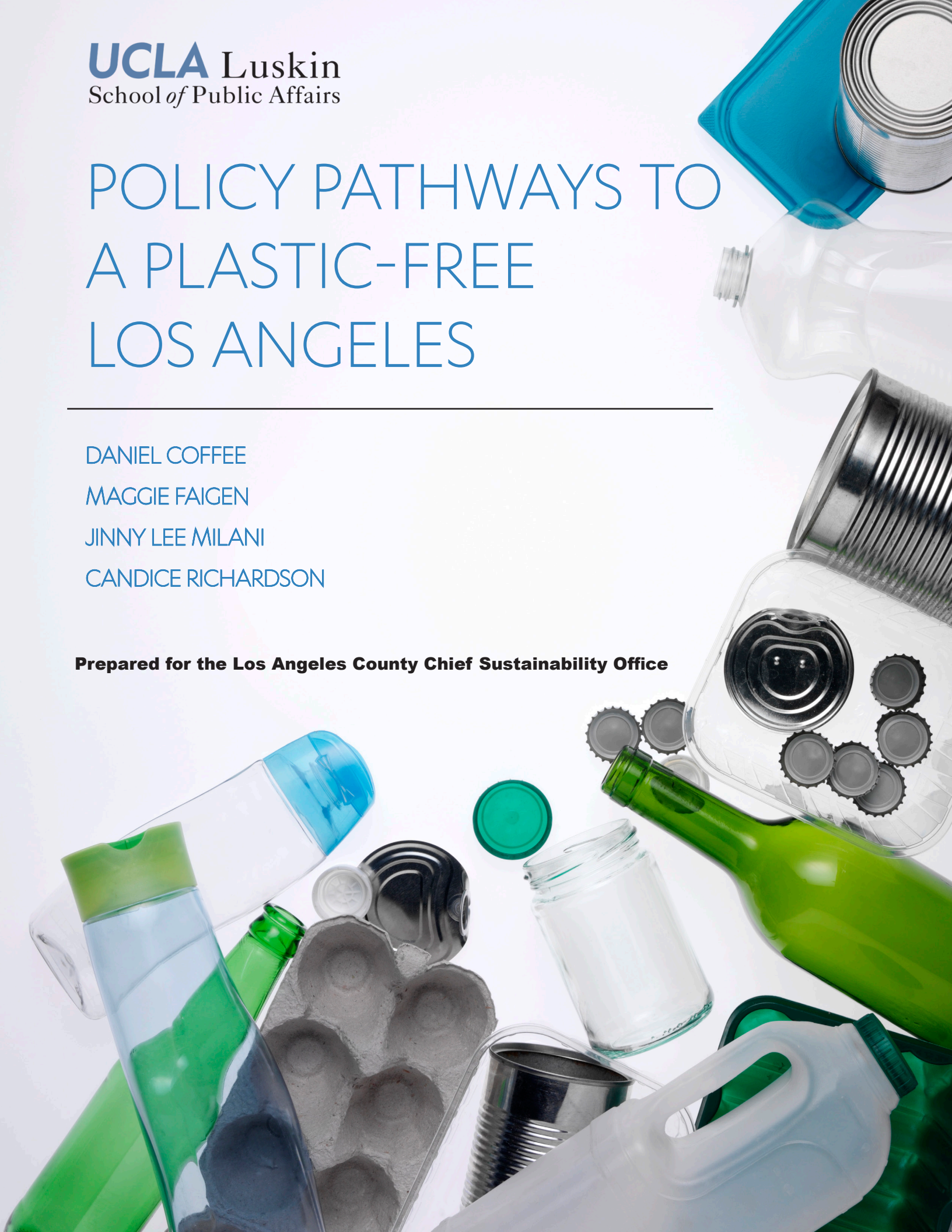
UCLA Luskin
School of Public Affairs

POLICY PATHWAYS TO A PLASTIC-FREE LOS ANGELES

DANIEL COFFEE
MAGGIE FAIGEN
JINNY LEE MILANI
CANDICE RICHARDSON

Prepared for the Los Angeles County Chief Sustainability Office



ACKNOWLEDGMENTS

This Applied Policy Project (APP) was made possible thanks to the logistical support and expert advice from the Los Angeles County's Department of Public Works, countless other government officials, as well as numerous waste industry operators, composting and digester operators, waste landscape experts, product manufacturers, and policy experts who consented to be interviewed. We are incredibly grateful for the continued guidance and encouragement from our faculty advisor, Dr. Mark Peterson, and our external advisor, Dr. J.R. DeShazo. We would lastly like to acknowledge and thank the University of California, Los Angeles (UCLA) Luskin Center for Innovation for funding our survey analysis which was instrumental in the development of this report. Copyediting services were provided by Natural Resource Strategies.

DISCLAIMER

In the interest of soliciting candid, fact-based information, all individuals and entities interviewed for this report have been guaranteed confidentiality.

This report was prepared in partial fulfillment of the requirements for the Master in Public Policy degree in the Department of Public Policy at the University of California, Los Angeles. It was prepared at the direction of the Department and for the Los Angeles County Chief Sustainability Office as a policy client. The views expressed herein are those of the authors and not necessarily those of the Department, the UCLA Luskin School of Public Affairs, UCLA as a whole, or the client.

table of contents

definition of terms

Biodegradable: Disposable items that are certified to break down in an appropriate environment within a certain time frame based on physical disintegration to pieces below a certain size and chemical decomposition, but which may leave behind certain nonorganic residues.

Bioplastic: Plastic polymers derived from naturally occurring organic compounds such as plant sugar, as opposed to petroleum.

Compostable: Disposable items that are certified to break down in an appropriate environment within a certain time frame based on physical disintegration to pieces below a certain size and chemical decomposition, resulting in solely organic matter. A more stringent classification than biodegradable.

De Facto Recyclability: The degree to which a given product is economically viable for recovery and processing to be used in the manufacture of a new item based on a holistic consideration of its features, including material properties, contamination, and sorting processes.

Food Service Ware: Items used to package and serve food and beverages by food service vendors (e.g., restaurants, food trucks, fast-food and fast-casual establishments). Includes plates, trays, bowls, clamshell containers, cups, lids, and accessory items like utensils, straws, and condiment packages.Plastic: A broad class of versatile and durable carbon- based polymers derived from petroleum.

Recycled: When a product that has entered the waste stream is recovered by a material recovery facility, processed into its material components, and used in the manufacture of a new product.

Reusable: Items that are manufactured and sold with the intent of fulfilling their intended purposes multiple times before disposal.

Single-use: Items that are manufactured and sold with the intent of being used once before being discarded and entering the waste stream.

Technical Recyclability: The degree to which a given product is capable of being recovered and processed to be used in the manufacture of a new item based on its material properties, but not considering factors such as economic viability or contamination.

100% Fiber-based: Disposable items made from naturally occurring plant fibers such as bagasse (sugarcane or sorghum pulp) and bamboo.

executive summary

The production, consumption, and subsequent disposal of single-use plastics pose a grave threat to human and ecological welfare worldwide. Our population has grown dependent on plastic materials, most notably those serving single-use applications. Historically, the food service sector has relied on single-use plastics for their convenience and affordability, resulting in detrimental impacts spanning environmental, economic, energy, and health sectors. Facing an uncertain future, the world is turning to more sustainable efforts within all aspects of daily life.

The County of Los Angeles is home to over 10 million inhabitants, making it the largest in the United States. It is therefore imperative that the County decrease the region's carbon footprint and support the growth of more resilient and sustainable communities through policies that reduce the usage of single-use plastics.

In August 2019, the Los Angeles County Board of Supervisors adopted the OurCounty Sustainability Plan—a broad, regional strategy for transitioning the County to a more sustainable future. This plan calls for a transition away from single-use plastics, an area in which the County has taken little policy action in the past. Our client, the Los Angeles County Chief Sustainability Office, first asked that we thoroughly examine the state of plastic waste in the region and related factors to inform the drafting of an ordinance that the County is currently working on to address the issue. We conducted this initial analysis based on extensive review of academic research and relevant documents, plus information provided with stakeholder groups and over 30 in-depth interviews with facility operators, waste industry experts, government officials, and product manufacturers.

Using these initial findings and 12 additional interviews with government officials, this report is focused on identifying the best implementation strategies for the County's forthcoming ordinance. With over 26,000 food establishments in the County, orchestrating an industry-wide transition is a sizeable challenge.[1] However, there are clear benefits to providing businesses and consumers with sufficient information and resources such that said transition can be made both smoothly and promptly. Ensuring that businesses can adopt alternatives to disposable plastics, with minimal hurdles and at the earliest opportunity, will reduce the generation of plastic waste and its associated impacts sooner, while decreasing economic costs associated with potential disruptions to the County's food service sector.

We herein address the policy question that logically follows:

Regarding Los Angeles County's forthcoming plastics ordinance, what implementation and outreach strategies will best achieve high compliance rates and a smooth transition for affected businesses and consumers?

Using a decision tree model based on five criteria and several sub-criteria, we rated the priority of strategies available to the County and eliminated those that proved to be low performing.

Ultimately, this report should serve as a model for maximizing compliance for both the County and other jurisdictions that follow suit in enacting policies to reduce usage of single-use plastics.

[1] County of Los Angeles Public Health. Environmental Health. Retrieved from http://publichealth.lacounty.gov/eh/DSE/RetailFoodInsection/desfood.htm

Our key findings are:

- There are adverse environmental, economic, energy-related, and human health-related impacts associated with plastic production and waste in Los Angeles County. Single-use plastic food service ware is a contributing factor to all these impacts, and its outsized representation in litter suggests a particularly significant environmental impact.
- No recovery facility serving Los Angeles County currently recycles plastic food service ware, primarily due to issues of food residue contamination, product size, and product material.
- All available evidence suggests that replacing single-use plastic food service ware with reusable ware (e.g., multi-use dishware, cups, and utensils) will reduce the negative impacts of plastic waste in Los Angeles County.
- In the food service sector, the adoption of compostable ware presents potential benefits, including lower net lifetime environmental impact and higher food waste diversion rates. All available evidence suggests that of the potential alternatives, 100% fiber-based products without chemical treatments will produce the best outcome.
- There are several barriers to achieving optimal disposal outcomes for compostable packaging, including technical limitations, lack of consistent labeling and material guidelines, and broader challenges (e.g. regulatory hurdles) faced by the composting industry.
- The experiences of jurisdictions interviewed indicate that policies restricting plastics have been effective at reducing the adverse impacts of plastic waste with no reported negative economic impacts.
- Six city interviewees reported estimated compliance rates of 90% or higher, with all having used hard copy information dissemination as a way of informing affected businesses. All also provided businesses with online resources, including a one to two page fact sheet explaining the tenets of the policy. Four of these six cities provided businesses with an alternatives catalog (either online or hard copy).
- Our food vendor survey showed that, overall, food trucks, street vendors, and smoothie or boba shops should be considered "high-needs targets" for support during the implementation and outreach process for Los Angeles County.
- Our client's top priorities in the short-term should be to disseminate hard copy information to affected businesses and create both passive and active online resources to assist them in the transition.
- Our client's top priority for the mid- to long-term should be to create a collaborative regional body to begin developing cross-jurisdictional guidelines for compostable packaging.

our client

The Los Angeles County Chief Sustainability Office (CSO) was formed in October 2016 with the primary mandate of developing a regional sustainability plan for Los Angeles County. CSO supports the County Board of Supervisors and departments via innovative policy to ensure more equitable, resilient, healthy, and economically strong communities.

In August 2019, the Board of Supervisors unanimously adopted OurCounty Sustainability Plan, a broad, regional strategy for transitioning the County to a more sustainable future. Action 107 of the Plan calls for the County, in cooperation with the City of Los Angeles, to phase out single-use plastics by 2025.

Timeline

In October 2019, the Board of Supervisors passed a motion directing the CSO to contract with the University of California, Los Angeles (UCLA) Luskin Center for Innovation to produce a standalone research report studying the issues of plastic waste, processing, recyclability, and alternatives in the County. We submitted this report to the client on January 15, 2020, and it is currently being used to inform the drafting of an ordinance addressing single-use plastic waste within the food service sector in unincorporated areas only.

Key elements of our analysis are included in this report to provide relevant background information and analysis pertaining to the policy question that we address here for the client, which is the best policy implementation strategies for the County post-adoption of the ordinance.

I. introduction

Plastics play a central role in everyday use due to convenience and affordability, yet their negative impacts spanning environmental, economic, energy, and health sectors are reason for concern. The versatile and resistant qualities of traditional plastics make them especially advantageous in the food service sector, notably for disposable food packaging applications.

Plastic is reported as the primary source of land litter in California, making up seven of the top 10 litter products found on beaches, with four being food service ware.[2] When littered, plastics infiltrate drainage systems as urban runoff, threatening valuable natural habitats and marine life.[3] Furthermore, plastic litter imposes a significant financial burden on jurisdictions and taxpayers by way of substantial cleanup costs. Although efforts have been made in other California cities to reduce plastic waste, Los Angeles County has yet to take significant action towards addressing this universal issue. As the largest County in the United States, Los Angeles has a responsibility to adopt innovative and effective plastics-reduction initiatives.

A well-executed implementation process and effective outreach program will likely generate numerous benefits for the County and the businesses and consumers that will be affected by the forthcoming ordinance. Transitioning from single-use plastic items to reusable or compostable versions imposes varying degrees of disruption on businesses and often requires new investments, thus imposing economic costs. Ensuring that businesses are well-informed about the tenets of the new law and the steps they will need to take to comply will help them manage these changes more smoothly and reduce the need for punitive enforcement measures. More broadly, a smooth transition process that leads to higher compliance rates over shorter time frames helps achieve the intended purpose of the law: to reduce the generation of plastic waste and its associated impacts.

To help ensure the success and maximum effective impact of the County's new policy for addressing single-use plastics, we are guided by the following policy question:

Regarding Los Angeles County's forthcoming plastics ordinance, what implementation and outreach strategies will best achieve high compliance rates and a smooth transition for affected businesses and consumers?

In order to best address this policy question and to satisfy the information needs of our client, we refer to our initial analysis of the issue of plastic waste for Los Angeles County and management challenges related to plastic waste.

For this APP report, we first explain our sources for analysis, and then offer relevant background information on the impacts of plastics and the issue of waste in Los Angeles County with an analysis on plastic alternatives. We subsequently discuss lessons learned from cities with existing policies, and key findings from a survey of food vendors that we conducted. We next present policy options for implementation along with respective criteria and evaluation of these options. Finally, using a decision tree model, we recommend which short-, mid-, and long-term strategies the County should prioritize regarding the implementation of its forthcoming ordinance.

[2] California Coastal Commission. California Coastal Cleanup Day History. Retrieved from https://www.coastal.ca.gov/publiced/ccd/history.html

[3] National Oceanic and Atmospheric Administration, "Marine Debris: Frequently Asked Questions," 10 August 2012, marinedebris.noaa.gov/info/faqs.html, #1

II. sources for analysis

Interviews & Data Requests

In order to inform our policy recommendations, we conducted two rounds of semi-structured interviews with various stakeholders (see Appendix A). The first set of interviews were each an hour long and focused on questions relating to the waste landscape in Los Angeles County. This was done to provide essential background and contextual information and to inform the County's ordinance to transition away from single-use plastics. The second round of interviews were 30-45 minutes, depending on if they had been interviewed previously. This phase focused on implementation strategies, challenges, and actions the County can take to smooth the rollout of the ordinance. We conducted 49 total interviews across three main categories: materials recovery facilities, composter and anaerobic digester operators, and officials from cities that have enacted policies to reduce plastic waste. We also spoke with environmental consulting firms and non-profits that are heavily involved in plastic waste policy. Our primary interview methodology was snowball sampling, which involved a series of interviewees following an initial contact. Interview guides were made for each category below, and can be found in Appendices B-E.

Materials Recovery Facilities (MRFs)

MRF personnel have a thorough technical understanding of materials and processing, making them valuable interviewees. An initial list of 36 MRFs and transfer stations was provided by the Los Angeles County Department of Public Works. This list included facilities with a permitted capacity of 100 tons of waste per day or greater. We contacted 25 of those on the list and interviewed 10 respondents from eight different MRFs. In addition, we conducted two site visits to gain a hands-on understanding of everyday operations and technologies used. Questions focused on operations, sorting strategies, material types, contamination requirements, and alternative strategies (see Appendix B). This allowed us to better understand the overall waste system in Los Angeles County and the first-hand input of these facilities. MRFs were interviewed in the first phase of our project.

Composting Facilities, Anaerobic Digester Operators, Manufacturers, and Experts

Since compostable materials are a potential alternative to single-use plastics, it was important to understand both the technical and processing aspects of these materials. We interviewed 11 composting experts. These contacts were found through online research or referred by a previous interviewee. For composting facilities and anaerobic digester operators, questions related to what materials can be processed, challenges with composting, and the County's capacity for composting (see Appendix C). Compostable manufacturers were asked questions about the technical aspects of their compostable products (see Appendix D). Additional composting experts included a third-party certification body, consultants, and community groups. These facilities, manufacturers, and experts were interviewed in both the first and second phases of our project.

