Creating Healthier Food Packaging by Eliminating and Reducing Reliance on Plastic Food Packaging

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I. Executive Summary

Plastics used for food packaging represent a huge stream of waste, an environmental hazard, and can negatively affect human health by leaching toxic chemicals into food products. The government's current approach to regulating food packaging is insufficient and does not recognize the harms of leaching. Further, most consumers are unaware of the hazards plastic packaging causes to their health and their environment. To mitigate the impact of this issue, greater consumer awareness coupled with strong disincentives surrounding the use of plastic food packaging are needed. Investing in and encouraging alternate food packaging materials, like glass or bioplastics, is crucial to protect public health and the environment.

II. Problem Statement

The widespread use of non-biodegradable, single-use food packaging significantly contributes to environmental pollution by generating large volumes of plastic waste that accumulate in landfills and waterways, while also potentially leaching harmful chemicals into food, posing a risk to human health.

III. Problem Explanation

a. The Vast Majority of Plastic Waste Generated by Food Packaging Cannot Be Recycled

Food packaging is one of the most prevalent forms of packaging with some studies indicating that around 66% of all packaging waste can be related to food products given the scale and frequency at which food is purchased by consumers (Marsh & Bugusu, 2007). Packaging products used to "wrap or protect goods," comprises more than 28% of total municipal solid waste according to the U.S. Environmental Protection Agency (2017). The American Chemistry Council, an industry trade group, attributes about 23% of plastic sales in 2023 to packaging (American Chemistry Council, 2024).

While many forms of food packaging, like cardboard and glass, are commonly recycled (US EPA, 2017), plastic stands out for its inability to be effectively recycled at cost and scale (Di et al., 2021). Many recognize plastic as a waste disposal challenge and as having a largely linear life-cycle (Di et al., 2021), yet plastic consumption, and the subsequent waste and environmental pollution it generates, has boomed in recent decades (Eriksen et al., 2023).

The "New York State Solid Waste Management Plan" published in 2023 by the Department of Environmental Conservation reports 14% of municipal waste in the state

consisted of plastic. There was no data included pertaining to food packaging specifically. Most plastic will end up in a landfill once discarded (Di et al., 2021). While it's more common among developing nations, poor waste management will allow a significant amount of plastic to leak directly into the environment, especially the world's oceans (Eriksen et al., 2023; Jambeck et al., 2015).

A 2011 report found that plastics, a wide-ranging category of petroleum-based materials, is the most common material used to package food items (Rexam, 2011). There are more than 11,000 chemicals found in different quantities and at different stages of production across plastic food packaging items (Groh et al., 2020). It is extremely difficult to determine what chemicals compose a given plastic packaging item because so many plastic polymers exist, and industry is constantly innovating and creating new plastic products for use in food packaging (Groh et al., 2020; Muncke et al., 2020).

b. Toxic Chemicals Leach from Plastic Food Packaging and Harm Humans, Animals, and Our Environment

Scientific evidence suggests that plastic polymers and additives contained therein leach varying amounts of the chemicals into the food products they package (Biryol et al., 2017a; Muncke et al., 2020). Toxic chemicals in plastic polymers commonly used for food packaging have been found to contribute to numerous negative human health outcomes, including disruptions to the endocrine, metabolic, and renal systems even at small amounts of exposure (Kataria et al., 2015; Stevens et al., 2024). Dietary exposure to associated toxic chemicals in very small quantities has been directly linked to leaching from packaging and subsequent consumption of the packaged food by humans (Biryol et al., 2017a). Endocrine disruptions cause cancers (especially in children), negatively impact reproduction, and have a well-documented history of additional negative outcomes (Jones et al., 2024; Nerin et al., 2018). A 2018 study estimated the United States incurs about $269 billion dollars of direct and indirect economic costs that could be linked to the effects of chronic illnesses either caused, exacerbated, or otherwise linked to chemicals contained within plastics (Trasande et al., 2024).

