastic bags included a logo and slogan used to raise awareness around plastic bag disposal. Six main elements were highlighted in the plan: Recycling containers with the logo and slogan, Reduce, Reuse, Recycle messaging on bags, Education and Marketing Partnerships, Reusable carryout bags, Effective measurements, and community input (BCS, n.d.). Furthermore, a website was created that lists where people can find containers.

Phoenix consumes 300 million plastic bags each year and the curbside program does not accept plastic bags. However, since the City owns its own facility for trash and recycling, it made sense to encourage the take-back program to reduce the contamination and equipment downtime at the facility (BCM, n.d.). The city partnered with the Arizona Food Marketing Alliance to start this program and grocers were on board instead of being mandated to comply with a program (BCM, n.d.).

According to McCabe, the Arizona take-back program was started eight years ago. Every person can recycle plastic bags through their major grocery stores. Grocery stores collect with bins in the stores, send the bags through a distribution center, and make outdoor decking or playground equipment. The program was started to voluntarily encourage grocery stores to have bins for consumers to bring back bags. The Arizona Food Marketing Alliance was approached by Phoenix to deal with the issue of Plastic bags, less than 1% of which make up the litter stream. However, plastic bags are a very visible form of litter, especially up against fences. People did not know what to do with their plastic bags and now everyone can go to the grocery stores and bring the bags back with them. All retailers agree with the program and support it eight years after implementation.

There are 150 businesses of all types signed up for the program, mostly grocery and retail stores with the following elements:

1. *Recycling containers – Most retail establishments have placed recycling containers for recycling plastic bags in a prominent location within their store. This was done without mandates or ordinances.*
2. *Reduce, reuse, recycle message on bags – The partners agreed that a message on each bag was important and that more than the current standard “This bag is recyclable” was needed.*
3. *Education and marketing partnership – The City of Phoenix committed to education and advertising on plastic bag recycling programs using the City’s available methods of outreach which include:*
 - A. *Inserting notes/advertisements in the municipal utility bills, such as the CityPage, a water bill insert.*
 - B. *Promotion on Channel 11 Cable TV, the public service channel*
 - C. *Promoting the Bag Central Station program along with the slogan campaign of “Recycling Changes Everything” at associated school and neighborhood events*
 - D. *Distributing reusable carry out bags – The City of Phoenix has purchased and personalized reusable bags and they are working with various retailers for distribution at specific events. The retailers have also committed to providing reusable bags at their store sites.*
4. *Effectiveness measurements – The city of Phoenix has committed to measuring the program’s effectiveness by monitoring the volume of plastic bags and film at the City’s transfer stations and material recovery facilities (MRFs). The retail community has committed to monitoring the volume in the recycling containers in select retail establishments.*
5. *Community input – The Public Works Department uses its quarterly Customer Service Survey process to incorporate plastic bag recycling questions to gather community input into the process and determine education effectiveness. Retailers have committed to monitor complaints and/or praise concerning the plastic bag recycling programs. (BCM, n.d.).*

Outcome

The program has been successful, plastic bag use at stores has dropped by 12%, 1,300 tons of plastic bags have been captured annually by six grocery store chains, and there was a 20% decline in plastic bags coming through the Material Recycling Facility (BCM, n.d.). The program is continuing to spread to more stores including Target (BCM, n.d.).

The hardest part of getting the program in place was finding agreement among competing grocery stores and how to proceed. In addition, promoting plastic bag recycling messages with limited funding and staffing resources was a problem. There was also a problem coming up with a consistent approach to labeling plastic bags. According to McCabe “the program has been pretty successful and there is a strong demand of people wanting plastic bags to be recycled. All retailers agree with the program and support it eight years after implementation.” In the 2015 Arizona Legislative Session, SB 1241 was passed which preempts cities, towns, and counties from enacting fees or bans on auxiliary containers such as cups, cans, bottles, or plastic bags (BCS, n.d.).

4. Brooklyn, New York

Legislation/Reasoning

On February 12, 2015 at 2:30PM I spoke with Eadaoin Quinn at Sims Municipal Recycling.

The following questions were asked about their plastic bag program:

Where did the idea come from? Are other communities in NY doing this?

Is there any way to ensure the bags that are separated are clean? Do you recycle the bags for anything or are they just taken out?

Education coordinator: Did you have to put much energy into telling/educating people they couldn't throw plastic bags into the recycling bin?

Reduction in plastic bag litter?

The main problem in Brooklyn, New York is that plastic bags were getting stuck in equipment, wrapped around magnets and clogging areas for optical sorters and the machines had to be stopped on a constant basis to clean out the bags. Brooklyn has ballistic separators which (See Figure 10):

...Act as a series of sieves and shakers to remove any remaining two-dimensional material, such as paper contaminants, from the three-dimensional containers. The various plastics and aseptic containers, which include milk cartons and juice boxes, pass through a series of near-infrared optical sensors that sort plastics based on polymer type. When a sensor finds what it's looking for, like a PET bottle or juice carton, air jets launch the material out of the stream. Whereas most facilities are equipped with one or two optical sensors, Brooklyn's has 16, which means it can sort nearly all the material automatically (Tweed, 2013).

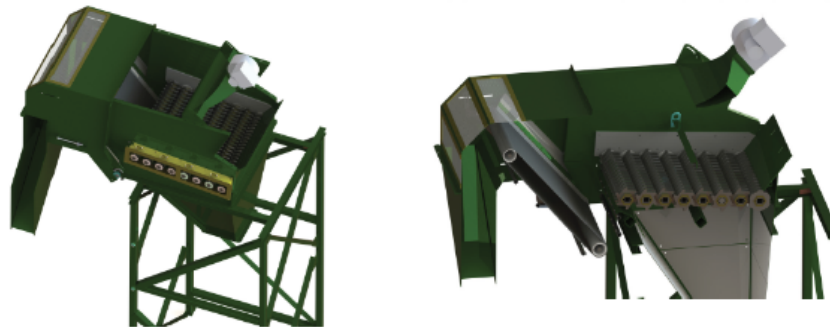


Figure 10: Visual depiction of ballistic separators (Retrieved from: GreenMachine, n.d.).

The ballistic separators are effective but they still have to stop to be cleaned. Sims Recycling was given a 20-year contract for New York City residential waste. There are a lot of small apartments in New York so people put recyclables out on the curb in plastic bags instead of recycling bins as they do not have the space for recycling bins. Therefore, New York City collects a lot of plastic bags. The recycling system as bags are taken into a big pile, pushed onto

a conveyor belt, a liberator shreds and opens plastic bags, catches them and sorts what is inside. The ballistic separators have panels inside that move like a bike, plastic bags and paper will get moved up and cans will roll back down, grocery bags and boxes get brought up while everything else falls through. A stream of 2D recyclables including plastic bags, flat recyclables, are brought onto conveyor belts with optical scanners, these scanners look for plastic bags and use air jets to tell what type of bags are present based on the type of plastic. Clean plastic bags are sent to the market for reproduction. While less expensive than landfilling, dirty, wet bags require a fee for disposal as they cannot be recycled.

Outcome

While some bags still get caught in the system, it is working out really well. Plastic bags make up 7.5% of waste in Brooklyn and never degrade. Many stores around the city have take-back programs due to a local law requiring recycling of plastic film such as plastic shopping bags (Green in Bklyn, n.d.).