Cities

We interviewed 12 relevant local government employees that work for cities with plastic related policies in place. Six of these are located within Los Angeles County, five are in other regions of California, and one is outside the state. The experiences of these cities were key to informing our recommendations for the County. In the first phase of interviews with cities, the goal was to better understand the intricacies of creating a policy restricting plastic materials. For the second interview phase, we focused on the intricate details of policy implementation, including timeline, personnel, resources, and outreach (see Appendix E for both interview guides). Initial contact was provided by our client to some of the cities and we were referred to the others.

At the end of each interview, we asked the city employee to provide any available quantitative data related to compliance, complaints, and monetary costs to implement their policy. In many cases this data was unavailable or limited, so we conducted an outreach effort to 84 additional cities and counties that have passed various plastic restriction policies. This expansion of our information collection was done to gather data on (1) number of food vendors, (2) compliance rates, (3) complaints or violations, (4) outreach, and (5) total implementation cost estimates. This data was necessary to analyze whether certain outreach and implementation efforts undertaken by jurisdictions result in higher compliance rates and/or lower recorded numbers of complaints and violations.

Food Vendor Survey

In order to best inform our client of the impacts concerning the County's forthcoming ordinance, we developed and subsequently administered a vendor-facing survey to gather quantitative data on affected businesses to help answer two important questions:

1. Which types of vendors in Los Angeles County unincorporated areas will be most impacted by the ordinance, based on the products they currently use?
2. What methods of receiving information and support do these high-needs vendors prefer?

Survey Methodology

We surveyed food vendors in and near Los Angeles County unincorporated areas in order to accurately assess whether any particular vendors are more likely to be disrupted by the policy (see Appendix H). We selected a representative sample of major intersections within Los Angeles County unincorporated areas, within logistical constraints, including sites within all five supervisorial districts. Surveyors visited 133 vendors within 0.5 mile of these loci (as determined by Google Maps) between January 25 and March 8, 2020. Of these, 70 completed the full survey. The remainder of surveyors made note of disposable products in use and left other questions blank. One survey response was invalidated due to incompletion. We used this data to inform the effectiveness of our short-term policy options, specifically whether each option was well-aligned with the needs and preferences of the most impacted vendor types.

III. background

Analyzing the Impacts of Plastics

This section relies on a literature review to further understand the sweeping influence of single-use plastics as it pertains to the County's forthcoming policy.

Aquatic and Marine Impacts

Aquatic ecosystems provide our planet with critical benefits, yet over eight million tons of plastic enter the oceans each year, degrading these natural habitats and threatening wildlife species, tourism, and commercial fisheries.[4] The California Coastal Commission reports that plastics make up seven of the top 10 litter products found on beaches, with four being food service ware.[5]

Of crucial concern is this sizable portion of single-use plastic waste that is littered. Inland litter is carried by rainwater and wind to gutters and storm drains, clogging systems that contribute to street flooding and traffic congestion, while leading debris into rivers, lakes, and the ocean. Researchers at the University of California, Santa Barbara Bren School of Environmental Science & Management conclude that urban runoff is the primary source of marine debris in the Los Angeles and San Gabriel River Watersheds, with plastic debris collected in river and beach cleanups accounting for about half of all the trash amassed in California. Over time plastics naturally break down into fragments termed microplastics, which measure less than five millimeters in length.[6] A wide range of species can ingest these particles, while larger items pose the risk of entanglement.[7] These impacts compromise natural processes and threaten wildlife with laceration or death.[8]

Economic and Community Impacts

Significant economic costs are incurred by coastal communities through both direct and indirect expenses related to plastic debris. With waste management responsibility falling on County and/or city agencies, residents are directly impacted regardless of their proximity to the ocean. Litter cleanup and prevention efforts, property damages, and tourism/industry revenue loss prove costly for municipalities and residents.[9]

The California Recycling and Plastic Pollution Reduction Act of 2020 reported that California taxpayers pay close to $420 million each year in beach cleanup and prevention efforts across all waste categories, with plastic items routinely identified as the most common litter type in coastal litter inventories.[10] The nonprofit, Natural Resources Defense Council, further reported that the largest California communities spend an average of up to $4.4 million in annual street sweeping and $2.3 million in manual land litter cleanup.[11]

---

[4] United Nations Environment Programme. (n.d.). *Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations*. UNEP

[5] California Coastal Commission. California Coastal Cleanup Day History. Retrieved from https://www.coastal.ca.gov/publiced/ccd/history.html

[6] Midbust, J., Mori, M., Richter, P., & Vosti, B. (2014). *Reducing Plastic Debris in the Los Angeles and San Gabriel River Watersheds* (MESM Report). Bren School of Environmental Science & Management: University of California, Santa Barbara

[7] *Ibid*.

[8] Thompson, R.C., Moore, C.J., Saal, F.S. vom, & Swan, S.H. (2009). Plastics, the environment and human health: current consensus and future trends. *Philosophical Transactions of the Royal Society B: Biological Sciences*. Retrieved from https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2009.0053

[9] Jahn, A., Kier, B., & Stickel, B.H., (2013). *Waste In Our Water: The Annual Cost to California Communities of Reducing Litter That Pollutes Our Waterways*. Kier Associates. Retrieved from https://www.nrdc.org/sites/default/files/oce_13082701a.pdf

[10] *Ibid.*; California Recycling and Plastic Pollution Reduction Act of 2020 (n.d.). Retrieved from https://caaquaculture.org/wp-content/uploads/2019/11/Plastics-Initiative.pdf

[11] Jahn, A., Kier, B., & Stickel, B.H., (2013). *Waste In Our Water: The Annual Cost to California Communities of Reducing Litter That Pollutes Our Waterways*. Kier Associates. Retrieved from https://www.nrdc.org/sites/default/files/oce_13082701a.pdf

Energy Impacts

Plastic production relies on nonrenewable energy sources including feedstock derived from petroleum.[12] These processes have been reported to use close to 4% of global oil yields, with a proportional amount of energy used in the process.[13] With over one-third of plastic production dedicated specifically to plastic packaging, continued rise in single-use plastic applications is likely to lead to significant increases in oil consumption.[14] Bottled water consumption in the United States alone rose 284% between 1994 and 2017, with 67% of all sales being single-use water bottles.[15]

The California Recycling and Plastic Pollution Reduction Act of 2020 notes that global plastic production is estimated to at least triple by 2050, which would encompass 20% of all fossil fuel consumption.[16] Ultimately, the energy-intensive nature of plastic manufacturing, production, and recovery further contributes to greenhouse gas emissions, climate change, and a global reliance on fossil fuels.

Health Impacts

Adverse human health effects related to plastics have been studied more recently, with specific focus on the chemical styrene. This chemical has been determined to be a carcinogen by California's Office of Environmental Health Hazard Assessment and is of particular concern when heated.[17] Many studies emphasize the negative effects of occupational, high-level exposure to styrene.[18] However, in terms of average human exposure, more robust scientific study on the topic is essential in order to further understand impacts.

Styrene is the main compound of polystyrene—a plastic type commonly used to make disposable food service ware. Polystyrene's foamed version (expanded polystyrene) is commonly used to make single-use clamshells and containers. Occupational studies have found that workers exposed to styrene have increased risks of lymphoma, leukemia, lung tumors, prostate, and colorectal cancers.[19] According to the U.S. Environmental Protection Agency, chronic long-term exposure to styrene can affect the central nervous system, resulting in headaches, fatigue, weakness, and depression.[20]

The Issue of Waste in Los Angeles County

To assess the state of plastic waste in Los Angeles County, we examined its waste stream and management structure based primarily on interviews with waste management experts.

---

[12] Thompson, R.C., Moore, C.J., Saal, F.S. vom, & Swan, S.H. (2009). Plastics, the environment and human health: current consensus and future trends. *Philosophical Transactions of the Royal Society B: Biological Sciences*. Retrieved from https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2009.0053

[13] How much oil is used to make plastic? (n.d.). Retrieved from https://www.eia.gov/tools/faqs/faq.php?id=34&t=6; Thompson, R.C., Moore, C.J., Saal, F.S. vom, & Swan, S.H. (2009). Plastics, the environment and human health: current consensus and future trends. *Philosophical Transactions of the Royal Society B: Biological Sciences*. Retrieved from https://royalsocietypublishing.org/doi/abs/10.1098/rstb.2009.0053

[14] *Ibid*.

[15] Goldsberry, C. (2018, December 20). Pressure to reduce consumption of single-use plastic packaging will continue into 2019. Retrieved January 10, 2020, from https://www.plasticstoday.com/packaging/pressure-reduce-consumption-single-use-plastic-packaging-will-continue-2019/8501551360001

[16] California Recycling and Plastic Pollution Reduction Act of 2020 (n.d.). Retrieved from https://caaquaculture.org/wp-content/uploads/2019/11/Plastics-Initiative.pdf

[17] State of California Environmental Protection Agency Office of Environmental Health Hazard Assessment Safe Drinking Water and Toxic Enforcement Act of 1986 (n.d.). Retrieved from https://oehha.ca.gov/media/downloads/proposition-65//p65list091319.pdf

[18] U.S. Department of Health and Human Services National Toxicology Program. 2016. Report on Carcinogens, 14th Edition.; Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service. Retrieved from https://ntp.niehs.nih.gov/go/roc14; Huff, J., & Infante, P.F. (2011). Styrene exposure and risk of cancer. Mutagenesis, 26(5), 583–584. https://doi.org/10.1093/mutage/ger033

[19] U.S. Department of Health and Human Services National Toxicology Program. 2016. Report on Carcinogens, 14th Edition.; Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service. Retrieved from https://ntp.niehs.nih.gov/go/roc14

[20] U.S. EPA. Styrene (n.d.). Retrieved from https://www.epa.gov/sites/production/files/2016-09/documents/styrene.pdf

Who Manages Waste in Los Angeles County and How?

MRFs are the primary facilities in Los Angeles County for managing the recycling stream and some mixed-waste processing. Historically, the County has relied on both private and public firms to operate these facilities. Composting facilities have traditionally played a lesser role, but their importance in the waste landscape is expected to increase due to recent industry changes and state legislation. MRFs receive waste from residential, commercial (including multifamily residences), or industrial sources. It is then sorted and baled by material type, and ultimately sent to one of the following:[21]

1. **A remanufacturing facility** accepts baled recyclable materials to turn into new products or packaging.
2. **A secondary MRF** can serve as a second line of defense after waste is sorted by the primary facility. Materials that would otherwise be destined for landfill can instead be recaptured. There is only one secondary MRF currently operating in Los Angeles County: Titus MRF Services.
3. **Waste-to-energy processing** combusts waste in order to produce and recover energy. These processes further divert waste from landfills.
4. **Landfill sites** are where the majority of leftover materials are sent, with waste layered up to hundreds of feet beneath the ground.[22] There are approximately 18 landfills operating in the County.[23] Strong resistance to degradation allows all common plastic types to persist in landfills for centuries.

Waste sorting operations vary considerably depending on the MRF and inputs received. Facilities either operate with mixed or presorted inputs. Mixed MRFs receive an aggregated waste stream of materials and must sort them accordingly. However, the majority of waste facilities in Los Angeles County receive presorted waste, also known as source-separated, which is the result of well-established two- or three-bin recycle collection systems. Even when receiving presorted recyclables from jurisdictions with bin systems, facilities must further sort by individual material type (e.g., plastic, cardboard). There are approximately 55 large facilities in the County that process over 100 tons of waste per day.[24]

Generally, MRFs receive paper, metals, glass, and plastics and some receive organic waste (e.g., food waste, yard waste, and plant-based food service ware). However, organic waste is not ideal to be mixed with those other materials for MRFs to process due to contamination and separation challenges. It is preferable for organic waste to be collected in a separate stream and sent to a composting or digestion facility. Based on our discussions with industry experts, however, there are a very limited number of composting facilities currently operating in the Los Angeles region, proving inadequate for the predicted increase in compostable use.

Materials in the Los Angeles County Waste Stream

The California Department of Resources Recycling and Recovery—the state agency overseeing waste management—provides county-level waste characterization data in the form of residential and commercial streams by material type.[25] Findings from their 2014 analysis reveal that in Los Angeles County, organics (45%), paper (19%), inert

[21] Los Angeles County Department of Public Works (2018). Polystyrene Food Service Ware in Los Angeles County. (2018). Retrieved from http://file.lacounty.gov/SDSInter/bos/supdocs/115952.pdf

[22] County of Los Angeles Department of Public Health (n.d.). Solid Waste Management Program Facilities. Retrieved from http://publichealth.lacounty.gov/eh/EP/solid_waste/facilitieslandfill.htm?func=1&Landfill=landfill

[23] County of Los Angeles Department of Public Health (n.d.). Landfills. Retrieved from http://publichealth.lacounty.gov/eh/AreasofInterest/landfill.htm

[24] Los Angeles County Department of Public Works (2017). Countywide Integrated Waste Management Plan 2017 Annual Report. Retrieved from https://pw.lacounty.gov/epd/swims/ShowDoc.aspx?id=11230&hp=yes&type=PDF

[25] California Department of Resources Recycling and Recovery (CalRecycle) (2014). Solid Waste Characterizations Home. Retrieved from https://www2.calrecycle.ca.gov/WasteCharacterization/

materials such as concrete (12%), plastics (10%), and metals (3%) make up the top five waste materials by tonnage produced by residences.[26] From the commercial waste stream, the top five materials by mass are organics (36.8%), paper (30.3%), metal (9.4%), plastic (9.2%), and inert materials (9.1%).[27] While MRFs receive all of these materials, plastics are the most difficult to process and sell to market. According to various MRFs interviewed, this is because contamination is common in plastic materials and there are technological challenges to correctly sort different types.

How Recent Policy Has Upturned the Waste Industry

Traditionally, other countries have borne the brunt of solid waste from the United States. Prior to 2018, China was the preeminent market for waste exports, which relieved some of the waste burden for domestic municipalities but fostered a reliance on these external markets.[28] However, the implementation of China's "National Sword" policy in early 2018 significantly disrupted the market for plastic waste across the globe, saddling operators, customers, and municipal governments with new fiscal burdens. The policy imposed demanding restrictions such as a 0.5% contamination level on imported recyclable material which took effect immediately, giving the industry little time to sufficiently prepare.[29] This disruption has rippled throughout global recycling markets and led to a sizable increase in waste material being kept in the United States after recovery by MRFs.

In the Los Angeles region, managing paper and plastic waste post-National Sword has proven to be the most problematic because of subsequent decreases in value for several categories of items previously considered recyclable. One facility in Los Angeles County noted that prior to the new restrictions, 98% of its paper went to China, but currently it exports only about 1%.[30] In some cases, values for certain goods have fallen precipitously, which has led many operators to experience a sizable drop in revenue and caused closures and operational losses.[31] Six MRFs indicated that their primary markets for major resin categories were now within California and strong within Los Angeles specifically. Four MRFs indicated that small markets for particular resins continue to exist overseas, yet those accepted are not currently economically viable to recover.

An important element of the National Sword regulation is that it demonstrated to operators that market conditions for recovered plastic can change unpredictably, quickly, and drastically. Several interviewed operators characterized National Sword not as creating a new problem for recycling, but merely making extant contamination and infrastructure issues harder to ignore.

IV. findings: alternatives to plastics

Analysis of Plastic Alternatives

We found numerous issues with the recyclability of plastics, especially single-use plastic food service ware products, within Los Angeles County. An overview of the different plastic resins as well as the full results of our analysis of plastic recyclability can be found in Appendices F and G, respectively. Given the challenges we identified, it is important to evaluate the two key categories of food service ware alternatives: reusable and compostable products.

These options have proliferated in recent years, particularly for compostable food service ware, and several cities in California have enacted policies designed to increase usage of reusable items by food vendors and their customers. It is important to evaluate the pros and cons of these options when considering how to reduce plastic waste generation and litter, ensuring that the chosen alternatives do, in fact, reduce negative lifetime impacts.

Reusable Alternatives

Based on available information, increased usage of reusable ware in the Los Angeles County food service sector would be an unequivocal net benefit. Potential avenues for such a transition include more consistent usage of reusable items at dine-in food service locations, increasing the frequency with which customers purchase beverages in reusable cups or travel mugs, and adopting models that allow for food and beverages to be placed in reusable containers.

Reusable ware avoids many potential pitfalls and challenges posed by the need for disposal. Available research indicates that reusable food service items have lower environmental impacts than equivalent disposable items over a product's lifetime. However, increased adoption of reusables would in many cases require investment in new equipment and reworking of everyday operations, while presenting some potential issues regarding compliance with health codes in the case of customer-owned reusable items.

Comparative Life Cycle Impacts of Reusables

Across most environmental impact categories, a reusable food service ware product—given reasonable assumptions about its lifetime use—will have a smaller footprint than a disposable option. The exact break-even point varies among product types, depending on production inputs and rates of loss, theft, or breakage. Estimates may also vary based on the exact methods researchers use. Reusables and disposables have mainly been compared to each other with regards to greenhouse gas emissions, energy inputs, water use, ecosystem impacts, and solid waste generation.