Because of their differing chemical composition and factors like heat and time, materials can leach at different rates and in different quantities depending on the polymer and the food item it is packaging (Alamri et al., 2021). A food item's packaging is of great food safety

importance because oftentimes substances leach from packaging into the food they store (Muncke et al., 2020).

Children are particularly susceptible to and at risk of hormone disruptions and the developmental disorders toxic chemicals cause (Trasande et al., 2018). The American Academy of Pediatrics has specifically acknowledged the Food and Drug Administration's regulatory system is highly flawed and inadequate for protecting children, and the current scale and scope of chemicals leeching into food is a particular concern to our nation's most vulnerable consumers (Trasande et al., 2018).

Because the majority of plastic cannot be recycled, it wreaks havoc on animals and ecosystems by both accidentally and purposefully entering the environment (Bodor et al., 2024; Eriksen et al., 2023; Jambeck et al., 2015; Mansfield et al., 2024). In the oceans, plastic waste becomes microplastics and is toxic to a number of organisms crucial to the ocean's food chain (de Sousa, 2024). Further, fish consume plastic waste, are caught by fishermen, and are consumed by humans representing a second pathway that the toxic chemicals found in plastic can be ingested by the public (de Sousa, 2024). Reducing plastic's use cases is crucial to both human health and the health of our environment.

c. The Plastic Industry Externalizes and Minimizes the True Cost of Plastic Packaging

Our reliance on plastic comes at a cost to human health and the environment, and the public's "throwaway culture" remains an increasingly concerning driver of plastic waste generation (New York State Department of Environmental Conservation, 2023). People view plastic as convenient and harmless, but this is far from the truth. The plastic industry regularly lies to the public, lawmakers, and government regulators understating both the direct and indirect harms of the products they market (*California v. Exxon Mobil*, n.d.; Davis Allen, PhD et al., 2024). This creates a perception that plastic is safe and that is untrue. The cloud of misinformation also affects consumers who recognize the harm plastic waste can cause, want to recycle their plastic after its useful life has ended, and find the process of recycling to be difficult, confusing, and ultimately recycle incorrectly (Murphy, 2021). Many studies have directly linked a person's understanding and familiarity with an outcome or problem to behavior changes that will either continue or change that outcome (Carey et al., 2019). New Yorkers are situated far removed from the dangers of plastic waste thus behavior changes with a goal of

reducing consumer waste generation may be difficult to produce without increased consumer education.

While consumers may be unaware of plastic's negative consequences, they are certainly footing the bill for the economic, environmental, health, and societal costs externalized by the plastic industry. One study attempting to commodify the plastic industry's damage to marine life, terrestrial ecosystems, and human health estimated the industry could pass more than thirteen thousand, seven hundred billion dollars of direct and indirect costs onto the public by 2040 (Cordier et al., 2024). The number is staggering, and looking on a micro-level this means fisheries no longer producing fish, declining tourism and forced migration due to rising sea levels, increased medical bills and chronic illnesses due to polluted water and air, and the list goes on (Cordier et al., 2024; Vannela, 2012). Plastic may be economically cheap to produce, but the true costs of its continued use, hidden by the industry's propaganda machine, can be found in how plastic hurts humans, oceans, and terrestrial ecosystems.

d. Viable Alternatives

Plastic is one of the most widely used packaging materials, but only gained this prominence in the past thirty years (Marsh & Bugusu, 2007; Morris, 2024). Other materials, like glass, cardboard, metals, and bioplastics, are increasingly becoming cost-competitive with plastics and certainly have more desirable human and ecosystem health outcomes (Adewumi et al., 2024; Dolci et al., 2024; Mayuri et al., 2023). Furthermore, advancements in new materials represent an opportunity for New York State to lead the nation in reducing waste, reducing people's exposure to toxic chemicals, and slowing the effects of global warming.