Plastic Bag Tax

1. Washington D.C.

Proposed Legislation/Reasoning

Effective September 23, 2009, Washington DC implemented the Anacostia River Clean Up and Protection Act of 2009 (D.C. Law 18-55; DC Official Code § 2-1226.51 *et seq.*). The Act implements a 5 cent tax on plastic bags. Starting on April 1, 2010, each disposable carryout bag provided by a retail establishment must meet the requirements:

- I. All paper and plastic disposable carryout bags provided shall be one hundred percent (100%) recyclable

- II. All paper and plastic disposable carryout bags shall display in a highly visible manner the phrase “Please Recycle This Bag,” or a substantially similar phrase. The lettering of the phrase shall meet the following requirements:
 - A. The lettering of the phrase shall be at least one half and inch (0.5”) in height or at least seventy-five percent (75%) of the width of the front panel of the bag;
 - B. The lettering of the recycling statement shall appear on the exterior of either the front or back panel of the bag, and not on a gusset or the base of the bag; and
 - C. The lettering of the recycling statement shall be in a boldface font
- III. A disposable carryout bag made of paper shall contain a minimum of forty percent (40%) post-consumer recycled content; and a disposable carryout bag made of plastic shall be made of high-density polyethylene film marked with the SPI resin identification code 4 (DDOE, n.d.).

The disposable carryout bags must meet these requirements even if the bag is compostable or biodegradable. A retail establishment is identified as “any business required to have a Public Health: Food Establishment Retail” endorsement, including: bakeries, delicatessens, grocery stores, convenience stores that sell food, restaurants, food vendors, street vendors that sell food, liquor stores and any business that sells food items including a department store or electronics store that has a Public Health: Food Establishment Retail endorsement to its basic business license (DDOE, n.d.).

Excluded from the ordinance are the following:

- I. A bag used by a customer inside stores to package bulk items, such as fruit, vegetables, nuts, grains, or candy

- II. A bag used by a customer inside a store to contain or wrap frozen foods, meat, or fish, whether or not the items are prepackaged
- III. A bag used by a customer inside a store to contain or wrap flowers, potted plants, or other items where dampness may be a problem
- IV. A bag used by a customer inside a store to contain unwrapped prepared foods or bakery goods
- V. A bag used by a pharmacist to contain prescription drugs
- VI. A newspaper bag, door-hanger bag, laundry-dry cleaning bag, or bags sold in a package intended for use as garbage, pet waste, or yard waste bags
- VII. A bag provided to a customer by the retail establishment for the purpose of transporting a partially consumed bottle of wine
- VIII. A paper carryout bag provided to a customer to take food away from a restaurant with seating if the bag contains food items, food and non-food items that the restaurant does not directly charge the customer for
- IX. A reusable carryout bag (DDOE, n.d.).

One cent (\$0.01) of each fee of five cents (\$0.05) is retained by the retail establishment, the remaining (\$0.04) is kept by the Office of Tax and Revenue (DDOE, n.d.). The ordinance also includes a Voluntary Carryout Bag Credit Program which credits the customer at least five cents (\$0.05) for each carryout bag provided (DDOE, n.d.). The first violation in a calendar year is one hundred dollars (\$100), the second violation is two hundred dollars (\$200), and the third violation and each subsequent violation is five hundred dollars (\$500) (DDOE, n.d.).

Outcome

A Bandalong litter trap device was funded by the tax to clean up the Anacostia River, a polluted waterway littered with soda bottles, cigarette butts, rusty tires and raw sewage (Brittain and Rich, 2015). The river-cleaning cause was promoted by the slogan “Skip the Bag, Save the River.” It is essentially a giant skimmer that spans about 100 feet across Watts Branch and funnels trash into a cage. It rises and falls with the water and there are three of them in the District. The trap and the employees who clean it out each week and after every rainfall are funded by the bag tax (Ben-Achour, 2013).

The revenue from the bag fees have contributed roughly \$10 million since 2010 to the Anacostia River Cleanup and Protection Fund (Brittain and Rich, 2015). \$1,510,088 in 2010, \$1,845,413 in 2011, \$1,993,183 in 2012, and \$2,001,575 in 2013 (Lebowitz et al., 2014). DDOE has the following internal controls in place to monitor plastic bag charges: established a tip-line/web-link for the public to report retailers that are not charging for bags and randomly selected retailers where DDOE’s inspector acts as a secret shopper to determine if the bag fee is being charged, and if the bags are receipts comply with labeling and material requirements (Lebowitz et al. 2014).

According to a city audit and the Washington Post’s review of the fund a majority of the money has been allocated for fieldtrips for schoolchildren and employee salaries than to tangible cleanup projects on the river and its watershed, for example, the largest grant from the fund thus far, \$1.2 million will be paid over the next two years to send every D.C. fifth grader on a two-night field trip at campsites outside the district, 30 miles from the Anacostia River (Brittain and Rich, 2015). Furthermore, more than \$1.7 million of fund money went toward personnel costs (Brittain and Rich, 2015). One-third of the spending and allocations from the fund have gone

toward trash traps to clean the river and other environmental matters such as green roofs and tree plantings (Brittain and Rich, 2015).

After the fee started, within months officials released figures showing a drop from a purported 22.5 million bags used per month to 3.3 million an 85% decrease (Brittain and Rich, 2015). However, there is little evidence of a sudden, drastic reduction (Brittain and Rich, 2015). A local survey in 2013 funded by \$60,000 of bag-fee money asked 600 residents of D.C. households how many disposable bags they used before the fee compared with their current use, the results show that District households, on average, have decreased bag use by 60%, from 10 bags per week to four (Brittain and Rich, 2015). Revenue from the bag fee is not declining which means that shoppers are still choosing to pay the fee rather than switch to reusable bags, perhaps the results from the survey (funded by plastic bag revenue) are misleading.

2. Portland, Maine

Proposed Legislation/Reasoning

Effective April 15, 2015 Portland introduced a Reusable Bag Ordinance (Ch. 12, Article IX § 230-237). in which local retailers will begin charging customers \$0.05 per plastic or paper shopping bag they use to package purchases goods (Portland, Maine). The City Council adopted this ordinance to reduce waste through providing customers with a financial incentive to bring their own bags when they go shopping. Plastic bags are problematic sources of litter, they hang from trees, block storm drains, and are hazardous to wildlife on land and in the waterways (See Figure 11). They get tangled in the machinery at recycling plants creating a maintenance problem. Furthermore, the City of Portland's taxpayers must bear costs associated with the effects of single-use carryout bags on the solid waste stream, drainage, litter, and wildlife. The City supports the waste management hierarchy (reduce, reuse, recycle, compost, waste-to-energy

landfill) and supports efforts to achieve State recycle goals and the best alternative to single-use carryout bags is to shift to reusable bags for shopping and the council seeks to conserve resources, reduce greenhouse gas emissions, waste and litter and to protect the public health and welfare, including wildlife, which increase the quality of life for the City’s residents and visitors (Ch. 12, Article IX § 230-237).

Portland’s ordinance defines a single-use carryout bag as “...a bag other than a Reusable bag provided at the check stand, cash register, point of sale or other point of departure for the purpose of transporting food or merchandise out of the establishment. The term Single-Use Carryout Bag includes compostable and biodegradable bags but does not include reusable bags, produce bags, product bags or bags provided by pharmacists to contain prescription drugs” (Ch. 12, Article IX § 230-237). The ordinance defines a “produce bag or product bag” as “...any bag without handles used exclusively to carry produce, meats, other food items or merchandise to the point of sale inside a store or to prevent such items from coming into direct contact with other purchases items” (Ch. 12, Article IX § 230-237).