Even accounting for varying methodologies, reusable items result in lower lifetime impacts than disposables. In one of the most heavily studied comparisons—ceramic coffee cups versus disposable paper or polystyrene cups—estimates on lifetime uses for the former to outperform disposables range from as low as 18 (vs. paper) or 70 (vs. polystyrene) to a few hundred.[32] For context, lifetime uses of dishware in a food service setting can be in the thousands.[33] It is also worth noting the trend of more recent studies finding lower break-even points—that is, reusables seem to become more advantageous compared to disposables over time. Increases in the energy and water efficiency of

[32] Sheehan, Bill (2017). Greenhouse Gas Impacts of Disposable vs Reusable Foodservice Products. *Clean Water Action/Clean Water Fund*. Retrieved December 12, 2019, from https://www.cleanwateraction.org/sites/default/files/CA_ReTh_LitRvw_GHG_FINAL_0.pdf

[33] City of Portland Sustainability at Work (2019). Reusable Dishware (Why switch?). *The City of Portland Oregon Sustainability at Work*. Retrieved December 12, 2019, from https://www.portlandoregon.gov/sustainabilityatwork/article/507480

dishwashing processes have likely contributed to this change.[34]

Reusables maintain their advantage in several other food service ware item categories. While life cycle analysis research on these items (e.g. clamshells) is less prevalent than studies comparing ceramic mugs and disposable cups, available data shows greater benefits and lower break-even points for reusables. Findings of reusable preferability hold for items that are commonly customer-owned, such as travel mugs and to-go food boxes.

Perhaps the most impactful effect of replacing disposable food service ware with reusables is in the area of solid waste. Past assessments and case studies found that transitioning to reusables from disposables in both the food service sector and other areas (e.g. drinking water) drastically reduces the weight and volume of solid waste generated.[35]

Economic Ramifications of Increased Reusable Adoption

Adoption of reusables shifts a food vendor's expenditures toward larger, upfront, one-time costs.[36] These come in the form of investing in reusable items themselves and (occasionally) in additional equipment to clean them, the total costs for which can be thousands of dollars or more, depending on the size of the business. In contrast, disposable items impose a lower but constant, recurring cost.

Available studies suggest that a transition from disposables to reusables typically leads to significantly lower expenditures for food service ware while slightly increasing costs associated with equipment, utilities, and labor on a per-meal or per-customer basis.[37] Over time, adoption of reusables tends to result in net savings for vendors, with the fiscal break-even point occurring within the first year of the transition.[38] Macroeconomic benefits can accrue through reductions in solid waste production and its associated costs, along with potential for jobs as some businesses hire more personnel for dishwashing tasks.[39]

Other Considerations for Implementation

Because reusable food service ware requires a fundamentally different usage model, there are certain key aspects where they differ from other alternatives with regard to implementation:

A. **Health Code Concerns:** Despite the attempt by California Assembly Bill 619 to provide guidelines on sanitary reusable usage, health officials still have concerns regarding compliance with health code when it comes to customer-owned reusables. Businesses may need to change their procedures and/or even the physical layout of their food preparation and pickup areas if they wish to facilitate customer-owned reusables usage, discussed further below.

B. **Equipment and Space Constraints:** It may be difficult for some food vendors to utilize reusables and/or install dishwashing equipment due to physical space limitations or other facility attributes.

---

[34] Woods, Laura and Bhavik R. Bakshi (2014). Reusable vs. disposable cups revisited: guidance in life cycle comparisons addressing scenario, model, and parameter uncertainties for the US consumer. *The International Journal of Life Cycle Assessment* 19, 931-940. doi:10.1007/s11367-013-0697-7. Retrieved December 12, 2019, from https://link.springer.com/article/10.1007/s11367-013-0697-7

[35] Franklin Associates (2009). Life Cycle Assessment of Drinking Water Systems: Bottle Water, Tap Water, and Home/Office Delivery Water. *State of Oregon Department of Environmental Quality*. Retrieved December 12, 2019, from https://www.oregon.gov/deq/FilterDocs/wprLCycleAssessDW.pdf; Keoleian, Gregory A. and Dan Menerey (1992). Disposable Vs. Reusable Systems: Two Source Reduction Case Studies. *Journal of Environmental Systems* 20(4), 343-357. doi: 10.2190/P25E-HNAE-7G81-JAPY

[36] Ellis. "Disposables versus reusables in foodservice operations." 7 March 2018. *Foodesign The Food Service Design Agency*. Retrieved December 12, 2019, from https://foodesignassociates.com/disposables-vs-reusables-food-service/

[37] Keoleian, Gregory A. and Dan Menerey (1992). Disposable Vs. Reusable Systems: Two Source Reduction Case Studies. *Journal of Environmental Systems* 20(4), 343-357. doi: 10.2190/P25E-HNAE-7G81-JAPY.

[38] City of Portland Oregon Sustainability at Work (2019). Restaurant Case Study. *The City of Portland, Oregon Sustainability at Work*. Retrieved December 12, 2019, from https://www.portlandoregon.gov/sustainabilityatwork/article/507590; Cioci, Madalyn (2014). The Cost and Environmental Benefits of Using Reusable Food Ware in Schools. Minnesota Pollution Control Agency. Document number: p-p2s6-16. Retrieved December 12, 2019 from https://www.pca.state.mn.us/sites/default/files/p-p2s6-16.pdf

[39] City of Portland Oregon Sustainability at Work (2019). Restaurant Case Study. *The City of Portland, Oregon Sustainability at Work*. Retrieved December 12, 2019, from https://www.portlandoregon.gov/sustainabilityatwork/article/507590

Compostable and Biodegradable Alternatives

The issue of compostable and biodegradable materials is highly complex, making it difficult to draw firm conclusions about the net impacts of replacing single-use plastic food service ware with compostable or biodegradable alternatives in Los Angeles County. Based on our interviews, our findings are:

- While no compostable material can be considered an ideal candidate for food service ware in the County at this time, displacement of single-use plastic food service ware with compostable products will likely produce some benefits.
- One-hundred percent fiber-based items that are free of per- and polyfluoroalkyl (PFAS) or other chemical coatings and which are manufactured from agricultural byproducts appear to be the best option.
- Evidence suggests that usage of such products will increase food waste diversion rates and reduce the burden on solid waste disposal systems.
- They will degrade more readily should the items be littered and can be integrated more easily into composting operations than bioplastic equivalents.
- There is a major disconnect between the specifications of products being certified and manufactured and what is compatible with composters and digesters in the Los Angeles region.

Major Categories of Compostable Materials

There are several different types of materials that can be used to manufacture compostable food service ware:

A. **Paper:** A familiar material that can be used to manufacture a variety of products. However, some paper-based products, such as cups for hot liquids, may contain additional coatings or chemicals.

B. **Fiber-based:** A material made from the fibers of plants such as sugarcane, sorghum, and bamboo. Some types, such as molded pulp or bagasse, are manufactured from the leftover material produced by agriculture, lowering environmental impacts. Such containers may have coatings of other materials or chemicals when intended for liquids.

C. **Bioplastics:** Plastic resins made from plant materials. The most common type is polylactic acid (PLA). These substances can be used to make entire products (e.g. clear drinking cups almost indistinguishable from some traditional plastics) or in combination with other materials (e.g. a PLA coating inside a paper cup).

Comparative Life Cycle Impacts of Compostable Food Service Ware

Existing research on the life cycle impacts of compostable food service ware compared to non-compostable products paints an unclear picture. Studies vary considerably in what products they compare, what scenarios they consider, and what impact categories they examine, making side-by-side comparisons difficult.

A 2009 assessment comparing PLA and polystyrene (PS) clamshells found that PS was preferable to PLA across most impact categories, including climate change, air pollution, and impacts on aquatic environments.[40] However, this study was narrowly focused and did not consider some negative ecological impacts associated with PS. In contrast, another study, published in 2008, focused on starch-based biodegradable and compostable versus single-use plastic cutlery. In this instance, the compostable alternative had significantly lower impacts across all categories, including greenhouse gas emissions, solid waste generation, and eutrophication.[41] These examples illustrate the difficulty of

[40] Madival, Santosh, Rafael Auras, Sher Paul Singh, Ramani Narayan (2009). Assessment of the environmental profile of PLA, PET, and PS clamshell containers using LCA methodology. *Journal of Cleaner Production* 17(13), 1183-1194. DOI: 10.1016/j.jclepro.2009.03.015

[41] Razza, Francesco, Maurizio Fieschi, Francesco Degli Innocenti, Catia Bastioli (2008). Compostable cutlery and waste management: An LCA approach. *Waste Management* 29(4), 1424-1433. DOI: 10.1016/j.wasman.2008.08.021

making firm conclusions regarding whether increased compostable food service ware usage will be an environmental boon or not. It is therefore important that the County consider compostable alternative materials on their individual merits as opposed to generalized data.

A 2017 report by Wageningen Food & Biobased Research in the Netherlands succinctly outlines how assessing compostable products' life cycle impacts is complicated by how one values certain categories of environmental impacts. In discussing the specific role of bioplastics:

> *Substitution of fossil-based plastics by bio-based plastics generally leads to lower nonrenewable energy use (NREU) and greenhouse gas (GHG) emission. The GHG emission reduction, however, may be negatively influenced by direct and/or indirect land-use change.... For the categories related to agriculture, such as eutrophication and acidification, bio-based plastics generally have a higher impact than fossil plastics.... No absolute rule can be given.*[42]

A major factor for the County to consider is the role of compostable food service ware in the food waste stream. The environmental footprint of food and its associated waste dwarfs that of food packaging, particularly with regard to climate-related impacts.[43] Packaging choices that achieve even small reductions in food waste can dominate impact differences associated with the packaging itself.[44] Use of compostable food service ware by vendors has been linked to higher rates of food waste capture, the benefits of which outweigh potential downsides associated with the packaging itself.[45]

End-of-life Disposal Considerations

Ensuring that desirable end-of-life options exist for compostable items in Los Angeles County is currently a difficult proposition. Challenges related to disposal, in turn, have consequences for a product's lifetime environmental impacts. The question of disposal is thus one of the primary confounding factors that makes it challenging to assess the magnitude of potential benefits arising from displacing single-use plastics with compostable materials in the County.

However, even when ideal outcomes are not achieved (e.g., a compostable item becomes litter or is sent to a landfill), there are marginal benefits to be had by transitioning from single-use plastic food service ware to those that are compostable. Non-bioplastic compostable products will break down in a landfill setting, reducing the solid waste burden on facilities compared to plastics.[46] If littered, according to experts, fiber-based products will degrade in the natural environment significantly faster than plastics.

The primary challenges related to disposal of compostable materials are:

A. **Feasibility of Degradation:** The primary concern with compostable materials expressed by four of four composting and organic disposal operators interviewed (three in Southern California, one in Northern California) is that products do not disintegrate in the timeframes necessary for their business model. The 90-day disintegration standard met by products certified by Biodegradable Products Institute (BPI) is insufficient for many facilities,

[42] van den Oever, Martien, Karin Molenveld, Maarten van der Zee, Harriette Bos (2017). Bio-based and biodegradable plastics - Facts and Figures. Wageningen Food & Biobased Research number 1722. http://dx.doi.org/10.18174/408350

[43] Suggitt, Jackie (2018). The link between food waste and packaging. *GreenBiz*. Retrieved from https://www.greenbiz.com/article/link-between-food-waste-and-packaging.

[44] Wilkstrom, F., H. Williams, G. Venkatesh (2016). The influence of packaging attributes on recycling and food waste behavior — An environmental comparison of two packaging alternatives. *Journal of Cleaner Production* 137, 895-902. http://dx.doi.org/10.1016/j.jclepro.2016.07.097

[45] Ekart, Dale and Kate Bailey (2019). Maximizing food scrap composting through front-of-house collections at food establishments. *Eco-Cycle*. Retrieved December 13, 2019, from http://www.ecocycle.org/files/pdfs/Reports/front-of-house-composting-study-ecocycle.pdf

[46] Lou, X.F.; and J. Nair (2009). The impact of landfilling and composting on greenhouse gas emissions - A review. *Bioresource Technology* 100(16), 3792-3798. https://doi.org/10.1016/j.biortech.2008.12.006

which may operate on cycles as short as five weeks and an average of approximately 60 days. Inconsistent conditions can also slow breakdown time.

B. **Separation of Contaminants:** All Southern California-based operators interviewed (three of three) indicated that there are issues with efficiently separating compostable products from non-compostable ones. In many cases, especially with bioplastics, the products are indistinguishable at a glance. Therefore, operators separate all packaging as a rule because they do not have the time and resources to filter items reliably. Composting operators indicated that thorough, obvious labeling on a regional or statewide basis would help address this issue.

C. **Organic Certification and Markets:** Organic farms are a key market for many California-based composting facilities. The standards for organic certification are set by the Organic Materials Review Institute (OMRI) based on guidelines from USDA. These standards do not currently address the incorporation of compostable material into the compost waste stream, meaning that facilities that do so risk losing their certification. Facilities are therefore erring on the side of caution by excluding compostable materials. BPI is currently working to include compostable materials in OMRI standards, which could potentially remove this barrier. However, at this time, the concerns of composters regarding organic certification is a significant source of reluctance to accept compostable materials.

D. **Item Composition:** Some types of compostable products may be manufactured with PFAS chemicals, which have come under increased scrutiny in recent years due to concerns about their impacts on human health.[47] Given that agriculture is the primary market for composters in California, PFAS contamination is a threat from both business and public health standpoints.

Economic Considerations

Adoption of compostable food service ware in place of other disposables does not represent a significant change in the business model for food vendors but would likely result in increased expenditures for food service ware items. Compostable items are generally more expensive than plastic equivalents across all categories. However, assuming a reasonable adjustment period, a transition to compostable products is unlikely to cause significant economic disruption, based on the following considerations:

A. **Past Experience:** Policies restricting certain types of plastic food service ware have been enacted in over 100 California cities and counties, and we identified no instance where a food vendor shuttered as a consequence. Most policies of this type have historically included language allowing businesses to apply for exemptions due to economic hardship. Of the 12 city officials interviewed, a majority noted that their city has not received any exemption applications, and only one has granted any exemptions.

B. **Small Magnitude Per-unit Cost Increases:** While the relative cost increases for compostable items on a per-unit basis can be proportionally high in some categories compared to plastic items, these increases are typically less than five cents per item. This suggests that businesses can pass these minor cost increases on to their customers or adopt "upon request" models.

C. **Market Conditions:** According to compostable product manufacturers, market conditions in the Los Angeles region are such that economic disruption from new adoption of compostable food service ware would be minimal. This is primarily thanks to a glut of suppliers.

[47] Cohen, Albert M. (2019). PFAS Under Increased Scrutiny in California. *Lexology*. Retrieved December 13, 2019, from https://www.lexology.com/library/detail.aspx?g=4def5cf9-959c-49ae-9d2e-d6ffdec12255

v. findings: cities & food vendor survey

Policy Process Lessons Learned from Cities with Existing Policies

In California, there are currently 135 local ordinances, either city- or county-wide, that have adopted some sort of plastics restriction (see Appendices J and K).[48] To evaluate existing regulation in the state, we conducted a series of eight interviews with city officials from jurisdictions that have implemented plastic policies. Officials from five cities within Los Angeles County were interviewed in addition to officials from three cities outside the County in order to gain more insight on the policy process and design, as well as lessons learned from their experience. To enhance the quality of information obtained, identities of city officials remain confidential throughout this report.

Single-use Plastic Regulation in California Cities

In addition to plastic bag bans, several cities have adopted other policies to reduce plastic including, but not limited to, plastic straw restrictions (full bans or that they be provided upon request only), latex balloon bans, and bans on expanded polystyrene. Historically, the majority of these policies have focused on expanded polystyrene or polystyrene products.[49] Within Los Angeles County, 13 cities currently have policies restricting plastics (see Appendix L). The development of recent ordinances has demonstrated city/county efforts to dramatically reduce regional waste and develop more sustainable solutions to the challenges posed by plastics.

Policy Development and Respective Rationale

We sought to understand the stated rationale behind these policies. Unsurprisingly, litter and its subsequent impact on marine environments was noted as the primary motivation for policy development from all city representatives, most crucially by the two coastal cities that were interviewed. All referenced economic concerns related to cleanup costs or tourism revenue loss.

A lack of recyclability for many plastics, especially polystyrene, was cited as additional policy justification by several cities. Officials discussed the lack of a market for polystyrene and others, stressing economic inefficiency for local recovery facilities to recycle the material.

Policy Implementation

Many cities proved to share similar policy implementation processes including transition period mandates, extensive stakeholder engagement, and education/awareness campaigns.