III. Existing Policy

Federal

a. Break Free from Plastics (Proposed Legislation)

While unlikely to become law in today's political climate, the Break Free from Plastic Pollution Act proposed by Senator Merkley and Representative Huffman provides evidence of a federal legislative movement to reduce the United States' reliance on plastic. The proposed legislation includes bans on certain types of plastic packaging, incentives to encourage the use of refillable containers, extended producer responsibility to mandate the plastic industry clean up polluted areas and establish stronger waste management protocols, and a moratorium on new factories to manufacture plastic goods (Bellino, 2023). The legislation is bold, comprehensive,

and supported by many environmental advocacy groups, but it lacks majority support by lawmakers in both the House and Senate due to its high cost, lack of industry buy-in, and continued partisanship divides around global warming (Angela Logomasini, 2022; Brian Kennedy & Alec Tyson, 2024).

b. Federal Food, Drug, and Cosmetic Act (FFDCA, 1938)

The Federal Food, Drug, and Cosmetic Act authorizes the Food and Drug Administration (FDA) to set standards for which chemicals, such as color additives, are allowable in food products and at what levels (Federal Food, Drug and Cosmetic Act (FFDCA), 1934). The Act also gave the FDA broad powers to prevent the mislabeling of food items and to improve overall food safety by establishing safety standards, for example levels of pesticides permissible on agricultural products (Federal Food, Drug and Cosmetic Act (FFDCA), 1934). 21 U.S.C. §§ 301-392

Specifically on the topic of food packaging, the FFDCA stated, "edible products may not be packaged in a container which is composed in whole or in part of any poisonous or deleterious substances," that could negatively impact the health of the consumer (Federal Food, Drug and Cosmetic Act (FFDCA), 1934). The USDA and FDA both share responsibility to enforce this directive and ensure food packaging is safe. While the legislation was comprehensive in covering any and all materials used to package food items, including the phrase "other material" in its definition, the act fell short of defining what exactly makes a substance poisonous or deleterious (Federal Food, Drug and Cosmetic Act (FFDCA), 1934). Still, the legislation is clear that the FDA and USDA have the authority to regulate food packaging including that ability to ban dangerous materials from inclusion in food packaging. Demonstrating this authority, the FDA banned the use of three substances containing perfluoroalkyl ethyl in 2016 citing adverse impacts to human health when the chemicals leeched from paperboard or other food contact surfaces into the food people consume (21 CFR part 176, Indirect Food Additives: Paper and Paperboard Components).

c. Fair Packaging and Labeling Act (1967)

The Fair Packaging and Labeling Act primarily focuses on accurately accounting for the size of packages used for consumer products, including food packaging, and amount of product contained within packaging in an effort to allow consumers to make accurate value assessments of the products they are buying (*15 USC Ch. 39: FAIR PACKAGING AND LABELING*

PROGRAM, n.d.). An unintended, positive consequence of this legislation is direction from the government to limit unnecessary packaging materials thus eliminating some of the waste generated through packaging. The legislation, notably, did not require food packaging to indicate or disclose what materials are present in an item's packaging, but only to disclose what the composition and amount of the actual, primary product being purchased is (*15 USC Ch. 39: FAIR PACKAGING AND LABELING PROGRAM*, n.d.).

d. Food Additives Regulation and the FDA's Food Contact Notification Program

The FFDCA was modernized in 1997 and the Food and Drug Administration began maintaining an updated list of the substances intentionally or unintentionally added to food items including substances which make contact with food items during the manufacturing and packaging of said items (U.S. Food & Drug Administration, 2017). Companies who wish to use novel substances in a food directly or during their manufacturing or packaging processes are responsible for ensuring the safety of those novel substances and must notify the FDA of the new material (U.S. Food & Drug Administration, 2023). A substance is novel if it is not generally recognized as safe (GRAS) or previously evaluated by the FDA (U.S. Food & Drug Administration, 2023). The FDA then has the authority to offer no objection or ban or limit the use of any substance they feel poses a risk to human health (U.S. Food & Drug Administration, 2024c).

While a monumental example of transparency, the FDA's Food Contact Notification Program largely makes its safety determinations using data provided by the companies seeking to use and profit off of the material in question (21 U.S.C. § 348 (a)(1), (b)(2) (2018), 2018; Soroudi, 2020). This opens the door for significant conflicts of interest. Furthermore, a number of loopholes exist that give companies discretion over whether or not a substance is subject to FDA review and advocates have highlighted how this program is not thorough or transparent enough largely because the FDA is under resourced (Center for Food Safety, 2024; Pew Charitable Trusts, 2013; Soroudi, 2020). Since 2000, about 98% of novel substances have bypassed FDA review with companies claiming they are generally recognized as safe (GRAS) and thus not subject to review (Backhaus & Benesh, 2022).