Figure 11: Plastic bag litter in stormdrains and infrastructure impairment (Portland, n.d.).

Bags exempt from the ordinance include any bags used to carry goods to the point of sale. Including bags provided to customers to contain bulk items such as fruit and produce. Other

types of bags used by cashiers to contain products such as meat and soap are also exempt. Other bags exempt include bags provided to contain prescription medicines and reusable bags that the consumer brings to the store including plastic bags (Portland, Maine).

The ordinance applies to grocery stores, convenience stores, gas stations, pharmacies and other vendors that sell food items. Stores at which the sale of food items makes up less than 2% of gross sales are exempt from the ordinance as are restaurants.

Stores are required to do the following in addition to charging the fee:

1. Post signage indicating the per bag fee (See Figure 12)
2. Document the bag fee on the printed sales receipt
3. May not refund or credit the bag fee to customers
4. Must maintain records of the purchase and sale of single use carry out bags for at least 3 years.

Stores are allowed to keep the fee and use it for any legal purpose. Maine Revenue Services indicated to City staff that the fee is likely a taxable sale and that sales tax should therefore be charged (Portland, Maine). Retailers who do not comply with the ordinance are subject to a fine of \$250 for the first violation and \$500 for subsequent violations.



Figure 12: Signage in Portland, Maine outlining the plastic bag fee (Portland, n.d.).

Outcome

As of October, 2015 reusable bags have gotten extremely popular in Portland. Before the ordinance went into effect in April about 10 percent of Hannaford customers came to the store with reusable bags now more than 80 percent do. According to Hannaford spokesman Eric Blom, there has been a substantial increase in people purchasing reusable bags in Portland. The store will not reveal specific information but says that it is a 350 percent increase in sales from the 160,000 reusable bags Hannaford gave away in the week prior to the ordinance (Pols, 2015). Other communities including Brunswick, Falmouth, Freeport, Topsham, and York are following suit with Portland as well as South Portland which is set to introduce a bag ordinance in March

of 2016 (Pols, 2015). If all of these communities move toward plastic bag policy measures nearly 12 percent of Maine’s 1.3 million residents will no longer use plastic bags (Pols, 2015).

3. Breckenridge, Colorado

Proposed Legislation/Reasoning

Breckenridge passed a Disposable Bag Fee on April 9th 2013, which went into effect on October 1, 2013. The purpose of the ordinance was to promote the use of reusable bags and influence people not to use disposable plastic shopping bags. The Town has a “SustainableBreck Plan” which was developed over the course of three years by the community development department in Breckenridge and adopted by the town in 2011. The Town has one of the highest solid waste rates in the nation at 2.48 times higher than the national per capita average (Duboise, 2013). The Town uses more than 3 million plastic bags each year (SummitDaily, 2013).

Approximately two billion disposable bags are used annually in Colorado, however, less than five percent are recycled (Ch. 12 § 5-12-5(E)). The plastic bag ordinance places a ten-cent fee on both plastic and paper bags. The fee, however, does not apply to bags brought into a retail store by a customer and used to transport goods from the store and a bag that was previously used and made available to customers at the store (Duboise, 2013). The Town developed a reusable shopping bag to provide to merchants to use in the store, designed to be a “souvenir” of Breckenridge (See Figure 13).



Figure 13: Souvenir bag in Breckenridge, Colorado designed to be an alternative to plastic bags (Town of Breckenridge, n.d.).

The Council adopted the Disposable Bag Fee ordinance after months of committee discussions and receiving public input through surveys and at a number of public meetings (Town of Breckenridge, n.d.). The Town exempts bag fees for foods such as fresh foods, meat and fish for hygienic reasons and also for bulk items such as fruit, vegetables, nuts, grains, candy or small hardware items like nails, nuts, and screws (Town of Breckenridge, n.d.). In addition, bag fees are exempt to wrap flowers, potted plants and other items where dampness may be a problem as well as bags used to contain unwrapped prepared foods or bakery goods (Town of Breckenridge, n.d.).

Revenue generated from the plastic bag fees is split between the Town and the retail businesses, who are given a portion of the fee to help recoup costs of implementing the program (SummitDaily, 2013). The Town uses fee revenue to purchase and distribute the Breckenridge bag and educates the public about the fee program. The Town collects bag fees and records them in a return form (See Figure 14).

PERIOD COVERED	01/01/14 - 01/31/14	ACCOUNT NUMBER		TOWN OF BRECKENRIDGE			
DUE DATE	02/20/14			BAG FEE RETURN			
BUSINESS NAME AND ADDRESS				DIVISION OF FINANCE & MUNICIPAL SERVICES - TOWN OF BRECKENRIDGE - PO BOX 1517 - BRECKENRIDGE, CO 80424 (970) 453-3182			
1. TOTAL NUMBER OF REUSABLE BAGS SOLD				COMPUTATION OF FEE			
2. TOTAL NUMBER OF DISPOSABLE BAGS DISTRIBUTED				3. AMOUNT OF TOWN BAG FEES (10% OF LINE 2)			\$ -
SCHEDULE - A:				4. ADD EXCESS FEES COLLECTED ¹			\$ -
<input type="checkbox"/> SPECIAL MESSAGE TO TOWN (COMPLETE THE BOX TO THE RIGHT IF ANY OF THE BELOW APPLY)				5. TOTAL FEES: (ADD LINES 3 AND 4)			\$ -
<input type="checkbox"/> CHECK HERE FOR CHANGE OF ADDRESS / PHONE NUMBER / FAX NUMBER				6. RETAINED PERCENTAGE (50% OF LINE 5, \$1000 MAXIMUM / MONTH) ²			\$ -
<input type="checkbox"/> CHECK HERE FOR FINAL BAG FEE RETURN TO TOWN OF BRECKENRIDGE (NOTE REASON WHY)				7. PENALTY 10% <i>not auto calculated</i>	\$ -		\$ -
<small>¹ Compare the fees collected for the month to line 3. If fees collected exceed line 3, put excess here.</small>				INTEREST (1% PER MONTH) <i>not auto calculated</i>	\$ -	TOTAL	\$ -
<small>² Maximum retained percentage will adjust to \$100 / month on 11/01/2014.</small>				8. A - ADD			\$ -
ALWAYS SIGN YOUR FORM				B - DEDUCT			\$ -
SPECIAL MESSAGE TO TOWN (COMPLETE THE BOX TO THE RIGHT IF ANY OF THE BELOW APPLY)				9. TOTAL DUE AND PAYABLE (MAKE CHECK OR MONEY ORDER PAYABLE TO TOWN OF BRECKENRIDGE)			\$ -
<input type="checkbox"/> CHECK HERE FOR CHANGE OF ADDRESS / PHONE NUMBER / FAX NUMBER				SHOW BELOW CHANGE OF OWNERSHIP AND/OR ADDRESS, ETC.			
<input type="checkbox"/> CHECK HERE FOR FINAL BAG FEE RETURN TO TOWN OF BRECKENRIDGE (NOTE REASON WHY)				I HEREBY CERTIFY UNDER PENALTY OF PERJURY THAT THE STATEMENTS MADE HEREIN ARE TO THE BEST OF MY KNOWLEDGE, TRUE AND CORRECT.			
<small>¹ Compare the fees collected for the month to line 3. If fees collected exceed line 3, put excess here.</small>				BY _____			
<small>² Maximum retained percentage will adjust to \$100 / month on 11/01/2014.</small>				TITLE _____			
<small>² Maximum retained percentage will adjust to \$100 / month on 11/01/2014.</small>				COMPANY _____			
<small>² Maximum retained percentage will adjust to \$100 / month on 11/01/2014.</small>				PHONE _____			
<small>² Maximum retained percentage will adjust to \$100 / month on 11/01/2014.</small>				DATE _____			
<small>² Maximum retained percentage will adjust to \$100 / month on 11/01/2014.</small>				BUSINESS ADDRESS ? _____			
<small>² Maximum retained percentage will adjust to \$100 / month on 11/01/2014.</small>				MAILING ADDRESS ? _____			

Figure 14: Town of Breckenridge bag fee return spreadsheet (Town of Breckenridge, n.d.).