A. **Transition Periods:** All cities interviewed granted a minimum six-month "grace period" for policies banning certain products to give businesses enough time to use up their current stock and to develop a plan for transitioning to compliant alternatives. This delay allowed for internal adaptation, especially concerning subsequent modifications to business operations. For one city, the transition period proved much longer (almost triple in length) and was strongly advised against by the interviewed official.[50] For the cities with the most stringent plastic policies, many employed a phased-in approach comprising an initial policy that banned only expanded polystyrene or polystyrene food service ware, for example, then a second phase banning the retail sale and distribution of most polystyrene products.

[48] (C. Cadwallader, personal communication, January 6, 2020)

[49] Californians Against Waste. Table View PS Ordinance. (n.d.). Retrieved December 16, 2019, from https://www.cawrecycles.org/psordinancetable

[50] City 5 (personal communication, November 18, 2019)

B. **Stakeholder Engagement Process:** Several cities took a proactive approach to the stakeholder engagement process. Pre-policy implementation, many officials noted, citizens and businesses were provided with ample resources to understand the purpose of the policy as well as the relevant details and timeline. Once passed, many cities sent mailers to all affected stakeholders to raise awareness of initial policy implementation. Workshops were also used as an educational tool, providing businesses with compliant product samples or brochures including a list of compliant materials by product category. One unique strategy was the creation of an explanatory video for affected businesses, distributed along with a brochure of compliant products.

C. **Public Education and Awareness:** Public education and outreach were a top priority for all city officials interviewed. To maximize public awareness, several city teams created explanatory flyers in multiple languages for diverse constituents. The majority of the cities stated that the public reception has been mostly positive and that most people in the community have been in favor of the ordinance. Several mentioned that their citizens welcomed the ordinance as they wanted to help make a positive impact on their community.

Challenges and Areas for Improvement

City officials expressed a shared primary challenge concerning policy enforcement. Ensuring compliance for businesses proves difficult and demanding considering the sheer number of firms in one region. With a lack of resources notably including time and staff, most cities have been unable to monitor compliance. Instead, many city officials rely on a simple complaint-based system, transferring responsibility to local customers and employees. One city allows citizens to report violations through an app, making the complaint process easy and convenient.[51]

The city exhibiting the strictest enforcement system has an inspector personally "audit" every restaurant to ensure businesses are complying with the ordinance.[52] Due to the time-consuming process that this requires, inspectors have yet to visit every affected establishment after more than two years since the policy's enactment date.

Additionally, challenges regarding city borders were raised, particularly when neighboring cities do not have a policy in place. It is especially difficult to ensure compliance from food trucks that cross city borders daily.

Policy Execution and Effects

It is important to note that we were unable to access city-specific quantitative data pertaining to post-policy effects of respective ordinances. Although statistics are limited, city officials observed a reduction in litter based on anecdotal evidence, especially with regard to polystyrene. This information has not been historically tracked by municipalities, in part due to logistical difficulties, and information available through nongovernmental organizations can be inconsistent in its methodology.

The lack of quantitative litter data pre- and post-policy proved a common issue for many officials we spoke with, making it difficult to accurately assess how effective the policy has been at reducing plastic waste.

Economic Impact on Affected Businesses

Impacts on affected businesses were the main concern for a majority of the city officials interviewed. Seven of the eight cities interviewed currently offer a financial hardship waiver for businesses, allowing them to express a state of financial distress and need for additional time to purchase compliant product alternatives. All allowed exemptions in cases where no compliant alternative existed. The only city that did not include a financial hardship waiver in its ordinance conducted an alternative cost-evaluation study, concluding that only high-volume food providers exclusively using expanded polystyrene would be significantly impacted and therefore are outliers.[53]

[51] City 3 (personal communication, November 14, 2019)
[52] City 1 (personal communication, October 31, 2019)
[53] City 3 (personal communication, November 14, 2019)

Our study ultimately revealed that few financial hardship waiver applications have been submitted in all cities interviewed, with waivers being granted only in one-off circumstances. Most cities have been successful in finding affordable alternative solutions for businesses that are easily adoptable. Importantly, no negative effects for businesses were reported by any city official following policy implementation.

Implementation Lessons Learned from Cities with Existing Policies

In order to gather further information concerning the implementation of these ordinances, we conducted a second set of interviews with officials at the original eight cities, as well as four additional cities that also passed a plastics-restriction policy. The focus of these interviews was to understand the specifics pertaining to jurisdictions' implementation processes including effective stakeholder engagement methods, personnel requirements, cost breakdowns, as well as policy timeframe rationale. We additionally requested an estimated compliance rate for each policy, with the goal of using this data in conjunction with the aforementioned information to best determine the most effective strategies for achieving high compliance rates.

Outreach/Stakeholder Engagement

Of the six city interviewees that reported estimated compliance rates of 90% or higher, all used hard copy information dissemination as a means to inform the affected businesses of the policy (see Appendix M). All cities also provided businesses with online resources surrounding the ordinance, including a one-two page fact sheet explaining the tenets of the policy simply and briefly. Four of the six cities provided businesses with an alternatives catalog (either online or hard copy), with the fifth city providing businesses with a link to the website of an approved alternative manufacturer. Four of the six cities used social media as a means to inform businesses and the community, while three cities hosted workshops for businesses to learn more about the specific details of the policy.

Personnel

For most cities, implementation of the ordinance was one of several responsibilities for the dedicated personnel, with around 50% of staff time devoted to the implementation of the ordinance. Three cities had staff allocating over 50% of their time to implementation. The number of personnel involved in the implementation process varied, ranging from two to six internal staff, with only one city (due to its large size) having an additional six to 11 people specifically responsible for outreach. Two cities utilized interns or student volunteers for education and outreach at no cost, while three cities either hired a consultant or contracted out certain services to an external company.

Costs

Most cities used their existing operating budget to implement their ordinance. The few who received extra funding or grants were the larger cities that received these funds for a specific program or giveaways. Total monetary costs ranged widely, with the highest estimate being $200k. Contract costs ranged from $30k to $50k.

Unique Features

Some unique features include reporting violations through an app, a dedicated environmental compliance officer that visits businesses to ensure they are compliant, an economic incentive program for early-compilers, an exposition for businesses, alternative manufacturers, and distributors, and a foam-free recognition program. The city that provided economic incentives to early-complying businesses did not recommend this strategy, as they expressed managing the program was a huge challenge and very time-consuming.[54] The city that allows citizens to report violations through their app strongly recommended this method as a means of monitoring enforcement to ensure compliance, with the app accounting for four citizen-reported violations.[55]

[54] City 5 (personal communication, November 18, 2019)
[55] City 3 (personal communication, November 14, 2019)

Policy Timeline

The time from enactment to enforcement of the ordinance varied among cities, ranging from 30 days to 18 months. Most cities implemented an effective policy date six months to one year from passage. Once the policy took effect, many cities did not actually begin enforcement until six months later, with a majority employing an educational, rather than punitive, business-facing strategy.

Compliance Rates

Of the nine cities that were able to provide compliance rates, six estimated rates of 90% or higher. One city official estimated its current compliance rate to be around 85%, while another estimated 75%. The remaining cities were unable to provide compliance rate estimates, either due to the policy being too new to collect compliance data or inactive tracking.

We mathematically analyzed whether cities that used particular strategies saw notable increases or decreases in their compliance rates. Specifically, we regressed compliance ratings on a set of binary variables (Yes or No) indicating whether each city that provided data utilized one of the implementation or outreach strategies under consideration, the results of which can be seen in Table 1. The exact nature of these options is discussed in the following section. Our analysis found decentralized person-to-person outreach and provision of sample compliant products to have a statistically significant positive impact on compliance rates ($p<0.01$ and $p<0.1$, respectively), while public relations-focused incentive strategies were found to have a negative impact ($p<0.1$).

Table 1: Estimates table for compliance rate regressed on usage of implementation policy options. Hard copy information dissemination and online resources (active) were omitted due to collinearity. n=17. * p<.1; **<.05; *** p<.01

Option	Coefficient
Hard Copy Information Dissemination	(omitted)
Electronic Information Dissemination	-0.105
Online Resources (Passive)	0.0025
Online Resources (Active)	(omitted)
Person-to-person Engagement (Centralized)	-0.04125
Person-to-person Engagement (Decentralized)	.19625***
Traditional Media	-0.0225
Social Media	-0.02
Fiscal Incentives	-0.0075
PR Incentives	-0.135*
Consumer-Facing Tools	-0.0275
Sample Provision	.105*
Constant	.8125***

To reduce the chance of drawing unwarranted conclusions given the limited data, we only considered findings significant at the 95% confidence level. Therefore, we rated decentralized person-to-person outreach as having a notably positive impact on compliance. Based on supplementary qualitative evidence from city officials, we similarly rated hard copy information dissemination and both active and passive online resources as being positive with respect to compliance. We rated all other options as having marginal benefit.[56]

[56] City 3 (personal communication, November 14, 2019)

Interviewee Implementation Recommendations

Most city officials stressed the importance of engaging with affected businesses throughout the implementation process while soliciting community feedback and engagement. Many cited door-to-door canvassing as a highly effective method. Multiple interviewees also noted the importance of developing a business-facing alternatives catalog after receiving positive feedback from firms. One interviewee highlighted the need for a convenient and easy-to-use system for residents to report violations.

High-Needs Target Findings from Survey Analysis

As discussed in *Sources for Analysis* above, we conducted a survey of food vendors near major intersections in unincorporated areas of Los Angeles County to identify those that will be most impacted by the ordinance. We surveyed 133 locations, 70 of which completed the survey and 52 of which we only observed products in use. One survey was unusable.

We used a one-way ANOVA statistical test to assess whether particular types of food vendors or vendors in certain parts of the County are more likely to use plastic or foam items. Our survey showed that, overall, food trucks, street vendors, and smoothie or boba shops should be considered "high-needs targets" for support during the implementation and outreach process. These conclusions are based on the following findings, the underlying analysis for which can be found in Appendix I:

- Restaurants and smoothie or boba shops were more likely to use plastic or foam items across multiple product categories.
- Food trucks and street vendors, other beverage vendors (not coffee shops or smoothie or boba shops) and restaurants were more likely to use foam products of some type and for these products to be among their top four most-used. Food trucks and street vendors were more likely to use ONLY plastic or foam products.
- Restaurants are (unsurprisingly) more likely to use reusable ware for dine-in customers.

Based on these findings, we categorized food trucks and street vendors and smoothie or boba shops as "high-needs" for purposes of policy evaluation. The modal desired forms of outreach for these groups were online resources and hard copy information. Therefore, in our evaluation, we rate these policy strategies as positive in addressing the needs of vendors who are likely to be disproportionately disrupted by the ordinance.

VI. policy options for county implementation

Our client, CSO, does not face an "either/or" decision in choosing how to implement the forthcoming ordinance. Rather, there are multiple domains within which County action could assist in creating a smooth transition to the new conditions created by the law, and each of which offers several possible courses of action that are not mutually exclusive. Therefore, our goal in describing these options is to present a "menu" of possibilities, any or all of which could be undertaken by the County or other jurisdictions. Our subsequent analysis provides our client with an assessment of how these options compare such that they can prioritize those that will likely create the most beneficial outcome, given inputs of time, labor, and resources.

We categorized the implementation options discussed below by two fundamental aspects: the time frame within which the measure is intended to be accomplished; and the primary role or mechanism of the strategy (e.g. outreach).

Short-Term Actions

Items in this category are intended to be completed between the enactment of the ordinance and the point at which enforcement of the law begins. Based on patterns of action from other jurisdictions that have adopted similar policies in the past and ongoing discussion with our client, we estimate this time period to be between six months and one year.

Outreach

Outreach strategies are intended to provide information to food vendors and other affected businesses to assist them in transitioning from disposable plastic products to compliant alternatives specified in the policy. These measures also include those that seek to deliver information to the patrons of affected businesses using the businesses as an intermediary.

A. **Hard Copy Information Dissemination:** The County would produce printed materials—including, but not limited to, flyers, mailers, brochures, and/or pamphlets—that explain the key tenets of the ordinance, what steps businesses must take to be compliant, and what resources are available to assist in the transition. These materials would be distributed primarily by mail, using address information from existing business licenses and mediated, if necessary, by industry groups (e.g. California Restaurant Association).

B. **Electronic Information Dissemination:** The County would create and distribute informative materials—similar to those described in "Hard Copy Information Dissemination" above—in electronic form, using extant business email lists and via intermediary stakeholder and industry groups.

C. **Online Resources (Passive and Active):** The County would create online resources and make them accessible to affected businesses, with the goal of assisting those businesses in transitioning away from restricted products. These resources are distinguished from the aforementioned informative materials in that they constitute a first step in technical assistance to businesses, providing them with breakdowns of compliant products, manufacturers and suppliers of those products, and materials the business can print and post on their premises (e.g. tabletop triangles, posters, disposal labels).

We distinguish between two types of online resources. Passive resources include printable materials, products lists, and other elements made available online in their final form. Active resources are designed to include an interactive element for businesses utilizing them. Two key examples are an online tool whereby vendors can create customized waste bin labels specific to their business and an interactive product search tool that assists businesses in finding compliant, non-plastic alternatives based on their specific needs.

D. **Person-to-person Engagement:** The County would create opportunities for in-person discussion between County personnel and stakeholders—especially affected businesses—about the ordinance and, importantly, its underlying goals. In-person strategies offer a key advantage over other forms of outreach in that they offer the chance for community feedback, questions, and clarification. These actions also have the potential for synergistic benefits with other outreach measures that focus on provision of materials by providing additional opportunities to do so.

   We distinguish between two types of person-to-person engagement. Centralized strategies use an event-based approach, such as scheduling workshops or tabling at public events, where time and location are shared with stakeholders ahead of time and County personnel can discuss the ordinance and answer questions with many individuals at once. Decentralized strategies focus on a canvassing approach, whereby County personnel visit affected businesses in person and discuss the ordinance with them in a small group or one-on-one setting.

E. **Sample Provision:** The County would purchase and distribute samples of compliant products to affected businesses and/or the public. Giveaways offer early exposure and first-hand familiarization, helping to eliminate potential pushback by hesitant businesses or consumers while increasing overall community engagement and support. These samples would be distributed at County-organized events such as those described above in "Centralized Person-to-person Engagement."

Public Relations

Public relations measures attempt to disseminate information about the policy to the broader public, not just affected businesses or the customers of a given establishment. Effective public relations campaigns serve to inform people about what day-to-day changes will accompany the policy and, importantly, explain the underlying rationale. We distinguish between two general categories of public relations:

A. **Traditional Media:** The County would publicize information about the policy through "traditional" news sources such as local and regional newspapers, radio stations, and television broadcasts. It would facilitate news coverage of the ordinance's enactment through press releases and making personnel available for statements or interviews.

B. **Social Media:** The County would provide information and regular updates on the policy through major social media networks, including Facebook and Twitter. Social media posts provide a means of issuing regular, widely accessible updates to interested parties. Social media public relations also have the potential to assist in creating incentives for early compliance, discussed further below.

Early Compliance Incentives

Early compliance incentives are meant to offer affected businesses tangible or intangible benefits in return for complying with the policy before the enforcement period begins, helping speed the transition and creating normative pressure on other businesses to follow suit. We examined two different types of incentive programs available to the County:

A. **Fiscal Incentives:** The County would solicit applications from businesses that achieve early compliance and offer monetary benefits—most likely between $100 and $500, based on precedent from other jurisdictions—for those verified to have done so.

B. **Public Relations Incentives:** The County would solicit applications from businesses that achieve early compliance to be recognized through any ongoing public relations efforts (e.g. social media). As part of such efforts the County could issue official forms of recognition—"A Los Angeles Green Packaging Restaurant" certification, for instance—and assemble publicized lists of such vendors to help inform consumer choice.

Consumer-facing Tools

Other jurisdictions have used mobile apps to assist in educating the public and/or crowdsourcing reports of violations with respect to plastics restriction policies. Creating and publicizing such a tool could assist the County's consumer-facing outreach efforts and enable participation by environmentally conscious consumers in reporting both violators and exemplars of the policy. An integrated search tool could assist consumers in finding food vendors that have received recognition for early or exceptional compliance, increasing the value businesses receive from a public relations incentive program.

Mid- to Long-Term Actions

Implementation strategies in this category are intended to be a first step or proof of concept for future endeavors that will help promote compliance with the ordinance and achievement of the broader policy objectives—that is, reducing the generation and impacts of plastic waste—over a multi-year time frame.

Pilot Programs

In key areas, pilot programs or expansion of existing efforts may assist businesses in transitioning away from disposable plastics and creating more preferable disposal outcomes for compostable materials. We identified two such areas:

A. **Reusable Ware Investment Assistance:** While available evidence suggests that food vendors who transition to reusable items for dine-in customers save money over time, the capital investment this change requires can be prohibitive for many businesses. The County would either directly offer grants or loans to food vendors to assist them in adopting reusable ware over disposable items, or work with non-governmental organizations already engaged in such work to expand their efforts.