New York State

a. Toxics in Packaging Act

New York State banned two plastic substances, perfluoroalkyl and polyfluoroalkyl, from use in “food packaging” via an amendment to the established Toxics in Packaging Act which set limits of some toxic metals in packaging broadly (Toxics in Packaging Act, 2024). The legislation, however, offered an extremely narrow definition of “food packaging” which included only items that come into contact with food and are composed primarily of, “paper, paperboard, or other materials originally derived from plant fibers” (Toxics in Packaging Act, 2024). Many food products are packaged in materials that are not derived from plant fibers, such as plastic, glass, or metal (Marsh & Bugusu, 2007). The narrow definition provided by the legislature allowed for widespread exceptions and applied only to a small portion of total food packaging. Both banned substances, commonly known as PFAS, are still permitted to be present in plastic food packaging, as the law did not include plastics used to carry, store, or serve food. Thus both the presence of PFAS in food packaging and the risk those chemicals leaching into the foods they come into contact with persists (Neltner, 2021). PFAS have been identified in plastic packaging and in the coatings of metal food packaging, and this use is still permitted by a loophole in this legislation (Geueke, 2024).

b. Expanded Polystyrene Foam Container and Polystyrene Loose Fill Packaging Ban 6 NYCRR Part 353

New York State has banned the use of polystyrene foam (a plastic material colloquially, albeit incorrectly, known as Styrofoam (Tasneem, 2023)) in the context of disposable food containers, but similar to the Toxics in Packaging Act this ban is extremely narrow in scope and the definition provided by the legislation only applies to temporary, single-use plastics and containers used in cold storage situations (Expanded Polystyrene Foam Container and Polystyrene Loose Fill Packaging Ban, 2024; Toxics in Packaging Act, 2024). A number of parties are allowed exemptions from the restriction including small businesses and houses of worship (Expanded Polystyrene Foam Container and Polystyrene Loose Fill Packaging Ban, 2024). Most significantly, this legislation only applies to disposable and cold storage containers which enables the use of polystyrene foam in more permanent food containers. While a promising initial step, this legislation is quite far from holistically addressing the growing waste and health problems prevalent in food packaging plastics, a category containing expanded polystyrene along with many other polymers both known and unknown to legislators and the

public (Expanded Polystyrene Foam Container and Polystyrene Loose Fill Packaging Ban, 2024; Groh et al., 2020).

c. Bag Waste Reduction Act (2019)

ECL §27-2803

In March of 2020, New York State was set to begin enforcing a ban on plastic bags provided to a customer by an entity that collects sales tax (Bag Waste Reduction Act, 2019), but lawsuits from business owners and the COVID-19 pandemic delayed the ban from enforcement until October (Kim, 2020). The law did not identify specific chemicals to be banned, but instead focused on a specific use case within a wide category of materials. While the application was wider than previous bans, the law still provided many exemptions and situations where the distribution of plastic bags was still permissible, albeit discouraged. These permitted situations disproportionately included use cases where food is likely to come into contact or be stored using a plastic bag including use at grocery stores, by restaurants, and at butcher shops (Bag Waste Reduction Act, 2019). The legislation also allowed municipalities to implement a tax on paper carryout bags, which were not banned, and ten of New York's sixty-two counties have implemented this five-cent tax (Bag Waste Reduction Act, 2019; NYS Department of Taxation and Finance, 2021). Interestingly, the law also prohibited businesses from preventing individuals from using their own bags and prohibits counties from passing local laws that might allow the use of plastic bags (Bag Waste Reduction Act, 2019).