The charge for paper and plastic bags is part of an ongoing sustainability effort by the council to reduce the use of disposable bags in Town (SummitDaily, 2013). In addition, plastic bags have a wildlife and recreation impact on the pristine land in Breckenridge. No one spoke out against the bag fee during a public hearing prior to the final vote (SummitDaily, 2013). The Council approved the measure by a 6-0 vote. The Council considered a full ban on plastic bags at larger grocery stores and a voluntary reduction program at other retailers but decided against it as some Town leaders felt it was unfair (SummitDaily, 2013). Furthermore, communities which bag fees have seen up to an 80 percent reduction in the use of disposable bags, these fees have been adopted at the local level in four Colorado communities including Telluride, Aspen, Basalt, and Boulder (SummitDaily, 2013). The amount of the fee in Breckenridge was determined based on an analysis model used by Boulder.

The ordinance in Breckenridge does not address the use of disposable bags or containers in restaurants and other businesses which is what Breckenridge officials plan to address in the future (SummitDaily, 2013). Each store is required to post signage outside or inside the store viewable to customers and alert them of the Breckenridge disposable bag fee (Town of Breckenridge, n.d.). The Council allocated \$50,000 to purchasing reusable bags to distribute to

consumers, bags were purchased for \$1 each, bag fees are used to replenish bags, after a year retailers and lodging are responsible for 50% of the cost of bags, bags are now sold for \$.99 and \$.89 goes toward replenishing bags at retail stores and the welcome center. The Town did months of advertising in the paper and media prior to implementation with catchy taglines i.e. no bag left behind, radio and tv, lodging and store signage, print media such as vacation guides, and a video was produced by a local news station (Surfrider, 2015). Retailers can pay fees online in mail or in person, forms are available online and retailers must report monthly to the finance office (Surfrider, 2014).

Outcome

Merchants response to the bag fee was mixed but overall positive, one retailer mentioned there was “too much government” and another said the only negative part of the ordinance is that the reusable bag was only one size and was too big for small items (Duboise, 2013). The disposable bag fee does not apply to bags used for loose small retail items including jewelry, buttons, beads, ribbon, herbs and spices. There are many small souvenir shops in Breckenridge and the ordinance takes into account the need to use small bags for these purchases (Duboise, 2013).

Some criticism arose from the bag fee by some locals who call it a “sin tax” and tourists who do not understand or appreciate the charge (SummitDaily, 2013). However, there was a 40% reduction in bags in the first year, locals have shown exceptional support, and tourists have been mostly supportive noting they have a fee at home. On the other hand, there have been some drawbacks to the fee. After the first year lodging is required to pay 50% of the cost of reusable bags at 50 cents each. There has been some pushback from some of the lodging companies as

these bags are distributed at no cost to visitors. Similarly, a few tourists have been upset with the fee (Surfrider, 2015).

4. Montgomery County, Maryland

Legislation/Reasoning

On January 1, 2012 a County law on disposable plastic bags went into effect in Montgomery County, Maryland. The legislation was passed (B-8-11) on May 3, 2011 and places a five cent charge on each paper or plastic carryout bag provided by retail establishments at the point of sale, pickup or delivery (Montgomery County, n.d.). The retailers retail 1 cent of each 5 cents for the bags they sell to a customer. The revenues are deposited in the County's Water Quality Protection Charge (WQPC) fund and effectively shift the burden of litter clean up costs from public taxpayers to consumers who have a choice to avoid the 5-cent charge by bringing reusable bags (Montgomery County, n.d.). The Water Quality Protection Charge is used for the following:

1. *Inspect over 1,500 publicly – and privately – maintained stormwater management facilities to ensure they are working. These devices effectively remove pollutants before they get into our streams and reduce the volume of flood water;*
2. *Construct or retrofit stormwater controls to better treat runoff from more than 1,000 acres;*
3. *Restore and stabilize 4.3 miles of degraded stream channels and eroding stream banks; and*
4. *Share the costs of 151 stormwater control projects on residential, private and institutional properties. (Montgomery County FAQ, n.d.).*

This is one example of something close to a Pigouvian tax (discussed above in Ch. II). in which the County established a Water Quality Protection Charge to correct an externality.

The reasoning behind this legislation is that plastic bags are the most commonly found items in the waterway litter. The streams in Montgomery County flow into the Potomac River carrying trash pollution into the principal source of drinking water (Montgomery County FAQ, n.d.). Furthermore, plastic bags consistently clog inlets and outlets of stormwater BMPs, increasing the risk of flooding. A study of trash and litter conducted in the Anacostia watershed in 2008-2009 found that Montgomery County tributary streams carry more than 121 tons of trash and litter over the entire watershed, a majority of which is plastic bags, to the Anacostia river during all four sampling seasons (Montgomery County FAQ, n.d.). Each year Montgomery County spends more than three million on trash and litter control activities, a cost all taxpayers bear, however the bag tax defrays this cost onto all taxpayers. Customers who bring their own bags can choose to avoid the cost that all taxpayers previously have had to pay to clean up the litter (Montgomery County FAQ, n.d.).

In order to publicize the bag tax, Montgomery County conducted a broad-based education campaign to inform businesses and residents about the law. Retailers were provided materials that advertise the bag law (i.e. decals, posters, and notices). The county also conducted a free bag distribution program to lower income households that will include a notice about the upcoming bag law (Montgomery County FAQ, n.d.).

Outcome

The cultural shift was not as dramatic as hoped; County shoppers have been more willing to pay for plastic bags than anticipated (Turque, 2013). Officials projected a 60 percent decline in bag usage for first fiscal year (82.9 million to 33.1 million), however, through the first five months of fiscal 2013, businesses sold 24.8 million bags (Turque, 2013). However, revenue from the tax, estimated at \$1 million per fiscal year exceeded \$2 million (Turque, 2013). Conversely,

environmental groups that conduct periodic cleanups of county stream banks reported a significant reduction in the number of bags recovered (Turque, 2013).

Many consumers bring reusable bags to grocery stores but are more likely to pay the five-cent fee for plastic bags at department stores such as Macy's: "I don't mind going in a grocery store, but in these kind of stores when you're buying a garment, I think it should be wrapped" (Turque, 2013).