B. **Small-scale Community Composting:** Commercial composters face a slew of challenges that make processing compostable packaging difficult. Small-scale urban composting sites, however, are a promising alternative disposal option for such materials, as they avoid altogether some barriers faced by commercial composters and circumvent others. Our client would work to increase the number of such facilities, either unilaterally or through partnerships with non-governmental organizations already operating community composting facilities; and would partner with such groups to increase investment in equipment to increase compostable material processing capability (e.g. grinders). This would likely involve input from other County departments, most notably Public Works and Parks and Recreation.

Regional Collaboration and Coordination Efforts for Composting

Independent of individual compostable material types, waste management strategies regarding compostable material will need significant modification pertaining to infrastructure and regulation in the coming years to create environmentally optimal disposal outcomes for compostable goods. Policy action that shapes the waste landscape will need to account for the constraints, both technical and fiscal, faced by large- and small-scale composting operators. Coordination among the various municipalities of the Los Angeles region will be necessary to create a model that is consistent for both waste operators and consumers with respect to key elements such as labeling requirements for compostable versus non-compostable materials and expanding composting capacity.

Our client could, therefore, work with other key County departments (e.g. Public Works, Parks and Recreation, Public Health) to establish working groups that include representatives from incorporated municipalities, businesses, composting operators, and other relevant stakeholder groups to examine the following key issues:

1. Begin formulating a multi-jurisdiction set of regional guidelines for permissible types and labeling of compostable material.
2. Identify opportunities and strategies to expand composting capacity capable of serving the region, using both large- and small-scale infrastructure.
3. Identify ways to streamline the regulatory process for siting and permitting new composting infrastructure.

VII. policy evaluation criteria

We identified five criteria in which to evaluate the short-, mid- and long-term policy options. We discuss each criterion in order of importance, an aspect with ramifications for the evaluation process given our decision tree model. In some cases, certain criteria incorporate multiple sub-criteria, which we identify and describe below.

Effectiveness

We evaluated the effectiveness of each implementation strategy as high, medium, or low using a decision tree model. For short-term options, our method focused on four aspects of the strategy: the degree to which it is predicted to benefit compliance rates (compliance), the proportion of intended targets the policy will reach (penetration), the degree to which it enhances adoption of reusable food service ware (reusables), and the degree to which it meets the needs of highly-impacted businesses (needs-based). For mid- to long-term options we assessed two aspects of the strategy: impact on the adoption of reusables and the degree to which the option will create better disposal outcomes for compostable packaging.

Monetary Cost

We assessed the approximate total monetary costs associated with each implementation and outreach strategy option, based on quantitative figures from other city and county governments (when available) that were extrapolated to a jurisdiction the size of Los Angeles County using simple arithmetic. We supplemented this data with estimates provided by city officials during interviews when exact numbers were not available.

We categorized short-term costs less than $1,000 over the lifetime execution of any strategy as negligible, as costs of this magnitude can be easily absorbed in our client's existing operating budget. For assessing short-term options, we thereafter "binned" each policy option as low cost (<$5,000), medium cost ($5,000- $10,000), or high cost (>$10,000). Mid- to long-term options were binned similarly, but with different cost thresholds (<$100,000, $100,000- $500,000, and >$500,000). Because all short-term options we considered are intended to be completed in less than one year and the only mid- to long-term options with non-negligible costs deliver tangible benefits within the first year, we chose not to discount these costs.

The cost of hiring additional County personnel is not reflected in monetary cost; it is instead accounted for in the *personnel* criterion.

Personnel

We evaluated the needs of each strategy in terms of full-time equivalent (FTE) from County personnel. Based on the current size of our client's team and knowledge of their intentions regarding expansion, we disregarded any option that would call for more than five FTE to implement. We categorized personnel needs for each option as low (≤1 FTE), medium (>1, ≤3 FTE), or high (>3, ≤5 FTE).

Reception

Public officials in other jurisdictions have highlighted particular strategies that were especially well-received by affected businesses and consumers. The positive reception of such options would likely help ameliorate any potential political blowback.

We rated each policy option on a binary scale: positive reception likely, or neutral. We found no instance of implementation or outreach efforts that were received in a notably negative manner, and therefore did not include a rating option to reflect this scenario.

Time

We assessed the necessary time frames for each option to be fully executed, both in terms of initial setup and co-ordination and how long it will take for its objectives to be completed. We "binned" each short-term policy option into one of three categories: fast (<3 months), moderate (3-6 months), and slow (6-12 months). In consultation with our client and based on policy precedent, we set the maximum allowable period for consideration of options to be utilized between enactment and enforcement at one year. We categorized mid- to long-term options based on the number of years before they are likely to deliver tangible benefits: fast (within 1 year), moderate (1-2 years), or slow (>2 years). In both cases, shorter time requirements are better.

Data for this criterion was derived primarily from qualitative interviews with jurisdictions that have previously instituted similar policies. We extrapolated the experiences of these areas—many of which are significantly smaller in geographic size and population than Los Angeles County—to a reasonable estimate for our client's area. The time component is also linked closely to the personnel criterion, as personnel assesses the labor needs of each policy option in FTE averaged over the entire time period.

VIII. evaluation of policy options

Given our goal of providing our client with a comprehensive list of non-mutually exclusive implementation options, we assessed each option as top, high, medium, or low priority. Using a decision tree model, we evaluated each option with each criterion in order of importance, adjusting the priority rating accordingly and eliminating those with poor performance over multiple criteria.

Rating Effectiveness

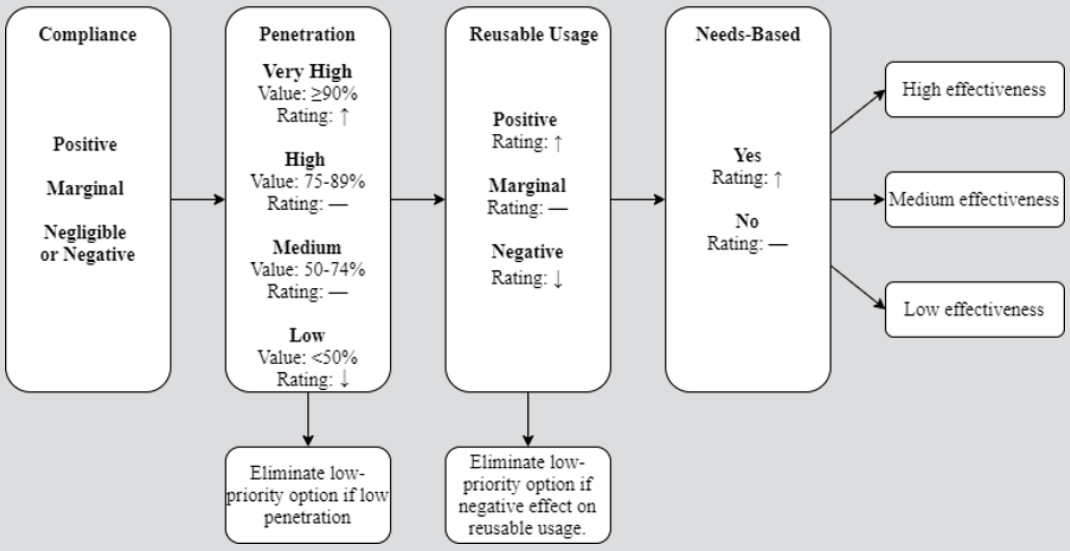
We rated each short-term option's benefits as positive, marginal, or negligible/negative with respect to compliance, based on our analysis of the option's performance in other jurisdictions and qualitative evidence. This constituted the option's "starting point" in the decision tree. We then categorized the option's penetration as very high (≥90%), high (75-89%), medium (50-74%), or low (<50%). We raised the effectiveness rating of each option with a penetration rating of very high by one level, lowered the effectiveness rating of those with a low penetration by one level, and left those with a high or medium penetration rating unchanged. Options with low compliance and low penetration ratings were eliminated.

Based on qualitative data, we rated each option's effect on reusable usage as positive, marginal, or negligible/negative. We raised the effectiveness rating of each option with a positive reusable rating by one level, lowered the effectiveness rating of those with a negligible/negative rating by one level, and left those with a marginal reusable rating unchanged. As in the case of penetration, we eliminated low effectiveness options that received a poor rating.

Lastly, based on analysis of a survey of Los Angeles County food vendors and qualitative data, we rated each option on a binary scale (Yes or No) with regards to whether the option is accessible to or addresses the needs of vendors that will be most impacted by the ordinance. We raised the effectiveness rating of those with a Yes rating by one level, leaving options with a No rating unchanged.

Diagram 1

Short-term Option Effectiveness Decision Tree Model



Because of their different nature, we assessed mid- to long-term options based on two sub-criteria: impact on the adoption of reusables, and the degree to which the option will create better disposal outcomes for compostable packaging. As no policy option considered addressed both of these areas, we first rated the lone option that would greatly benefit reusable adoption—a more desirable outcome from an impacts standpoint—as highly effective. We then assessed the relative magnitude of benefits for options addressing compostable disposal. Those likely to result in the greatest benefits were rated as having medium effectiveness, while all others were rated as low effectiveness.

Option Evaluation Process

Each option's effectiveness rating (high, medium, or low) was treated as its "starting point." We raised the rating of any option with negligible monetary cost by one, lowered the rating of those with medium monetary cost by one, and lowered the rating of those with high monetary cost by two, leaving those with low cost unchanged. We then raised the rating of any option with low personnel requirements by one and lowered the rating of those with high personnel requirements by one, leaving those with medium personnel requirements unchanged. Reception was a purely positive or neutral criterion. We raised the rating of any option assessed as likely to have positive reception, and left others unchanged. Lastly, we raised the rating of options with fast time frames and lowered the rating of those with slow time frames by one, leaving those with moderate time frames unchanged.

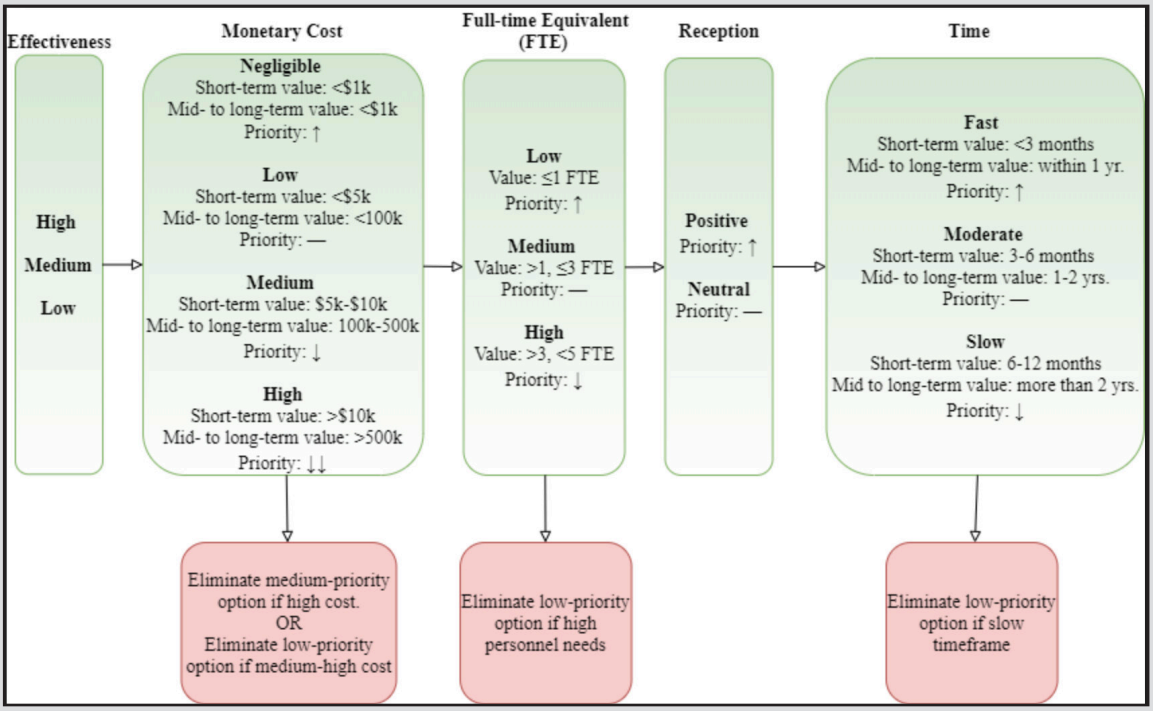
In all cases, a policy option ranked as high priority could not have its rating raised above that point. However, to highlight options that consistently performed well across all or nearly all categories, we identify such options as top priority. We eliminated options ranked as low priority whose rank was lowered further.

Example of the Evaluation Process

To illustrate the evaluation process, we considered the short-term policy option of decentralized person-to-person engagement (DP2P). We first used our effectiveness decision-tree model for short-term options to identify the strategy's overall effectiveness rating.

Diagram 2

Policy Option Evaluation Decision Tree Model



Based on the experiences of municipalities and analysis of compliance data, we assessed DP2P as having a positive impact on compliance rates. Therefore, its starting point in the effectiveness ratings tree is high. However, it has low penetration, which lowers its effectiveness rating to medium. Its impact on reusable usage is positive, raising the effectiveness rating back to high. It does not directly address the needs of highly-impacted vendors, leaving the rating unchanged at high.

Thanks to its high effectiveness rating, DP2P enters the overall evaluation decision tree with a high priority level. Its negligible cost elevates its priority, so it remains at high (the maximum rating possible during the process). This is unchanged by the medium personnel requirements. The positive reception expected elevates the priority once again, remaining at high, and the moderate time frame requirements leave this rating unchanged.

DP2P's performance places it in consideration for being a top priority option. However, this rating is reserved for options that perform well across all or nearly all categories. DP2P's shortcomings in some key areas preclude this possibility. Therefore, we categorize it as a high priority.

Short-Term Option Evaluation

Our criteria ratings for short-term policy options can be seen below.

Option	Effectiveness					Cost	Personnel	Reception	Time	Final Rating
	Compliance	Penetration	Reusable Usage	Needs-Based	Overall					
Hard Copy Information Dissemination	Positive	Very High	Marginal	Yes	Top	Low	Low	Neutral	Fast	Top
Electronic Information Dissemination	Marginal	Medium	Marginal	No	Medium	Negligible	Low	Neutral	Fast	High
Online Resources (Passive)	Positive	Very High	Marginal	Yes	Top	Negligible	Low	Neutral	Fast	Top
Online Resources (Active)	Positive	Very High	Marginal	Yes	Top	Low	Low	Positive	Fast	Top
Person-to-Person Engagement (Centralized)	Marginal	Low	Marginal	No	Low	Negligible	Low	Neutral	Moderate	High
Person-to-Person Engagement (Decentralized)	Positive	Low	Positive	No	High	Negligible	Medium	Positive	Moderate	High
Sample Provision (Low-cost Scenario)	Marginal	Medium	Positive	No	High	Medium	Low	Positive	Moderate	High
Sample Provision (High-cost Scenario)	Marginal	Medium	Positive	No	High	High	Low	Positive	Moderate	Medium
Traditional Media	Marginal	Medium	Marginal	No	Medium	Low	Low	Neutral	Fast	High
Social Media	Marginal	Medium	Marginal	No	Medium	Negligible	Low	Neutral	Fast	High
Fiscal Incentives	Marginal	Low	Positive	No	Medium	High	Eliminated			
PR Incentives	Marginal	Low	Positive	No	Medium	Negligible	Medium	Positive	Moderate	Medium
Consumer-Facing Tools	Marginal	Low	Marginal	No	Low	Low	Low	Neutral	Moderate	Low

Mid- to Long-Term Option Evaluation

Our criteria ratings for mid- to long-term policy options can be seen below.

Option	Effectiveness	Cost	Personnel	Reception	Time	Final Rating
Reusable Ware Investment Assistance	High	High	Medium	Positive	Fast	High
Small-Scale Community Composting Equipment	Low	Low	Low	Neutral	Fast	High
Small-Scale Community Composting Sites (Low-cost)	Medium	Medium	Medium	Neutral	Fast	Medium
Small-Scale Community Composting Sites (High-cost)	Medium	High	Eliminated			
Regional Collaboration Guidelines	Medium	Negligible	Low	Positive	Moderate	Top
Regional Collaboration Composting Capacity	Low	Negligible	Low	Neutral	Slow	Medium
Regional Collaboration Regulatory Streamlining	Low	Negligible	Low	Positive	Slow	Medium

IX. recommendations for implementation

Short-Term

Based on our evaluation, we recommend our client's top priorities in the short-term be to disseminate hard copy information to affected businesses and create both passive and active online resources to assist them in the transition. These options were rated as top priority given their high effectiveness, negligible costs, and low administrative burden. Other high-priority actions should include electronic information dissemination, both centralized and decentralized forms of person-to-person engagement (e.g. workshops and canvassing, respectively), providing samples of compliant products (assuming costs between $5,000 and $10,000), and mounting public relations campaigns through both traditional and social media. Based on our analysis, decentralized person-to-person engagement was rated as high-priority given that it was the only option that would likely have a significant positive effect on compliance rates and would also likely generate positive reception.