The Bag Waste Reduction Act is notably broader than the two referenced previously, and this opened the door for a challenges from both the plastics industry and mid-stream distributors of plastic bags (Villeneuve, 2020). Thus far, the law has held up against arguments both to the spirit of the law and to specific rules set by state regulators (Villeneuve, 2020), but enforcement of the ban by the NY Department of Environmental Conservation has lagged behind the expectations of activists and legislators alike (Blau, 2023). Public sentiment towards the legislation in New York seems to be generally positive or indifferent with many consumers noting they are more conscious of bringing their own bags to stores (Blau, 2023), but it is difficult for researchers to quantify the effectiveness of large-scale plastic bag bans at changing the culture around disposable plastics or reducing plastic waste in the environment (Muposhi et al., 2022).

d. Plastic Bag Reduction, Reuse, and Recycling Act

In 2009, before completely banning plastic bags, New York began enforcement of the Plastic Bag Reduction, Reuse, and Recycling Act. This law, which largely remains in effect aside from portions now unnecessary due to the banning of plastic bags, mandated stores of a certain size provide bins to collect plastic films for recycling (Plastic Bag Reduction, Reuse, and Recycling Act, 2014). Stores of a certain size were also responsible for ensuring collected plastic films were indeed recycled and for labeling all bags provided to customers with text like, "Return to Store for Recycling," to encourage participation in the at-store recycling program (Plastic Bag Reduction, Reuse, and Recycling Act, 2014). While plastic bags are now banned, stores of a certain size that sell plastic film of any kind, for example produce bags or dry goods packaged with plastic films, are still required to have a system in place to collect and recycle those films (Bag Waste Reduction Act, 2019). Unlike banning plastic bags, the actions of this legislation focused on consumer choice rather than absolute requirement. While the actions mandated in this legislation had strong intentions, no data has been provided on the effectiveness of the legislation at increasing either consumer participation in recycling or the amount of plastic film waste it has enabled to be recycled. The NY Department of Environmental Conservation does note that recycled plastic films, "can end up as composite lumber for making decks, benches, and playground sets," but the agency has not provided specific data detailing the outcomes of the legislation (*Plastic Bag And Film Plastics Recycling For Consumers - NYSDEC*, n.d.).

e. Packaging Reduction and Recycling Infrastructure Act (Proposed Legislation)

Recently, the NY Senate passed a bill aimed at forcing manufacturers to pay a fee for using packaging materials that are difficult to recycle (Packaging Reduction and Recycling Infrastructure Act, n.d.). The bill did not pass the Assembly but was reintroduced in 2025. In addition to fees, the bill would ban certain substances from being included in packaging and establish minimum standards of recycled content for commonly recyclable materials like glass and cardboard (Packaging Reduction and Recycling Infrastructure Act, n.d.). The bill sends a strong message to manufacturers that the government feels packaging should be as minimal as possible and as sustainable as possible. While the bill would almost certainly lead to less plastic waste, it also puts a significant burden onto companies and this burden would likely be passed to consumers in the form of higher prices. Furthermore, the bill focuses on plastic packaging exclusively as a waste generation issue without acknowledging or working to prevent the

negative human health outcomes that can result from plastic ingestion when chemicals leach from food packaging into the foods they enclose.

IV. Stakeholders

Government Agencies – Federal

The federal government recognizes plastic pollution as a global problem and across multiple agencies and initiatives the government is working to reduce plastic's use cases, find better waste management solutions for spent plastic, and support the development of new materials that are biodegradable or more easily recycled (United States Department of State Office of the Spokesperson, 2022). For food packaging specifically, the FDA, EPA, and USDA all have created programs to champion the use of biodegradable and compostable packaging primarily with the goal of reducing waste (Rosengren, 2024; The White House, 2024). The USDA has created a certification program for biobased products in an effort to empower consumers to make accurate purchase decisions and avoid greenwashing (United States Department of State Office of the Spokesperson, 2022).