CHAPTER V

Capstone

In this thesis, research was conducted to address the following research question:

Under what conditions is a ban, fee, or a take-back/recycling program best to address the end of life attributes of plastic bags in the waste stream?

In order to answer this question a subset of communities, states, and counties were looked at based on the availability of information. The theoretical foundation behind the policy measures was looked at in Chapter II and provided the background for the specific regulation. The main objective of this thesis was to understand the effectiveness, defined as a reduction in bags, of policies while keeping in mind different communal characteristics and trying to achieve the goal of answering the research question: “*under what conditions is a ban, fee, or take-back/recycling program best to address the end of life attributes of plastic bags in the waste stream?*” The research question was not addressed directly and evolved over time based on the availability of information. The “conditions” mentioned in the research question refer to the attributes: population, collection method, truck type, materials processing facility, funding, households served, container type, type of housing unit, and reason for policy action. If data connecting the 9 attributes above to plastic bags could be obtained, the results of this study would be more useful to communities (See Figure 15).

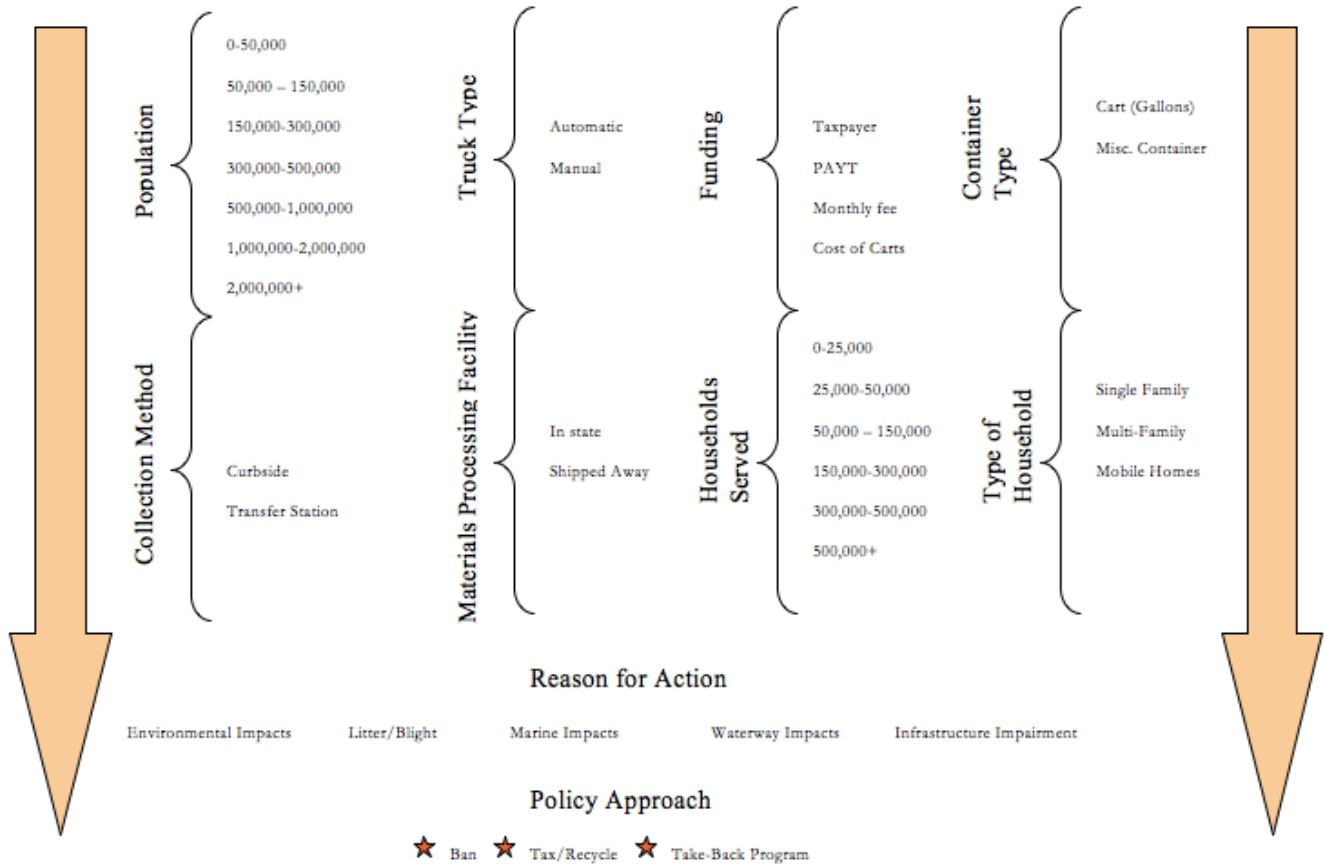


Figure 15: Desired outcome of research question.

For example, say the community Borike has the following characteristics:

Population: 270,000
Collection Method: Curbside
Truck Type: Automatic
Materials Processing Facility: In State
Funding: PAYT
Households Served: 240,000
Container Type: 64 Gallon Carts
Type of Household: Single-Family Homes
Reason for Action: Litter/Blight

With enough case studies and available data, the community could compare their characteristics and know the policy measure to take to resolve the litter/blight issues in their community. The research question had to evolve to address the missing information. The results of this study indicate that the policy measure to take depends on what the community wishes to see for results.

For example, if a community wishes to take the strictest method out there and is prepared to frame their ordinance language for specific bag weights, they should go for a ban. If a community is looking to raise revenue for bag clean-up or can set a tax high enough to eliminate bags (greater than 10 cents), they should go for a tax. If a community is looking to set up a voluntary at-store program accompanied with an education program, they should go for a take-back/recycling program.

One of the questions that this study leads to is: *is it better to keep plastic bags out of the environment or to clean them up once they are in the environment?* Again, it depends on a community's reason for action and their desired outcome. In terms of litter and blight, a community could put together a commission or a volunteer group to clean up plastic bags, however, they will always be present as they do not respect borders and will blow from community to community. In terms of marine and waterway impacts, plant and marine life will already be impacted by plastic bags whether it is choking on the bags or suffering from chemical repercussions of the bags. In terms of infrastructure, the machines will already be impacted from the bags and even after cleaning them out, might not run as originally intended. Because of these lasting impacts and the wind-driven nature of plastic bags, it is best to try to keep them out of the environment rather than clean them up once they have already had an impact on the surrounding environs.

The following cities, counties, and states initiated bans: Austin, Texas, Portland, Oregon, Westport, Connecticut, Hawaii, and Alameda County, California. Because Hawaii could not be looked at as a whole state, a subset of the state was chosen (Honolulu). The major reason for initiating a plastic bag ban in each of these locations was the concern about environmental

impacts. However, some communities were also concerned about citizen welfare, landfills and impacts to waterways.

The following cities, counties, and states initiated take-back programs and recycling: Delaware, Rhode Island, Phoenix, Arizona, Brooklyn New York. Because Delaware and Rhode Island could not be analyzed as entire states, subsets were chosen (Wilmington Delaware and Middletown Rhode Island). The major reason for initiating take-back programs and recycling programs was litter (especially in fences) as well as equipment costs and stormwater infrastructure impairment.

The following cities, counties, and states initiated a tax, fee, levy: Washington, D.C., Portland, Maine, Breckenridge, Colorado, Montgomery County, Maryland. The major reason for initiating a plastic bag tax in each of these places were impacts to waterways and the excessive use of plastic bags overall.