Should our client have additional resources to dispense thereafter, we recommend providing samples of compliant products (with costs exceeding $10,000) and providing incentives for early compliance through public relations benefits to vendors. Development of consumer-facing tools (i.e. mobile app) is low priority. We do not recommend providing fiscal incentives for early compliance.

Mid- to Long-Term

We recommend our client's top priority for the mid- to long-term be to create a collaborative regional body to develop cross-jurisdictional guidelines for compostable packaging. This option was rated as top priority due to negligible monetary costs, low personnel costs, and positive reception. Other high-priority actions include establishing a pilot program—either unilaterally or in partnership with existing non-governmental organizations—to provide investment and assistance to businesses looking to adopt reusable food service ware, and helping small-scale community composters invest in equipment to better allow them to process compostable packaging.

x. limitations

Our research relies heavily on qualitative data. This is mostly due to the lack of quantitative data available on waste and single-use plastics, as there are no tracking systems currently in place. Few cities were able to provide us with firm figures on compliance regarding their existing plastics policies: and no municipality with whom we spoke tracked the incidence of litter items, making it difficult to identify particularly problematic products. For these reasons, our estimates carry some degree of uncertainty. Moreover, we had to make approximations about how monetary costs, personnel requirements, and implementation strategies would scale from a city to the entirety of Los Angeles County. No city we examined is an equal comparison to Los Angeles County given the County's unique size and makeup. Therefore, successful strategies implemented in certain cities may not be as effective for the County of Los Angeles.

Furthermore, our survey of food vendors faced several limitations. While useful, mere observation of business practices is not a substitute for survey completion, and our usage of this data may create a slightly distorted picture of what products and materials are currently in use. When responses were recorded, the responding individual was often not a manager-level employee, and as such they may have submitted answers without complete information. Lastly, logistical constraints limited our ability to access some more remote parts of Los Angeles County's unincorporated areas, and the geographically fragmented nature of these areas required us to use a somewhat ad hoc approach to selecting survey locations.

XI. conclusion

The long-term negative impacts of disposable plastics far outweigh the short-term value they provide for consumers. Notably, plastic is the primary source of land litter in California, is imposing increasing and ongoing economic costs on both government and private citizens, and is causing untold ecological harm through its impacts on wildlife and the climate. For these reasons, numerous jurisdictions throughout the state have adopted policies restricting single-use plastics. Los Angeles County has similarly committed to a transition towards environmentally-friendly alternatives, and our client is already engaged in drafting an ordinance to that end.

Achieving high compliance in a short-time frame will reduce the negative impacts of plastic sooner and more thoroughly while minimizing harm to businesses. Our report identifies high-priority implementation and outreach strategies that are likely to result in transitioning the maximum number of County food vendors away from harmful plastic items in a manner that is swift and non-disruptive.

This report is a guide for the County's Chief Sustainability Office on how best to prioritize limited resources and personnel towards these actions while laying the groundwork for the multi-year collaborative efforts that will be necessary to continue this work in the future.

Finally, we hope that other jurisdictions seeking to ameliorate the harms of plastic in their own communities will use this report as a framework for action.

Recommendations for Future Research

It is worth reiterating that many aspects of our research and evaluation were made more challenging by a lack of quantitative data. Given that we expect the County to utilize its health department as a proactive enforcement body for the ordinance—as other municipalities that have such a department have done previously—we urge them to **collect and maintain thorough compliance records while tracking implementation and outreach activities, such that these data can be analyzed in the future to assess policy effectiveness and assist other municipalities in enacting similar policies.**

appendix a

List of Interviews

Stakeholder Category	Date	
	1st Round of Interviews	2nd Round of Interviews
MRF	10/23/2029	
MRF	10/25/2029	
MRF	10/29/2029	
MRF	10/30/2019	
MRF	11/1/2019	
MRF	11/15/2029	
MRF	11/29/2019	
MRF/Anaerobic Digester	12/5/2019	
MRF	12/6/2019	
MRF	12/10/2019	
Composting (Facility/Anaerobic Digester)	11/15/2019	
Composting (Facility)	11/15/2019	2/21/2020
Composting (Facility)	12/10/2019	2/14/2020
Composting (Facility)		2/24/2020
Composting (Facility)		3/3/2020
Composting (Manufacturer)	11/12/2019	
Composting (Manufacturer)	11/19/2019	
Composting (Manufacturer)	11/26/2019	
Composting (Industry Expert)	11/15/2019	
Composting (Industry Expert)	11/26/2029	
Composting (Industry Expert)	12/6/2019	
City (in LA County)	10/31/2019	2/10/2020
City (in LA County)	11/5/2019	2/18/2020
City (in LA County)	11/14/2019	2/7/2020
City (in California)	11/14/2019	2/11/2020
City (in LA County)	11/18/2019	2/14/2020
City (in LA County)	11/18/2019	2/18/2020
City (in California)	12/6/2019	2/13/2020
City (in California)	12/9/2019	2/19/2020
City (in LA County)		2/11/2020
City (outside California)		2/11/2020
County (in California)		2/20/2020
City (in California)		3/3/2020
Other (Consulting Firm)	11/6/2019	
Other (Recycling Center)	11/12/2019	
Other (Nonprofit)	11/19/2019	
Other (Agency)	1/6/2020	
Other (Nonprofit)		2/21/2020
Other (Nonprofit)		3/11/2020

appendix b

Materials Recovery Facility Interview Guide

Name of Individual:
Name of MRF:
Date:

1. Can you give us a brief overview of your operation (size/capacity, materials, sources, oversight, etc.)?
2. What sorting strategies does your facility use (e.g. optical, manual, air, etc.), particularly with regards to plastic?
3. What automation has your MRF employed? How has this affected manual sorting? Do you find manual sorting leads to inefficiency? Efficiency?
4. What input sources do you receive (e.g. residential, restaurant, etc.)? What is the breakdown? Do you have quantitative data on your inputs by source type?
5. What types of recyclable plastic do you recover?
6. What are your current challenges with respect to recovery and disposal of plastic waste?
7. To what degree does food contamination impact the MRF process in terms of wasted material, time, labor, etc., associated with plastics, esp. FSW?
8. How common is the practice of rinsing contaminated recyclable plastic (e.g. food service ware) such that it can be reclaimed? What portion of recyclable plastic is landfilled due to contamination?
9. What quantity/proportion of compostable materials do you receive? What portion of this is FSW? What is the outcome for these materials (e.g. sent to composting facility, landfill, etc.)?
10. Where do you send your recovered material, in what amounts? Do you know the product outcome of your recovered material?
11. Do you have quantitative data that we can access on plastic processing and general waste inventory in your facility?
12. Are there any other individuals at your facility that you think would be valuable for us to talk to, and if so, can you put us in touch with them?
13. Are there any questions we should have asked you that we did not, or any important topics we did not cover?

appendix c

Composting Facility Interview Guide

Name of Individual:
Name of Operation:
Date:

1. Can you give us a brief overview of your operation (size/capacity, materials, sources, oversight, time frame, etc.)?
2. To what degree do you sort or separate inputs of different types? Are there any inputs that you receive and have to reject routinely?
3. What role does automation play in your operation?
4. What input sources do you receive (e.g. residential, restaurant, etc.)? What is the breakdown by type (packaging, green waste, food waste)? Do you have quantitative data on your inputs by source type?
5. What portion of your received compostable materials is FSW?
6. Where do you send your composted material, in what amounts? Do you know the product outcome of your recovered material?
7. What are your biggest challenges with respect to compost?
8. How do changing seasons influence your processes?
9. What is the general timeframe?
10. Do you have quantitative data that we can access on composting processes and general waste inventory in your facility?
11. Are there any other individuals at your facility that you think would be valuable for us to talk to, and if so, can you put us in touch with them?
12. Are there any questions we should have asked you that we did not, or any important topics we did not cover?

appendix d

Compostable Manufacturer Interview Guide

Name of Individual:
Name of Company:
Date:

1. What are your company's biggest markets, in terms of location (e.g. particular cities), types of products (e.g. beverage containers), or particular businesses (e.g. restaurant chains)?
2. Relatedly, what are the most popular compostable products you sell currently, both the type and the material?
3. Walk us through the major technical differences among the different types of compostable materials used by your company and others (e.g. sugarcane, starch, bamboo, wood, bioplastic, etc.). Specifically:

    a. What are the required conditions for composting?

    b. Under optimal conditions, how long does composting take?

    c. Which can be composted without separating food waste?

    d. How labor- or material-intensive is the manufacturing process? Relatedly, how expensive are they?

    e. Are there any particular limits to each material's potential uses, both in food service and more general usage?

    f. What are the relative impacts of each material (e.g. land use, water, fertilizer)?

    g. Where do you source your input materials?

    h. Outside of a composting or anaerobic digestion facility, how well do products of each material break down naturally? (Specific scenarios: backyard composting, urban area, natural terrestrial area, aquatic/marine area.)

4. Are there any particular categories of plastic products for which no non-plastic alternative currently exists?

    a. (Follow-up) What are the reasons for the absence (e.g. infeasibility, cost)?

    b. (Follow-up) What conditions would be necessary for your company to enter into the market for such products (e.g. legal mandate for compostable materials)?

    c. Are there any categories of plastic products, especially packaging-related, that you do not foresee a non-plastic alternative being feasible within the next 5 years?

5. If the City of Los Angeles and the County mandated the use of some type of compostable food service ware for take-out food and drink providers, how would your company react? What would be the time frame needed for you to respond to the change in the market?
6. Given that you know what our goals and the goals of LA County are with regards to reducing plastic usage and waste, what additional information do you think we should know?

appendix e

City Interview Guide Round 1

Name of Individual:
Name of Company:
Date:

1. Can you give us a brief background on your expertise, your current duties, and the role of your department or agency in your City government?
2. What are the primary challenges in regards to waste management and litter? How does your city track or assess the state of waste?
3. Can you give us a high-level overview of policies your city has enacted to reduce waste and litter, especially with regards to plastic?
4. Can you characterize the policymaking process for your policies restricting plastics, particularly why the policy was crafted as it is, what factors were weighed, and what the intended outcome was? Were there any particular reports or studies (commissioned or otherwise) that played a major role in the decision to enact the policy?
5. What was the stakeholder engagement process like for this policy?
6. What political considerations, if any, weighed on the policy? What pushback or support did you receive? To what degree did that affect the policy?
7. Have there been any particular challenges with regards to implementation or enforcement?
8. How has the policy affected the state of waste and litter (or other factors) in your city? Compare pre- vs. post-policy.
9. Given the experience since the implementation of your policy, are there any tenets or elements that you would add, remove, or modify in hindsight? Have there been any unforeseen consequences?
10. Do you have any quantitative data (e.g. litter inventory) from the periods before and after the policy that we could access and compare? How has it affected businesses (e.g. food vendors, retailers)?

City Interview Guide Round 2: Implementation-Specific

1. Recap: Nature of the city's policy (types of products banned/restricted, enforcement methods, when enacted/ took effect, other mechanisms).
2. How much time elapsed between the enactment of the ordinance and its tenets taking effect? Did the timeline called for in ordinance language and the de facto timeline differ?

    a. What factors did you consider when deciding on your timeline? Ex.) 6 months vs. 1 year?

3. What city/county government department(s) or agency(s) were responsible for implementation of the ordinance?

    a. If multiple departments or agencies were involved in implementation, what steps were taken, if any, to coordinate among them? How successful was this coordination?

4. Overall, about how many personnel were involved in the implementation process? To what degree was implementation the sole focus of these personnel during this time period?

5. Can you characterize the monetary costs or budget used for your implementation process?

6. Following passage of the ordinance, walk us through the implementation process step-by-step (e.g. development of resources, outreach, etc.), including the timeline.

    a. What information/resources were used to educate businesses and customers about the ordinance, if any, and how were they disseminated?

    b. Of these resources, which did you find to be most effective?

    c. If it's difficult to determine just one, then which received the most positive feedback?

7. Did you receive any feedback from businesses or the community about the ordinance and the effectiveness of the implementation process? If so, what was its nature?

8. About what are the current compliance rates? How have they changed over time?

    a. Are there any trends you have noticed regarding compliance? (e.g. certain types of businesses that have been faster or slower to comply).

9. Describe your enforcement schema.

    a. In the case that an agency not involved in the ordinance development (e.g. Health Department) is responsible for enforcement in any way, what steps were taken to bring them on board?

10. What are the most important lessons learned regarding implementation of an ordinance restricting plastics that you and your municipality have learned?

11. Do you have quantitative compliance data you would be willing to share? May we have copies of any resources or materials you developed to aid in implementation, or can you direct us to where they are accessible?

12. Do you have records related to costs or budgeting of the implementation process that we may access?

appendix f

Plastic Resins by Resin Identification Code (RIC)

RIC	RESIN TYPE	PROPERTIES	USES	RECYCLED IN LA COUNTY
1 PET	Polyethylene Terephtalate	Lightweight; strong; resistant to bacteria; can be clear or color-matched	Water bottles; soda bottles; jars for spreads/jams; clamshells	Yes — bottles and jars only
2 HDPE	High-Density Polyethylene	Inexpensive; easy to form; strong; durable; resistant to chemicals and moisture; permeable to gas	Milk bottles; juice bottles; detergent/shampoo bottles; plastic grocery and retail bags	Yes
3 PVC	Polyvinyl Chloride	(Rigid) PVC: strong; stiff; noncorrosive (Flexible) PVC: softened with plasticizers	(Rigid) PVC: construction applications (Flexible) PVC: cling wrap; medical packaging; cosmetics packaging	No
4 LDPE	Low-Density Polyethylene	Flexible; soft; moisture-resistant; chemical-resistant	Plastic film; trash bags; dry cleaning bags; produce bags (Rigid) LDPE: lids; caps; toy products	No
5 PP	Polypropylene	Heat- and moisture-resistant; stiff	Yogurt containers; ice cream containers; microwavable food containers; automotive parts; carpeting	No — optical sorting-equipped facilities only
6 PS	Polystyrene	(PS): hard; brittle; low heat resistance; inexpensive (EPS): lightweight; thermal insulation; impact protection	(PS): disposable cutlery; smoke detector cases (EPS): clamshells; cups; plates; trays; egg cartons; coolers; cushioning	No
7 OTHER	Other	Mixed resins: acrylic, nylon; bioplastics (PLA)	Bottles; multilayer packaging	No

appendix g

The Recyclability of Plastics

Contrary to what may be a common perception, not all plastics are recycled. While it is technically possible to recycle most plastics, there are many types for which it does not make economic sense to do so. The actual recyclability of any given plastic product depends on the type of plastic, market conditions, and other factors, like contamination. Furthermore, there are fundamental aspects of the recycling process—such as the degradation in material quality that occurs—that limit the extent to which it can assist in addressing the problem of plastic waste.

The Fundamentals of Plastic Recycling

Even under optimal circumstances, the current common process of recycling plastic resins is imperfect. Plastic items recovered at a MRF are typically mechanically broken down via shredding or grinding, then subjected to high temperatures to melt the plastic into pellets.[57]

However, this process degrades the quality of recycled plastic compared to virgin material. Normal wear and tear on the polymers of plastic resins, incidence of impure inputs, and contamination (an almost inevitable occurrence with mixed-resin products) all contribute to the production of mixed-resin products that are less valuable and versatile than pure or virgin material.[58] This phenomenon, whereby recycling produces a less desirable product than the inputted material, is termed "downcycling."[59]

Downcycling has significant ramifications for the role of recycling in reducing plastic waste and its associated impacts. First, it imposes a terminal point on the life of any given plastic product, past which further recycling of the resin will produce recovered material so degraded that it is essentially valueless. Consequently, current recycling practices likely do not displace new plastic production on a one-to-one basis, contravening past assessments of recycling benefits.[60] It is estimated that between 1950 and 2015 only 0.9% of plastics produced had been recycled more than once, and doing so may not be an unequivocal benefit given the inputs of the process combined with the diminishing returns of the product.[61]

Second, recycled material merely delays production of virgin material from fossil fuel precursors until a later date.[62] This means that recycling alone, using current common methods, is incapable of fully eliminating the impacts—including greenhouse gas emissions—of plastic production. However, compared to other disposal options such as landfilling and incineration, recycling has consistently been the least harmful option from an environmental standpoint.[63]

---

[57] Tullo, Alexander H. (2019). Plastic has a problem; is chemical recycling the solution? *Chemical & Engineering News* 97 (39). Retrieved December 10, 2019, from https://cen.acs.org/environment/recycling/Plastic-problem-chemical-recycling-solution/97/i39

[58] La Mantia, Francesco Paolo (2004). Polymer Mechanical Recycling: Downcycling or Upcycling? *Progress in Rubber, Plastics and Recycling Technology* 20(1). https://doi.org/10.1177%2F147776060402000102.

[59] Geyer, Roland, Brandon Kuczenski, Trevor Zink, Ashley Henderson (2015). Common Misconceptions about Recycling. *Journal of Industrial Ecology* 20(5), 1010-1017. https://doi.org/10.1111/jiec.12355.