Additionally, the FDA has created a program to educate manufacturers and encourage the use of recycled plastics in food packaging (U.S. Food & Drug Administration, 2024b). While this does address some of the waste generated by plastic, it notably does not address the leaching of toxic materials into food items via their packaging. The federal government, especially the Food and Drug Administration, tends to view plastic primarily as a waste issue and generally does not recognize the potential negative human health impacts of plastic ingestion (U.S. Food & Drug Administration, 2024a). While the agency is correct that research on microplastic ingestion is relatively new and needs to be developed further, early research indicates a number of negative outcomes and thus a more cautious approach would be beneficial and better protect the public (Biryol et al., 2017b; Jones et al., 2024; Muncke et al., 2020; Nerin et al., 2018).

Government Agencies – State

Government organizations seeking to protect human and environmental health, such as the NYS Department of Environmental Conservation and NYS Department of Health, generally support measures that limit consumers' and the environment's potential exposures to the toxic chemicals potentially found within plastic packaging (Berkman, 2020; New York State Department of Health, 2022). The NYS Department of Environmental Conservation also highlights the reduction in greenhouse gas emissions, reduction in waste, and overall

environmental and ecosystem health benefits to legislation that results in less plastic being discarded (McTiernan, 2014).

State agencies and groups that represent business owners, such as The Business Council of New York State, generally raise concerns with the burden and cost bans of and forced alternatives to plastic can place on businesses citing the use-case these products provide and a lack of economically viable alternatives (Garber, 2024; Pokalsky, 2020).

The Empire State Development finds itself at the crux of both viewpoints. Tasked with growing the economy and creating jobs, the agency has voiced strong support for the plastics industry, which employs more than 20,000 people across New York, and has provided numerous tax incentives to plastic manufacturers expanding and creating new jobs throughout the state (Empire State Development, 2022a, 2023; New York Department of Labor, 2024). Empire State Development has also championed efforts to develop alternatives to plastics using the logic that new industries will create new jobs and economic opportunities for New Yorkers (Empire State Development, 2022b).

Plastic Industry

In general, trade groups and advocates for the plastics and fossil fuel industries have opposed any efforts that incentive or mandate the use of plastic-alternatives in food packaging. For example, when New York State was considering a ban of the use of PFAS in food packaging, both the American Coatings Association and New York State Chemistry Council sought a veto of the legislation (Gorman et al., 2020; McAuliffe, 2020) while other industry groups urged for a significant delay before the law was to be implemented. Plastic packaging is a huge, growing revenue source for the plastics industry, and bans coupled with a shift towards plastic alternatives represent a threat to the plastic industry's revenues (*The New Plastics Economy*, 2016). The plastic industry regularly characterizes actions to reduce reliance on plastic as economically fraught and overly aggressive (American Chemistry Council et al., personal communication, June 5, 2023).

Grocery Retailers

Grocery retailers have been on the front lines of several of New York's efforts to reduce plastic waste. Most notably, a number of grocery retail chains and industry groups expressed concern when New York banned plastic shopping bags in 2020 citing the increased cost of fabric or paper alternatives and the potential for confusion and anger amongst customers (McKinley,

2019). The grocery industry also appears to widely oppose fees, even those passed onto their customers, that seek to discourage plastic consumption without outright banning it (Durrant, 2024; McKinley, 2019). One industry spokesperson highlighted how the tax revenue from these fees often does not go towards government programs relevant to grocery retailers and instead is used for environmental protection (Durrant, 2024; McKinley, 2019). The grocery industry's trade groups often characterize legislation to reduce plastic's use in packaging as an elimination of consumer choice and bad economic policy (Misdary, 2024).

While the majority of grocery retailers oppose government regulation on the use of plastics in their operations, some larger retail chains, like Wegmans, have implemented self-imposed bans on plastic bags and taken other measures to reduce plastic waste in their stores (Redman, 2019). In recent years, the concept of "zero waste" grocery stores, where customers are encouraged to fill their own containers from selections of bulk goods, has taken hold in many areas (Moss, 2019; SANTA CRUZ, 2024). In addition to small, specialty retailers that focus heavily on reducing waste, larger chains like Whole Foods and Kroger have also expanded and promoted sections of bulk goods in their stores (SANTA CRUZ, 2024). While the grocery industry is trending towards sustainability, grocery retailers remain generally opposed to government mandates and fees imposed on themselves and their customers.