In each case it is evident that the environmental benefits are making it worthwhile to clean up plastic bag litter. However, there is no data that says the benefits of cleaning up are monetary, in each case the reasoning for regulation is because of the environment but there is no expansion on the costs and benefits. One example of this is in Montgomery County, Maryland in which it was pointed out that the watershed was so polluted with litter that it violated the Clean Water Act. Are there fees from the Environmental Protection Agency associated with not complying with the Clean Water Act? Is that the motivation behind plastic bag regulation or is it strictly the environment? There is no mention of these details in any of the cases.

In Alameda County, California the details of the plastic bag regulation were explicitly laid out. However, in some communities this was not the case such as with Austin, Texas in which a reverse incentive took place where the ban on plastic bags led to thicker more harmful

bags in the environment that were still allowed as they were not laid out and defined in the ordinance language.

A. Similarities Among Communities

When looking at the population for Austin, Texas, Portland, Oregon, Westport, Connecticut, Hawaii, and Alameda County, California we see that the population living in single family homes is between 50-60% for each community with the exception of Westport, Connecticut (91.43%), Austin, Texas (51.16%), Portland, Oregon (59.91%), Hawaii (55.99%), Alameda County (60.71%). Furthermore, each community has automated curbside trash and recycling with the exception of Westport, Connecticut which has a Transfer Station.

Each area chosen has similar attributes when it comes to the type of facility used for trash and recycling. The facilities are in the vicinity of the selected area although some are dual-stream processing facilities and others are single-stream processing facilities. The trash and recycling is collected and baled on site and then shipped off site to another area. This gives plastic bags a chance to get out of trash trucks, get caught in fences and in waterways.

Austin, Texas, Honolulu, Hawaii and Washington D.C., Montgomery County, Maryland have the most comparable number of households served (182,000, 180,000, 105,000, 90,000 respectively). Furthermore, the communities with the least amount of households served, Westport, Connecticut, Middletown, Rhode Island, and Breckenridge, Colorado (9,573, 4,500, and 1,081 respectively) are comparable. Likewise, Wilmington, Delaware and Portland, Maine (22,000 and 23,000 respectively) are also comparable in terms of households served. Alameda County, California (891,000), Phoenix, Arizona (389,000) and Brooklyn, New York (2,201,500) are outliers in terms of households served as most other communities did not serve nearly this number of households.

B. Differences Among Communities

Funding for trash and recycling collection varied among most areas chosen. For communities where the information was not explicitly available, it was assumed that this charge is included in taxpayer dollars. Most areas had either a monthly utility bill for trash collection, a quarterly charge, a charge per cart, or a pay as you throw flat fee system. The only area that did not have a charge was in Brooklyn, New York. The charge for trash collection comes out of the general city revenue and there are no charges on customers aside from “trash tickets” issued for not properly recycling or throwing away garbage.

Communities vary on the types of carts used. For instance, Austin, Texas, Alameda County, California, Rhode Island (Middletown), Phoenix, Arizona, and Washington D.C. each use trash and recycling carts varying in size from 96 gallons to 20 gallons. Wilmington, Delaware, Brooklyn, New York, Breckenridge, Colorado, and Montgomery County, Maryland are similar in that the bins vary based on maximum weights from 60 lbs. to 45 lbs. Portland, Maine uses city bags without stipulation as to bin types with the exception of carts for recycling. Hawaii uses both wheeled carts and 35 gallon containers. Westport, Connecticut is the only area chosen that did not have stipulations for the types of containers used as they have a transfer station to which residents have to bring trash.

C. The Economics of Plastic Bag Regulation

A ban on plastic bags can most closely be looked at as a command and control method of regulation. One of the benefits of command and control is that it is preferred in cases where pollution is so highly toxic that concerns regarding impact outweigh economic efficiency concerns. In instances where communities engage in plastic bag bans the reasoning is due to “highly toxic” pollution in the sense of aquatic impacts and litter impacts. For instance, bans

were initiated in Austin, Texas, Alameda County, California, Portland, Oregon, Westport, Connecticut and Hawaii, however, irrespective of the size of each case chosen litter/environmental impacts occur in each of the cases as reasoning behind bans.

One of the drawbacks of a command and control method of regulation is that standards are essentially one piece of the puzzle. Each individual firm or in this case grocery store have different cost structures or budgets and a one-size-fits all standard does not necessarily address the problems of externalities in a cost effective manner. In this case, plastic bags do not respect borders. One community might ban plastic bags but this does not mean plastic bags will stay out of their community as they can be brought in from elsewhere through human behavior or through natural causes.

The standard theory of optimal taxation says that a tax system should be chosen to maximize a social welfare function subject to a set of constraints (Mankiw et al., n.d.). Furthermore, the optimal marginal tax schedule could decline at high incomes, which is what we saw in some case studies where the revenue from the plastic bag tax was steadily increases each year, therefore, consumers were choosing to pay a tax rather than stop use of plastic bags which was the desired outcome. When both plastic and paper bags are not taxed similarly consumers will choose paper bags over plastic bags to avoid paying the cost, leading to an unintentional consequence. This concept is free to the “Pay-as-you-throw” program in which residents are required to pay for each bag of trash they use versus “free” recycling.

Another way to look at this is through the lens of a Marginal Abatement Cost (also discussed in Ch II) while looking at demand as environmental cleanup and supply as plastic bag litter. Unfortunately, this could not be done with the data available. However, monetary trends are evident. For instance, Washington D.C. set a tax of 5 cents per plastic bag. D.C. generated

\$1,510,088, \$1,845,413, \$1,993,183, and \$2,001,575 in years 1, 2, 3, and 4 respectively. This trend in increasing revenue leads one to believe that the tax was not high enough to warrant a behavior change as individuals are still choosing to use bags and pay the fee. Similarly, in Montgomery County, Maryland which also has a 5 cent tax, the revenue generated in the first year of the tax was over two million dollars. If we had data for Portland, Maine (5 cent tax) and Breckenridge, Colorado (10 cent tax), it would be easier to graph taxes vs. a reduction estimate.

Data needs to be obtained and used to further this research. For instance, if revenue was used as a measure of reduction and the tax was used as “price,” this would lead to the optimal pricing level needed on plastic bags and will provide the adequate level of reduction needed and the benefits of this reduction. If the optimal level is \$0, then this means a ban is the best measure to use and the least harmful solution is a ban where consumers have no choice.

A marginal damage function is a relationship between quantity of emissions and the damage caused by emissions (Sharma, 2011). In terms of plastic bags the damage function will change based on where the bags are being consumed. For example, in Breckenridge, Colorado where the population is 4,648 the damage caused by plastic bags is much less than in Brooklyn, New York where the population is 2.59 million. However, the visible nature of plastic bag litter and the amount of damage caused per bag causes each community to take action on bags in the form of a fee and a recycling system. In the instance of Brooklyn, a fee would likely not be as effective as consumers would choose to pay the fee and plastic bags would still exist.

D. Final Policy Decision

Which policy measure is best to control plastic bags: a ban, tax/fee, or a take-back program/recycling system? Looking at the data and drawing comparisons between communities, bans on plastic bags have the potential to work, but offer loopholes that actually harm the

environment. For instance, in Austin, Texas and Honolulu, Hawaii, banning plastic bags for certain thicknesses resulted in heavier plastic bags finding higher usage. In turn, these heavier, more environmentally impactful, bags found their way into the waste stream. On the other hand, Portland, Oregon found a 300% increase in reusable bag use, Westport, Connecticut saw the amount of loose bag trash drop, and Alameda County, California saw positive impacts in retail chains that show that reusable bag sales have increased. Stricter regulations for bag thicknesses could result in less plastic entering the waste stream, and could result in higher usage for reusable bags.