[60] Ibid.

[61] Geyer, Roland, Jenna R. Jambeck, Kara Lavender Law (2017). Production, use, and fate of all plastics ever made. *ScienceAdvances* 3(7). DOI: 10.1126/sciadv.1700782.

[62] Geyer, Roland, Brandon Kuczenski, Trevor Zink, Ashley Henderson (2015). Common Misconceptions about Recycling. *Journal of Industrial Ecology* 20(5), 1010-1017. https://doi.org/10.1111/jiec.12355.

[63] Bernardo, C.A., Carla L. Simoes, Ligia M. Costa Pinto (2016). Environmental and economic life cycle analysis of plastic waste management options. A review. *AIP Conference Proceedings* 1779(140001). https://doi.org/10.1063/1.4965581.

What is Recyclable? Plastics and Product Categories

Based on conversations with operators and experts in the Los Angeles area waste industry, three of the major plastic resin types are currently viable for recycling. However, these plastics vary in their recyclability depending on the type of product they are used to make.

1. High-Density Polyethylene (HDPE, Code 2): HDPE is currently the most valuable plastic resin type for recovery in the Los Angeles area. All MRF operators interviewed (eight of eight) currently recover HDPE.
2. Polyethylene terephthalate (PET or PETE, Code 1): PET is currently recovered by most MRFs serving Los Angeles County; seven of eight interviewees indicated they currently recover the material, the exception being an MRF that primarily processes demolition and construction material, and as such does not receive significant amounts of PET plastic. Two significant limitations make PET a less attractive option for recovery, generally, than HDPE. Firstly, the only category of PET plastic products that are consistently recycled are beverage bottles and jars. Secondly, the market price for recovered PET is not as high as that for HDPE, resulting in slimmer profitability margins for operators.
3. Polypropylene (PP, Code 5): PP merits special discussion. Only one MRF operator interviewed recovers the material, and at only one facility. PP can be recovered and sold at a profit at this facility only because of a significant investment in optical sorting technology. As more facilities integrate automation into their recovery processes, PP may become more viable for widespread recovery.

Outside of these categories, other plastics—regardless of the type of product—are not recovered and are currently sent to landfills. This includes PVC (Code 3), LDPE (Code 4), PS and EPS (Code 6), and OTHER or mixed plastics (Code 7).

Food Service Ware

Disposable plastic food service ware—which may be manufactured from several different resins, including PET, PP, and PS or EPS—is challenging to recover due to issues of food residue and small size. Food waste and residue can contaminate other products in the recycling stream, reducing their value or making them unrecoverable. Even when clean, the size and construction of plastic food service ware make recovery difficult. These products are unlikely to be recyclable in the foreseeable future and in some cases can be actively detrimental to the recycling of other materials. These issues are especially severe with EPS products, whose value is degraded when it absorbs grease or oil and are particularly challenging to recover in a MRF.

Only one of the eight MRF operators interviewed indicated that they currently recover and bale plastic food service ware on a routine basis at any location, and this facility does not serve Los Angeles County. No Los Angeles-based MRF currently recovers and recycles plastic food service ware.

appendix h

Los Angeles County - Plastic & Food Service Survey

LOS ANGELES COUNTY - PLASTIC & FOOD SERVICE SURVEY

Respondent Vendor Information – *Surveyor fill out in advance.*

Name of vendor: _____ Address: _____

Vendor Type (circle): _____

Coffee Shop	Smoothie/Boba Shop	Other beverage vendor
Food truck/Street vendor	Fast Food	Fast Casual
Restaurant (provides takeout)		

Preface – *Surveyor read to respondent.*

Los Angeles County is studying the issue of plastic waste to identify ways to reduce plastic litter and pollution. As part of the study, we are gathering information about the types of disposable products food vendors use.

This survey is being conducted by the UCLA Luskin Center for Innovation, the research group conducting the study for Los Angeles County. All answers will be confidential.

Important Terms – *Reference for clarification, if needed.*

This survey commonly uses two terms. To avoid any confusion, please see the definitions below before proceeding to the questions:

a. **Food service ware:** refers to any food or drink packaging items or containers—including trays, plates, clamshells, and cups—as well as accessory items like utensils and straws, that are meant for customers to be able to take "to-go" and are intended to be thrown away after one use.
b. **Reusable ware:** refers to any food or drink packaging items or containers, as well as accessory items like utensils, that are meant to be collected by staff or returned by the customer and then washed and reused.

Part 1 – *These questions should be answerable by any employee or through observation.*

1. What types of disposable food service ware does your business use? *Surveyor indicate types by item category and material in the table on the following page.*

Item Type	Materials				
	Paper or cardboard	Foam ("Styrofoam")	Plastic (Not foam)	Compostable (Fiber or bioplastic)	Other (Please specify)
Cold drink cups					
Cold drink lids					
Hot drink cups					
Hot drink lids					
Straws					
Utensils					
Food boxes or containers					
Plates and trays					
Bowls					
Bags					
Other items (please specify)					

2. Of the disposable item types above, which does your business use the most of? Please circle the **four most used items** in the table above.

3. Do you currently utilize reusable ware—such as glasses or mugs, washable plates, and metal utensils—for dine-in customers?

   Yes **No** **No dine-in customers**

4. Does your business currently allow customers to use personal reusable ware? Please circle one answer for each type below:
   a. Cups and Thermoses: **Yes** **No**
   b. Food boxes or containers: **Yes** **No**

5. Do you believe your customers would respond positively to your business using greener disposable items?

   Yes **No**

6. About what portion of your customer orders are take-out?
   a. A small amount (25% or less)
   b. A moderate amount (26-50%)
   c. A large amount (51-75%)
   d. A very large amount (75% or more)

7. If your business does NOT currently use **reusable ware**, what would be the biggest barrier to doing so?
    a. Cost of investing in reusable items.
    b. Cost of purchasing and/or access to dishwashing equipment.
    c. Physical space (for storing reusable ware and/or dishwashing equipment).
    d. Changing day-to-day business operations.
    e. Other (please specify): _____

8. If your business does NOT currently allow customers to use personal reusable ware for drinks and/or food, what would be the biggest barrier to doing so?
    a. Health code compliance.
    b. Changing physical space or structure of establishment.
    c. Changing day-to-day business operations.
    d. Other (please specify): _____

9. What methods would be most preferable for your business to receive additional information about greener food service practices and regulatory changes? More than one answer may be circled.
    a. Workshops or presentations, by time period:
        i. Morning
        ii. Afternoon
        iii. Evening
    b. Printed or mailed information.
    c. Emailed information.
    d. Online resources.
    e. Other (please specify): _____

10. The researchers conducting this study may have additional questions in the future. Contact information for a manager or similar individual for this business would be appreciated. This information will NOT be publicized or added to any mailing or call list, and all information supplied in this survey will remain anonymous.

    Future Contact Info

    Name: _____ Position: _____

    Phone: _____ Email: _____

appendix i

Business-facing Disposable Food Service Ware Survey Analysis

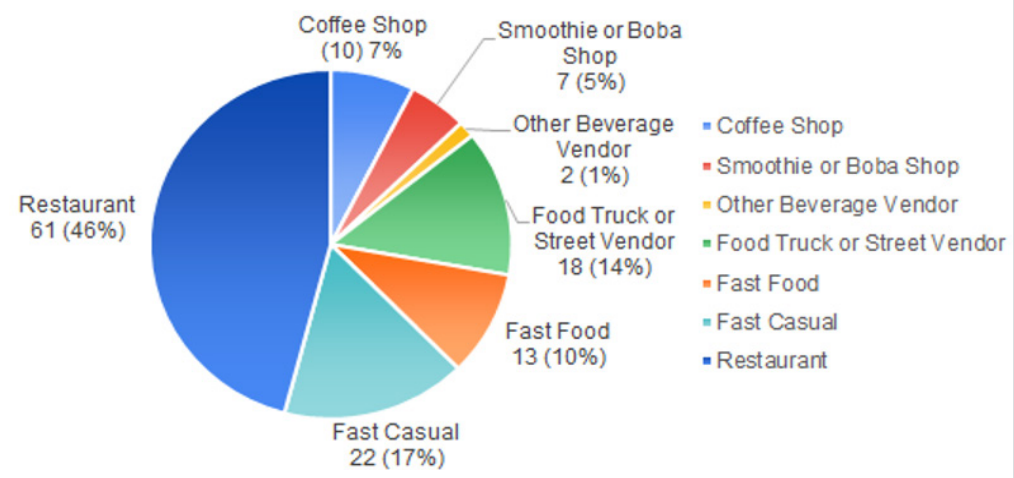
Our survey focused mainly on identifying trends in disposable food service ware product usage for vendors in and near Los Angeles County unincorporated areas. Our team conducted 133 surveys between January 25, 2020, and March 8, 2020 at food vendors within 0.5-mile travel distance of major intersections in a representative sample of these areas, as was feasible given logistical constraints. One response was not used for our statistical analysis due to incompletion. In the case that a vendor did not wish to take the survey, our team observed what products were in use at the site and left the remainder of the questions blank. Seventy respondents completed the survey in full, with the other 52 being observation-only.

A majority of our analytical questions focused on how product usage differs by vendor type. We categorized vendors as one of seven types, the breakdown of which can be seen in the figure below.

Figure 1

Survey Respondents by Vendor Type.

Includes both full respondents and observation-only.



To assess to what degree any given vendor utilizes expanded polystyrene (foam) or non-foam plastic disposable food service ware, we asked (or observed) what types of products the vendor used and of what material these products were made. We used the following categories of disposable products: cold drink cups, cold drink lids, hot drink cups, hot drink lids, straws, utensils, food boxes or containers, plates and trays, bowls, bags, and other items. We classified materials as paper or cardboard, foam, plastic (not foam), compostable (not paper), or other. Respondents also indicated which categories of products constituted their top four most-used.

Coding and Analysis

For our analysis, we coded this information using the following methodology:

1. Number of categories in which foam or non-foam plastic items are used: Each product category (e.g. cold drink cups) in which a business used any foam or non-foam plastic material was coded as 1, others were coded as 0, and summed the total number of categories in which the business used such materials.
2. Usage of any foam products: Businesses that used any foam products were rated 1, others were rated as 0.
3. Exclusive use of foam or plastic products: Businesses that used only foam or non-foam plastic products were rated 1, others were rated 0.

4. Top four most-used product materials: We summed the number of most-used product categories in which businesses used foam, non-foam plastic, and both combined, resulting in a 0-4 rating for each element for each business.

Other analysis questions already existed in binary form, and did not require additional coding pre-analysis.

We analyzed our data using a one-way analysis of variance (ANOVA) approach to answer the following research questions:

1. Does the number of product categories in which vendors use foam or non-foam plastic items vary by vendor type or vendor location?
2. Are certain vendor types more likely to use any foam products or only foam or non-foam plastic products?
3. Does the number of foam or non-foam plastic items among a vendor's top four most-used items vary by vendor type?
4. Does a vendor's likelihood of using reusable ware for dine-in customers and/or allowing usage of customer-owned reusable beverage and food containers vary by vendor type?
5. Does the proportion of orders which are takeout vary by vendor type?

Results

When considering all data points—both respondents and observation-only—we found no statistically significant results with respect to the number of product categories in which vendors use foam or non-foam plastic materials. However, when considering only full respondents, we found that restaurants use such items in approximately 2.5 more categories and smoothie or boba shops use them in 3.8 more categories, both significant at the p=0.05 level (See table below.) Because many vendors do not place items in a spot visible or accessible to customers and our observations were conducted for a limited time frame, we believe that the analysis of the respondent-only data is representative.

Table 1. Estimates table for one-way ANOVA of total product categories in which foam or non-foam plastic items are used by vendor type. Base vendor type is coffee shops. n=70. *p<0.1, **p<0.05, ***p<0.01.

Variable	Coefficient
Fast Casual	0.87142857
Fast Food	2.175
Food Truck or Street Vendor	2.05
Restaurant	2.5058824**
Smoothie or Boba	3.8**
Constant	4.2***

We did not find any particular locations, as indicated by zip code, where vendors were statistically more likely to use foam or non-foam plastic items in more product categories.

We found that food trucks or street vendors, other beverage vendors, and restaurants are more likely to use at least one foam product. However, we surveyed only two businesses that fell within the "other beverage vendor" category, suggesting the real possibility of a Type II error. Food trucks and street vendors were ~69% more likely to use at least one foam product, significant at the p=0.01 level (Table 2). Restaurants were 40% more likely to use at least one foam product, significant at the p=0.05 level.

Table 2. Estimates table for one-way ANOVA of usage of at least one foam product by vendor type. Base vendor type is coffee shops. n=132. *p<0.1, **p<0.05, ***p<0.01.

Variable	Coefficient
Fast Casual	0.3
Fast Food	0.26153846
Food Truck or Street Vendor	0.68888889***
Other Beverage	0.8**
Restaurant	0.4**
Smoothie or Boba	0.22857143
Constant	0.2

When replicating this analysis with only full response data, we found that only restaurants exhibited a statistically significant (p<0.05) greater likelihood of using at least one foam product. However, this is driven in large part by the fact that the vast majority of food truck or street vendor data points were observation-only. Therefore, we believe that the conclusions of our analysis of the full data set are representative.

We found that food trucks and street vendors were ~57% more likely to use only foam or non-foam plastic products at the p=0.01 level (Table 3). We found no statistically significant relationships at the p=0.1 level when examining response data only, again driven by the fact that most food trucks and street vendors declined to answer the full survey. Given the nature of this research question, we believe observational data to be sufficient, and that therefore the results of the full data analysis are representative.

Table 3. Estimates table for one-way ANOVA of exclusive usage of foam or non-foam plastic products by vendor type. Base vendor is coffee shops. n=132. *p<0.1, **p<0.05, ***p<0.01.

Variable	Coefficient
Fast Casual	0.03636364
Fast Food	-0.02307692
Food Truck or Street Vendor	.56666667***
Other Beverage	-0.1
Restaurant	0.3333333
Smoothie or Boba	0.04285714
Constant	0.1

We found that food trucks or street vendors and restaurants were likely to have, on average, 1.25 and ~0.9 more foam products among their top four most-used items, respectively (Table 4). These findings were significant at the p=0.05 level.

Table 4. Estimates table for one-way ANOVA of number of top four most-used products that are foam by vendor type. Base vendor is coffee shops. n=70. *p<0.1, **p<0.05, ***p<0.01.

Variable	Coefficient
Fast Casual	0.5
Fast Food	0.5
Food Truck or Street Vendor	1.25**
Restaurant	.88235294**
Smoothie or Boba	1*
Constant	4.441E-16

We found no statistically significant results regarding the number of non-foam plastic items among an establishment's top four most-used items. However, smoothie or boba shops were likely to have 2.6 more items that were foam or non-foam plastic among their top four most-used, significant at the p=0.05 level (Table 5).

Table 5. Estimates table for one-way ANOVA of number of top four most-used products that are foam or non-foam plastic by vendor type. Base vendor is coffee shops. n=70. *p<0.1, **p<0.05, ***p<0.01.

Variable	Coefficient
Fast Casual	0.8
Fast Food	0.8
Food Truck or Street Vendor	1.55
Restaurant	1.3882353*
Smoothie or Boba	2.6**
Constant	1.2*

Unsurprisingly, restaurants were more likely to utilize reusable food service ware for dine-in customers, significant at the p=0.05 level (Table 6). We found no statistically significant differences in the likelihood of establishments allowing the usage of customer-owned reusable cups, and given that only ~57% of respondents indicated they allow such items, this is not due to the practice being ubiquitous. However, fast-casual vendors, food trucks or street vendors, and restaurants were all more likely to allow customers to utilize personal reusable food containers (Table 7).

Table 6. Estimates table for one-way ANOVA of usage of reusable food service ware for dine-in customers by vendor type. Base vendor is coffee shops. n=70. *p<0.1, **p<0.05, ***p<0.01.

Variable	Coefficient
Fast Casual	0.02857143
Fast Food	0.1
Food Truck or Street Vendor	-0.4
Restaurant	.48235294**
Smoothie or Boba	-0.2
Constant	.4**

Table 7. Estimates table for one-way ANOVA of allowing personal reusable food container usage by vendor type. Base vendor is coffee shops. n=70. *p<0.1, **p<0.05, ***p<0.01.

Variable	Coefficient
Fast Casual	.57142857**
Fast Food	0.25
Food Truck or Street Vendor	.75**
Restaurant	.58823529**
Smoothie or Boba	0.4
Constant	-1.110E-16

We found no statistically significant (p<0.05) differences among vendor types with regards to the proportion of their orders that are take-out.

Discussion

Given the lack of patterns identified in foam or non-foam plastic product usage by geographic location (i.e. zip code) or in the proportion of orders that are take-out by vendor type, we chose to focus solely on trends in product usage by particular types of vendors to identify those that will be highly impacted. Specifically, we examined which types of vendors are more likely to use products that will be restricted or banned by the forthcoming ordinance (i.e. foam or non-foam plastic) and which types are currently more likely to utilize reusable items, the latter suggesting reduced need for support in a transition.