Food and Food Packaging Manufacturers and Distributors

Food product manufacturers often find themselves at a crux between functionality and sustainability. The primary responsibility of any food's packaging materials is ensuring the food it contains is safe and delicious to eat (Marsh & Bugusu, 2007). Food manufacturers are also looking to find the most functional materials at the lowest costs, and oftentimes more sustainable food packaging materials bear higher costs that must be absorbed or passed onto customers (Kete Group, 2023). At the end of the day, it is consumer's demands and preferences that drive the selection of a packaging material, and this can carry its own implications.

Because there are many definitions of what sustainable packaging constitutes, food manufacturers and companies of all kinds often make claims of sustainability in their products' packaging materials that environmentalists and scientists find to be an exaggeration or sometimes entirely false (Best, 2022a; Laville, 2022). Greenwashing is pervasive among food manufacturers both big and small, and its prevalence indicates that sustainability is often viewed through a marketing lens rather than an impactful, operational one (Best, 2022b; Laville, 2022).

AMERIPEN, one of the largest trade groups representing food and food packaging manufacturers, has fervently opposed legislation that seeks to mandate fair, transparent labelling regarding sustainability claims (AMERIPEN, 2023). Still, a shift in the industry towards true sustainability, including commitments to reduce reliance on fossil fuels and shift packaging towards sustainable materials, is taking hold among some companies (American Frozen Food Institute, 2023; AMERIPEN, 2023).

Environmental Organizations

Overwhelmingly, environmental organizations support legislation that aims to reduce plastic waste and promote or mandate alternatives to plastic (*Plastic Pollution | Sierra Club*, n.d.; Schlegel et al., 2020). In some cases, advocates have become particularly adversarial towards industry groups who oppose such efforts and are working to slow legislative progress away from plastic (Schlegel et al., 2020). Plastic packaging contributes to global warming and pollutes the environment harming wildlife, ecosystems, and humans alike (Adler & Wells, 2023; Di et al., 2021; Dolci et al., 2024; Eriksen et al., 2023).

Medical Professionals and Organizations

An increasing number of medical professionals have linked society's overreliance on plastic food packaging to an increase in negative health outcomes and have called for changes and legislation to address this issue and save lives (Muncke et al., 2020).

Grocery Shoppers/Consumers

Because the grocery store shopper includes almost all adults, consumers and grocery shoppers are the most wide-ranging, complex, and hard to understand group of stakeholders analyzed in this paper and affected by plastic packaging. Consumers make purchasing decisions based on a multitude of unknown and known factors that can be factual, emotional, and societal (Popovic et al., 2019). Whether or not a consumer values, prioritizes, or purchases an item based on how sustainable said item claims to be can vary widely based on ideology, gender, income, and other factors (Magnier & Crie, 2024). Motivating people to change their behavior is difficult (Carey et al., 2019). Consumers tend to respond better to incentives rather than penalties, but penalties often prove more effective at facilitating behavior change (Carey et al., 2019; Dalzell & Lynch, 2020).

In a recent survey, more than 80% of consumers responded they were willing to pay a premium for a more sustainable good, and the average tolerable mark-up for a more sustainable

choice was a 9.7% price increase when compared to a less sustainable alternative (Pricewaterhouse Coopers, 2024). A Siena College poll of more than one thousand New York voters found that legislation to encourage recycling and reduce plastic packaging waste was supported by 77% of Democrats and 48% of Republicans (Bruggers, 2024). Another poll of New York voters conducted by Ipsos found that 75% of New Yorkers are concerned with plastic pollution and around 61% stated they would pay more for a product if it didn't contain plastic (Ipsos, 2022). As global warming and its myriad of effects become more personal and impact consumers directly, more and more consumers are focused on the sustainability and the end-of-life of the products they buy, and this trend can be expected to continue as global warming continues to intensify (Muposhi et al., 2022; Popovic et al., 2019; Pricewaterhouse Coopers, 2024).