Take-back programs saw similar mixed results. On the whole, the recycling program in Delaware was not effective, as plastic bags still littered waterways and ecosystems, which provides a societal cost to remove the waste. Rhode Island, due to the widespread accessibility of the take-back program, saw great progress in reducing plastic bag waste. Having major retail and pharmaceutical chains on board helped with the success, as these businesses are the major distributors of plastic bags. In Arizona, plastic bag use dropped at stores by 12%, and there was a 20% decrease in plastic bags entering the Material Recycling Facility. In Brooklyn, New York, the enforcement of local laws have produced positive results in terms of decreasing plastic bag usage. A key component of recycling programs is outreach; a higher effort into getting competing retail, grocery, and pharmaceutical chains on board helps a long way to increase recycling habits in the consumer.

Taxes had mostly a positive impact on plastic bag usage. According to a survey in Washington, D.C., plastic bag use has decreased by 60% per household. The revenue generated from the tax has partially been allocated towards environmental issues, among other social issues. The revenue has not declined significantly, so some consumers are still opting to pay the

tax. In Portland, ME, reusable bag sales are up 350% at the Hannaford grocery chain. Other Maine cities are moving towards plastic bag legislation as a result. In Breckenridge, Colorado, a 40% reduction in bags was seen the first year. However, the reusable bag mentioned in the ordinance is only one size. In Montgomery County, Maryland, consumers were more apt to pay for plastic bags than anticipated, but environmental groups reported a reduction in plastic bag waste collected.

E. Intention vs. Outcome

With a sample size of 13 cases, the following 9 attributes were not able to be compared: population, collection method, truck type, materials processing facility, funding, households served, container type, type of housing unit, and reason for policy action (See tables 5 and 6). Populations were not compared as they ranged from 2.59 million in Brooklyn, New York to 4,648 in Breckenridge, Colorado. With only 13 cases it was not possible to find reliable similarities among communities in terms of their population sizes. For this same reason, trying to compare collection methods, truck types, materials processing facilities, funding sources, households served and container type also proved to be challenging. Phoenix, Arizona and Alameda County, California may have similar population sizes but their population densities of 3,165 and 1,800 people per square mile respectively are different. A population density of 3,165 people per square mile will cause different issues in terms of waste collection than a community that is more spread out.

Table 5: Selected Towns, counties, and states with plastic bag policy measures and the factors chosen to develop an environmental index including the population of a community, this is important to determine how large the area is that is being served, the collection method used in each community whether it is automatic or manual, the truck type in each community, some trucks allow plastic bags to escape easier than others, the materials processing facility, is there one on site or are plastic bag shipped away to another state which makes them less prevalent? The funding source for each community, the number of households served, and the type of container used, is it a closed lid container.

City/Town/State	Population	Collection Method	Truck Type	Materials Processing Facility	Funding	Households Served	Container Type
1. Austin, Texas	912,791	Curbside Trash & Recycling	Automated	Two Local Materials Recovery Facilities – Sorted/Baled, Sold to Manufacturers	Monthly utility bill for trash carts, Taxpayer	182,000	96 Gallon Wheeled Carts – Single Stream Recycling
2. Alameda County, California	1,510,271	Curbside	Automated	Alameda County Industries – Landfilled, recycling – Materials Recovery Facility, Bales are shipped to recyclers	Carts – 20, 32, 64, 96 gallon - \$91.94, \$116.05, \$190.68, \$266.32 respectively Quarterly	891,000	Carts – 20, 32, 64, 96 gallon for garbage, recycling 32, 64, 96
3. Portland, Oregon	609,456	Curbside biweekly	Automated	Metro Central	Taxpayer – thorough evaluation of costs of service	128,698	Trash carts range from 20 to 90 gallon cart, \$5 fee per extra cart or \$5-\$7 per month for upgrade
4. Westport, Connecticut	26,391	Transfer Station & Recycling Center	N/A	Transfer Station – Landfilled	Taxpayer	9,573	N/A
5. Delaware (Wilmington)	935,614 (72,828)	Curbside Weekly Trash & Recycling	Rear loaders, semi-automated using cart tippers	Single Stream processing Facility	Taxpayer – general fund	22,000	Bins – less than 50 lbs, Recycle bank – residents earn up to \$25/month in credits and coupons at chains around Town, 64 gallon recycling carts
6. Hawaii (Honolulu)	1.42 million (374,658)	Curbside, 2x/week – once for trash, once for recycling	Manual & Automated depending on location	RRR Recyclers Services Facility in Campbell Industrial Park, Trash – landfilled	Taxpayer	180,000	Wheeled carts, some using 35-gallon containers
7. Rhode Island (Middletown)	1.05 million (17,350)	Curbside 1x/week - Contractor	Fully automated, compacting	Central Landfill, Materials Recycling Facility, Dual stream processing	Pay-As-You-Throw & Flat Fee	4,500	Trash cart – 65 gallon carts, 2 64 gallon recycling

				facility			carts
8. Phoenix, Arizona	1,512,986	Curbside	Automated	Single Stream Processing Facility	Monthly user fee	389,000	Two 90 gallon rolling carts
9. Brooklyn, New York	2.59 million	Curbside	Manual	Sunset Park Material Recovery Facility	General City Revenue – no charges on customers (Trash Tickets)	2,201,500	Bins – no larger than 44 gallons, max weight 60lbs
10. Washington DC	658,893	Curbside	Manual	Trash Taken to Transfer and then Farifax County’s Energy Resource Recovery Facility – recycling MD	Taxpayer & Cost of Cans	105,000	Supercan = \$62.50, 32-gallon trash cart or recycling cart = \$45
11. Portland, ME	66,235	Curbside Trash & Recycling	Automated	EcoMaine – Trash Facility in Portland	Resident funded: pay-per-bag \$13.50/10 bags	23,00	Recycling Carts, Any Blue/Purple city trash bag
12. Breckenridge, Colorado	4,648	Curbside Trash & Recycling (Biweekly)	Manual	Summit County Recycling Drop-off Centers	Taxpayer	1,081	Any Recycling Container, under 50 lbs. Own garbage cans or rent 64-gallon can
13. Montgomery County, Maryland	1,030,447	Curbside	Manual	Montgomery County Recycling Center, Bales sent to processors	“Refuse collection charge” \$48.75/yea r tax bill	90,000 – private haulers for others	Container with 45 gallons or less and weigh 45 lbs or less

Table 6: Percentage of housing demographics of cities, towns and states with plastic bag policy. These include single family units, multi-family units, and mobile homes/other housing arrangements.