We found that food trucks and street vendors are likely to be the vendor type most highly impacted by the forthcoming ordinance. They were more likely to use at least one foam product, to use exclusively foam or plastic products, and to have foam products among their top four most-used items. While they were found to allow customer-owned food container usage at higher rates, this practice is rare behavior among consumers.

Smoothie or boba shops also exhibited trends that suggest potential for higher impacts as a result of the ordinance. They were found to use foam or non-foam plastic across more item categories and to have higher numbers of foam or non-foam plastic items among their top four most-used. We therefore rated smoothie or boba shops as likely to be highly impacted by the ordinance.

While restaurants were also found to use more foam or non-foam plastic items by product category, to use at least one foam product, and to have foam or non-foam plastic items among their top four most-used, they were also more likely to already use forms of reusable ware. Because these waste-reducing practices are more likely to already be in place at such establishments, we did not rate them as likely to be highly impacted by the ordinance.

We examined the responses of our two highly impacted vendor types to the question "What methods would be most preferable for your business to receive additional information about greener food service practices and regulatory changes?" While the limited number of responses was insufficient to perform quantitative analysis, the modal response across both types was "online resources," followed by "printed or mailed information." Therefore, these implementation options were categorized as aligned with the needs-based element of our effectiveness evaluation for short-term strategies.

appendix j

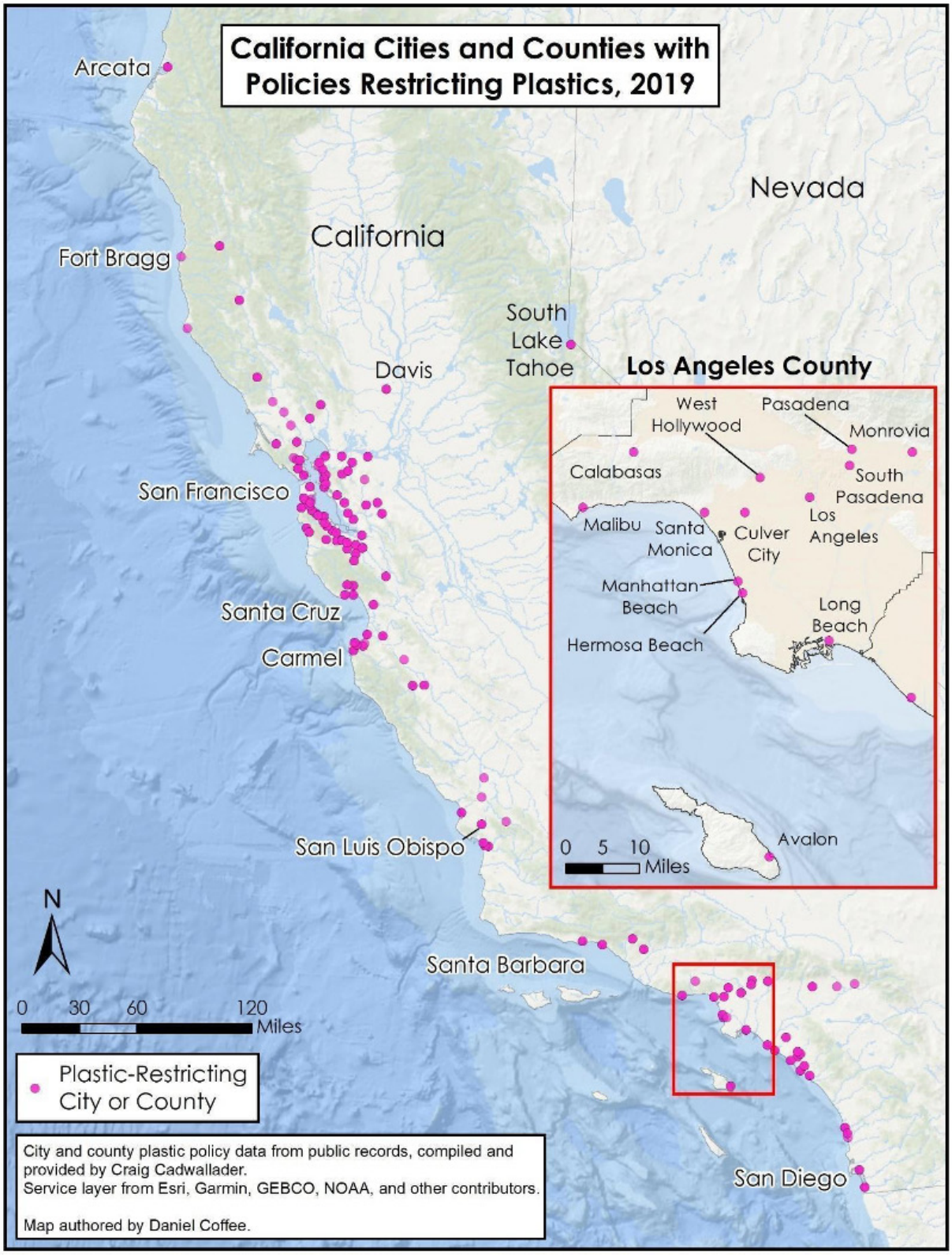
List of California Cities & Counties with Various Plastics Restriction Policies

Source: C. Cadwallader, personal communication, January 6, 2020

Alameda (2008/2017)	Imperial Beach (2018/2019)	Rancho Cucamonga (1988)
Alameda County (2015)	Lafayette (2014)	Redondo Beach (2020)
Albany (2008)	Laguna Beach (2007)	Redwood City (2011)
Aliso Viejo (2004)	Laguna Hills (2008)	Rialto (1988)
Arcata (2015)	Laguna Woods (2012)	Richmond (2009/13)
Arroyo Grande (2016)	Livermore (2010/2018)	Salinas (2011)
Atascadero (2019)	Long Beach (2018)	San Anselmo (2018/2019)
Avalon (2017)	Los Altos (2014)	San Bruno (2009)
Belmont (2012)	Los Altos Hills (2012)	San Carlos (2012)
Berkeley (1988/2019)	Los Angeles City (1988/2008)	San Clemente (2011)
Brisbane (2014)	Los Angeles County (2008)	San Diego (2019)
Burlingame (2011)	Los Gatos (2014)	San Francisco City/County (2006/19)
Calabasas (2007)	Malibu (2005/16/18)	San Jose (2013)
Campbell (2014)	Manhattan Beach (1988/2019)	San Juan Capistrano (2004)
Capitola (2009/2011)	Marin County (2009)	San Leandro (2011)
Carmel (2008/2017)	Marina (2011)	San Luis Obispo City (2015)
Carpinteria (2008/2017)	Martinez (1993)	San Luis Obispo County (2019)
Colma (2013)	Mendocino County (2014)	San Mateo City (2013)
Concord (2018)	Menlo Park (2012)	San Mateo County (2008/11)
Contra Costa County (2019)	Mill Valley (2009)	San Pablo (2014)
Cotati (1989)	Millbrae (2007)	San Rafael (2012)
Culver City (2017)	Milpitas (2017)	Santa Barbara (2018)
Cupertino (2014)	Monrovia (2017)	Santa Clara City (2014)
Daly City (2012)	Monterey City (2009)	Santa Clara County (2012)
Dana Point (2012)	Monterey County (2010)	Santa Cruz City (2008/12/17)
Davis (2017)	Morgan Hill (2014)	Santa Cruz County (2012/2019)
Del Mar (2019)	Moro Bay (2016)	Santa Monica (2007/2018)
Del Ray Oaks (2009)	Mountain View (2014)	Sausalito (2007)
Dublin (2019)	Newport Beach (2008)	Scotts Valley (2008)
El Cerrito (2013)	Novato (2013/2014)	Seaside (2010)
Emeryville (2007)	Oakland (2006)	Sebastopol (2019)
Encinitas (2016)	Ojai (2014)	Solana Beach (2015)
Fairfax (1993)	Orange County (2006)	Sonoma City (1989)
Fort Bragg (2014)	Pacific Grove (2008)	Sonoma County (1989)
Foster City (2011)	Pacifica (2009)	South Lake Tahoe (2018)
Fremont (1990/2010)	Palo Alto (2009/16/19)	South Pasadena (2016)
Gonzales (2014)	Pasadena (2016)	South San Francisco (2008)
Greenfield (2014)	Paso Robles (2019)	Sunnyvale (2013)
Grover Beach (2018)	Petaluma (2019)	Ukiah (2014)
Half Moon Bay (2011)	Pinole (2018)	Union City (2016)
Hayward (2010)	Pismo Beach (2015)	Ventura County (2004)
Hercules (2008)	Pittsburg (1991)	Walnut Creek (2014)
Hermosa Beach (2012/2019)	Pleasanton (2013)	Watsonville (2009/14/19)
Highland (1988)	Point Arena (2010)	West Hollywood (1990)
Huntington Beach (2004)	Portola Valley (2012)	Yountville (1989)

appendix k

Map of California Cities & Counties with Plastics Restriction Policies (as of January 15, 2020)



appendix I

Cities Within Los Angeles County with Various Plastics Restriction Policies

GOV = Applies only to government facilities
REST = Applies to food service establishments
FULL = Applies to food service establishments and restricts the retail sale of food service ware

City	Policy	Policy Description	Year Adopted	Type
Avalon	PS Ban	Ban on PS food service ware (FSW).	2017	REST
Calabasas	EPS Ban	Expanded polystyrene ban on all food packaging, requirement that all takeout food packaging must be returnable, recyclable, biodegradable, or degradable.	2008	REST
Culver City	PS Ban	Ban on distribution and sale of polystyrene food service ware, requires food providers to provide takeout disposable utensils to customers upon request only. Ban on polystyrene coolers (not encapsulated).	2017	FULL
Hermosa Beach	PS Ban	Initial ban includes polystyrene food service ware. Updated polystyrene ban includes ban on sale and distribution of meat trays, plastic straws, packing materials and mylar balloons.	Initial 2012, additional ban in 2019 (updated ban effective in 2020)	FULL
Los Angeles	EPS Ban	Government facility EPS ban.	1988/2008	GOV
Long Beach	EPS Ban	Expanded polystyrene food service ware ban. Also prohibits the sale and distribution of polystyrene ice chests and polystyrene bean bags. Utensils and straws are provided upon request only for takeout orders.	2018 (government facilities), 2019 (food establishments)	REST
Manhattan Beach	PS Ban	Initial ban on polystyrene food service ware. Ban in 2014 prohibits polystyrene coolers, straws, lids, and utensils. 2018 ban prohibits polystyrene egg cartons and packing materials. 2019 ban prohibits polystyrene meat and produce trays.	Initial in 2013, additional bans in 2014, 2018, 2019	FULL

Malibu	EPS Ban	Initial ban in 2005 prohibits sale and distribution of polystyrene food containers and packing materials. Additional ban in 2017 prohibits sale and distribution of other polystyrene products including all food service ware, meat and produce trays, egg cartons, packing materials, coolers, pool/beach toys, buoys, as well as plastic sandbags. Ban in 2018 prohibits the sale and distribution of single-use plastic and bioplastic straws, stirrers, and utensils.	Initial ban in 2005, additional bans in 2017 and 2018	FULL
Monrovia	EPS Ban	Prohibits the use or purchase of expanded polystyrene products at government facilities.	2017	GOV
Pasadena	PS Ban	Ban on sale and distribution of all polystyrene food service ware (cups, bowls, plates, takeout containers); does not include straws, lid cups, or utensils. Ban includes polystyrene coolers.	2017	FULL
Redondo Beach	PS Ban	Ban on PS FSW. *Passed January 7, 2020	2020	
Santa Monica	EPS Ban	Ban on all polystyrene and other nonrecyclable plastic disposable food service containers, requires all food packaging to be marine degradable.	2007, additional ban in 2019	REST
South Pasadena	EPS ban	Ban on sale and distribution of all expanded polystyrene food service ware for food providers and retail providers.	2017	FULL
West Hollywood	PS Ban	PS ban for restaurants and food vendors.	1990	REST

Sources:
Californians Against Waste, Table View PS Ordinance. https://www.cawrecycles.org/psordinancetable
C. Cadwallader, personal communication, January 6, 2020

appendix m

Policy Implementation Data by City

	Outreach/ Stakeholder Engagement	Personnel	Costs	Unique Features	Policy Timeline	Compliance Rates (Estimate)
City 1	Mailed notices to all affected businesses, provided 20-page catalog with alternatives, physically distributed video to businesses, held 3 workshops throughout various times of day with alternative products on display, mailed brochures, posted on next-door, posted on social media, provided online resources, and sent notices in utility billing to residents	3-6 (not full time)	Existing operating budget Full-time compliance inspector ($70k per year) Outreach ($5k-$10k)	Dedicated compliance inspector to visit businesses	Went into effect within 6 months, however enforcement did not begin until 1 year after policy	90%
City 2	Mailed guide with list of alternatives to all affected businesses, posted on social media, provided education at booths at public events/farmers markets, created giveaways (reusable utensil kits), and organized community events	2 personnel (one staff and one intern) Students/ volunteers for education	Existing operating budget Distributed 6,000 reusable utensil kits at $2 per unit	Distributed reusable utensil kits	~1 year	86%

City 3	Developed press releases; inserted information into utility bills; distributed catalog, brochure, and pamphlet, with list of alternatives; mailed newsletters to residents; provided online resources; sent mailers to all affected businesses; distributed flyers to businesses during health inspections; and held 3 public meetings	4- 6 (not full time)		App for citizens to report violations Business license forms require new businesses to sign off on awareness of ban Dedicated code enforcement officer that visits sites reported to be in violation	1 year	90%
City 4	Mailed postcards to all affected businesses, sent mailers, posted on social media, provided online resources with link to alternative products	N/A	N/A		30 days between enactment and effective date	N/A (not enforcing right now)
City 5	Sent 3 mailers to all affected businesses, mailed postcards, provided online resources such as compliance guide, promoted economic incentive for early compliance, canvassed door-to-door using interns, promoted through	2 personnel (>50% time)	Existing operating budget, with the exception of economic incentives program $13,000 distributed	Developed green business certification program Gave economic incentives to early-adopters	18 months between enactment and enforcement	85%

	social media		to 45 restaurants	Developed foam-free recognition program		
City 6	Provided flyers, online resources (info sheet/guide), catalog with list of alternatives, social media posts, texts, ads in local newspapers, and info booths at city/local events	3 environmental staff (50% time) 3 compliance officers	Existing operating budget		6 months	95%
City 7	Organized workshops, canvassed door-to-door, sent fact sheets and letters to all affected businesses, provided online resources including link to compliant products	2 contracted onsite technical assistance personnel to convert businesses to use reusables	Existing operating budget $48,000 contract with consultant	Reusable cup pilot program Ability for businesses to create customized signage for waste disposal bins	Enforcement begins 1 year after effective date 3 phases (6 months between each phase)	N/A
City 8	Conducted door-to-door outreach to affected businesses before and after policy adoption, mailed letters to all affected businesses, posted on social media, organized events and workshops, and provided information at a booth at distributor (Restaurant Depot), and held press events	3 zero waste program staff (<50% time) 6-11 outreach staff	$30k grant for reusable bags	Hired consultants to visit businesses	Varies (6 months to ~18 months)	90%

City 9	Conducted focus groups with businesses, business surveys, 2 workshops, and an exposition with businesses and manufacturers/ distributors; provided information at booths at events; held events (before, during, and after implementation), and a business mixer; sent mailers, flyers, postcards, and emails to affected businesses; maintains an online interactive list of compliant products and other resources (info sheet); and created poster and table cards for businesses to utilize	2 internal staff Contract with company to provide education at expos/ mixers	Existing operating budget $150-200k estimate (includes salaries, events, workshops, materials, food, giveaways)	Expo with business and manufacturers and distributors Giveaways at events	6 months between enactment and effective date	95%
City 10	Mailed flyers and postcards to businesses, provided online resources, conducted a packaging fair, and gave away free stickers/posters	2 internal staff Contract with consulting company 4 internal staff for targeted site visits	Existing operating budget $100k first year, $80k each year thereafter; $30k for external design of stickers/posters	Packaging fair, free stickers/ posters	18 months between enactment and enforcement	75%
City 11	Conducted outreach	3-5 staff	Existing	General info	1 year between	N/A

	to businesses prior to passage, sent direct mail and emails to affected businesses, provided online resources, distributed info brochure and a list of alternatives, provided a general info call line, organized events, and provided education at booths at a food safety conference	(>50% time) 20 total staff (<50% time)	operating budget Hired consultant for California Environmental Quality Analysis (CEQA) analysis	call line	enactment and effective date	
City 12	Mailed information to all affected businesses with info, provided online resources, and distributed reusable straws to public	1 (not full time)	Existing operating budget; $10,000 to create packet (hired local ad company to develop materials); $3000 for reusable straws	Reusable straw distribution to public	6 months from enactment date to enforcement date	98%