City/Town/State	Single Family Housing Unit	Multi Family Housing Unit	Mobile Homes/Other
Austin, Texas	191061 (51.16%)	177118 (47.42%)	5024 (1.35%)
Alameda County, California	356392 (60.71%)	223159 (38.01%)	7168 (1.22%)
Portland, Oregon	160268 (59.91%)	102959 (38.49%)	3813 (1.43%)
Westport, Connecticut	9521 (91.43%)	829 (7.96%)	63 (0.61%)
Delaware	300923 (73.17%)	73024 (17.76%)	37202 (9.05%)
Wilmington, Delaware	22193 (64.08%)	12326 (35.59%)	116 (0.33%)
Hawaii	325421 (62%)	198542 (37.83%)	781 (0.15%)
Honolulu, Hawaii	190286 (55.99%)	149203 (43.91%)	269 (0.08%)
Rhode Island	269637 (58.25%)	188541 (40.73%)	4469 (0.97%)
Middletown, Rhode Island	4702 (63.06%)	2503 (33.57%)	251 (3.37%)
Phoenix, Arizona	388213 (64.90%)	191369 (31.99%)	18255 (3.05%)

Brooklyn, New York	142044 (14.03%)	868481 (85.77%)	1502 (0.15%)
Washington D.C.	112414 (37.37%)	188166 (62.56%)	123 (0.04%)
Portland, Maine	14793 (44.62%)	18269 (55.10%)	82 (0.25%)
Breckenridge, Colorado	1959 (28.23%)	4980 (71.77%)	0 (0%)
Montgomery County, Maryland	253143 (66.57%)	126484 (33.26%)	541 (0.14%)

With plastic bag policy being a new field of study in trash/recycling research, there are no studies looking at plastic bag behavior in the waste stream. So while data was obtained for the 9 attributes listed above, there was no data linking these attributes to plastic bag behavior in the waste stream. Looking at the data alone without being able to draw comparisons to plastic bags proved to be not of use. Furthermore, the “reason for action” could not be looked at because there were only 13 case studies to draw comparisons between, with varying population sizes and waste collection attributes.

F. Future Research

The case studies used in this thesis used data from phone interviews, news articles, peer reviewed articles, reports from the Progressive Bag Alliance, environmental reports, and municipality websites. With more time, there could be more case studies included in this study to make results that could be extrapolated to every state. Furthermore, results can come out of analyzing the data and inputting it into a statistical program, such as SPSS. The variables (such as plastic bag policy reasoning) could be transformed into dummy variables and analyzed that way to show trends and regressions. Furthermore, variables that affect reduction such as the price point of the tax could be included.

More variables on the carrying capacity of plastic vs. paper bags and data on plastic bags bought and used per year at grocery stores over time (including those with taxes and take-back

programs) could be used to identify trends in behavior, however, it is a challenge in and of itself trying to get this data released. Unfortunately, having only 13 case studies makes it impossible to extrapolate these data to all 50 states to make it useful. This study can be expanded with someone looking at transfer stations around the United States and obtaining interviews with each operator regarding plastic bag consumption and end-of-life attributes at the landfill.

There were a number of drawbacks in terms of looking at each policy measure (See Table 7). Because plastic bags do not respect borders it is hard to track success of each measure in terms of the number of plastic bags still in the environment. Furthermore, more case studies need to be researched to expand on the data set laid out here. For example, the optimal level of plastic bag pollution reduction cannot be calculated by comparing Breckenridge, Colorado and Alameda County, California because of different demand curves due to income disparities, cultural issues, housing situations among others.

Table 7: Successes and drawbacks to studying plastic bag bans, taxes, and take-back programs/recycling programs.

Policy Measure	Successes with Studying	Problems with Studying
Ban	<ul style="list-style-type: none"> • Compliance is easy to track • Data are easy to obtain on success 	<ul style="list-style-type: none"> • Mixed reasoning for bans – would expect a major reason to take the most strict policy measure • Difficult to obtain municipality data – Dept. of Public Works released the most data in FAQs on populations served by MSW collection
Tax	<ul style="list-style-type: none"> • Compliance is easy to track 	<ul style="list-style-type: none"> • Difficult to track a reduction in bag pollution when bags still used • Data on success are hard to track – plastic bag litter still exists • Difficult to obtain municipality data – Dept. of Public Works released the most data in FAQs on populations served by MSW collection
Take-Back Program/Recycling	<ul style="list-style-type: none"> • Visibility of recycling and 	<ul style="list-style-type: none"> • Grocery stores unwilling to release data on plastic bags taken back

Program	take-back of bags helps to track success of policy	<ul style="list-style-type: none"> • # of recycled bags hard to track • Data on success are hard to track – plastic bag litter still exists • Difficult to obtain municipality data – Dept. of Public Works released the most data in FAQs on populations served by MSW collection
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While plastic bags make up a small portion of the waste stream, it is evident that they cause a lot more damage in terms of the impacts inflicted on the environment. Each policy measure looked at in this thesis has its advantages and disadvantages and each needs to be executed with specific parameters in mind. For instance, with a ban, it is necessary to not only ban plastic bags but to also ban paper bags, as without a ban on paper bags they will still be used, even if consumers are given the ability to pay a fee for the bags (standard theory of optimal taxation). Furthermore, with a tax it is necessary to also tax paper bags and set the tax high enough on both that consumers are going to change their behavior which is a key component to this policy measure and needs to be looked at more in depth through future research. Lastly, with a take-back program and recycling it makes the total environmental impact an easy data to retrieved. However, it is necessary to educate consumers to take their plastic bags to the stores or that a recycling system exists and offer incentives to turn plastic bag recycling into a habit for consumers to get into, otherwise the voluntary nature of this program makes it less successful to gain compliance.

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Appendix A: IRB Approval Letter

University of New Hampshire

Research Integrity Services, Service Building
51 College Road, Durham, NH 03824-3585
Fax: 603-862-3564

06-May-2014

McLaughlin, Megan
NREN, James Hall
20 Foote Street
Old Orchard Beach, ME 04064

IRB #: 5987

Study: Plastic Bags: Are They a Problem in Northern New England?

Approval Date: 05-May-2014

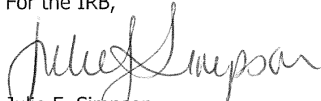
The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved the protocol for your study as Exempt as described in Title 45, Code of Federal Regulations (CFR), Part 46, Subsection 101(b). Approval is granted to conduct your study as described in your protocol.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the attached document, *Responsibilities of Directors of Research Studies Involving Human Subjects*. (This document is also available at <http://unh.edu/research/irb-application-resources>.) Please read this document carefully before commencing your work involving human subjects.

Upon completion of your study, please complete the enclosed Exempt Study Final Report form and return it to this office along with a report of your findings.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or Julie.simpson@unh.edu. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,



Julie F. Simpson
Director

cc: File
Halstead, John

University of New Hampshire

Research Integrity Services, Service Building
51 College Road, Durham, NH 03824-3585
Fax: 603-862-3564

19-Feb-2015

McLaughlin, Megan
NREN, James Hall
20 Foote Street
Old Orchard Beach, ME 04064

IRB #: 5987

Study: Plastic Bags: Are They a Problem in Northern New England?

Study Approval Date: 05-May-2014

Modification Approval Date: 18-Feb-2015

Modification: Expand Scope of Study

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved your modification to this study, as indicated above. Further changes in your study must be submitted to the IRB for review and approval prior to implementation.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the document, *Responsibilities of Directors of Research Studies Involving Human Subjects*. This document is available at <http://unh.edu/research/irb-application-resources> or from me.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or Julie.simpson@unh.edu. Please refer to the IRB # above in all correspondence related to this study.

For the IRB,



Julie F. Simpson
Director

cc: File
Halstead, John