Waste Management Companies and Municipalities

Plastic is a huge challenge for waste managers. In New York, only rigid, firm plastic packaging can be recycled, and food packaging products often employ flexible plastic films that cannot be recycled by municipalities (Howard, 2024; Marsh & Bugusu, 2007). Waste managers in New York have advocated for extended producer responsibility aimed at forcing companies to take responsibility for the waste their packaging creates and innovate towards solutions that are either biodegradable or easier to recycle (New York State Department of Environmental Conservation, 2023). In addition to recycling, waste reduction also remains a priority for waste managers (New York State Department of Environmental Conservation, 2023).

V. Recommendations

a. Consumer Education and Behavior Change

Consumer demand is a huge driver of change, and if consumers demand and actively seek out sustainably packaged foods, industry will invest to meet their demands. Unfortunately, a culture of throwing away items when they are no longer useful is commonplace in New York, America, and around the world. There is a serious, deadly disconnect between the convenience and functionality of plastic packaging to a consumer and the myriad of consequences related to both its creation and disposal. Consumers need to be educated, but also presented with viable, cost-effective, and convenient alternatives. Education is the first step. Beyond awareness, consumers, governments, businesses, organizations, and shoppers of all kinds have a duty to seek

out, support, and properly dispose of food items packaged in healthier materials, like glass, cardboard, and innovative bioplastics.

b. Empowering the FDA and Transparent Labeling

The FDA is struggling to keep up with the ever-growing number of substances it is tasked with cataloguing, assessing, and publishing safety recommendations regarding. Furthermore, consumers have little knowledge regarding what kinds of chemicals are present in their food packaging materials and potentially leaching into the foods they consume. A fair labeling process begins with properly resourcing the FDA and passing the cost burden of independent safety testing onto companies that seek to use innovative, novel substances around food products. Rather than a simple notification system, the FDA should require a specific adjudication process to use a novel substance, and the cost of testing said novel substance should be built into that program's application fee. Lastly, just as companies must disclose the ingredients within a food item, food manufacturers should be required to disclose the chemical composition of the packaging the item is contained within as well. This would empower consumers to make wholly informed choices, and encourage companies to use familiar, natural, and biodegradable food packaging materials. The FDA has the authority to make the above changes without additional legislation, but the agency needs congressional support in the form of an increased operating budget for new programs, better oversight, and to serve as a foil for the massive food and plastic industries.

c. Investments and Research in Plastic Alternatives

Food packaging serves an important purpose, and there are a myriad of plastic alternatives, both natural bioplastics and traditional materials like glass, that could enable a shift away from plastic food packaging. Investing in these materials is multifaceted. First, companies need to invest in the long-term health of their customers and the planet by prioritizing sustainable solutions wherever possible even if doing so raises costs. Secondly, governments and businesses together should research innovative, exciting new ways of packaging our food items. Some particularly promising new materials include chitosan, made from the shells of sea creatures and bugs, starch- seed- and vegetable-based bioplastics, and films derived from kelp and other seaweeds (Adewumi et al., 2024; Dolci et al., 2024; Fiallos-Núñez et al., 2024; Kokkuvayil Ramadas et al., 2024, 2024; Mayuri et al., 2023; Mwita et al., 2024; Vieira et al., 2011). Public-private partnerships have led to incredible innovation in the past, and could also lead us to a

safer, more sustainable food system in the future. A tax on plastic food packaging items would disincentivize their use by manufacturers, internalize some of the currently externalized costs associated with plastic, and enable New York to invest in the next generation of packaging materials and grocery stores.

d. Investments in Bulk-Goods Grocery Stores

Bulk-goods grocery stores in their present state are novel, boutique store experiences that must be sought out and are can be more expensive than a traditional grocery store. Rather than shifting consumers to an entirely new shopping experience, it is imperative that consumers see zero-waste and bulk-goods shopping experiences in their own, neighborhood grocery stores. By encouraging or mandating grocery stores to offer more products in bulk and encourage customers to bring reusable containers for filling, grocery stores can eliminate the stream of waste generated by food packaging. Both incentives (grant programs, tax breaks, and pulpit powers) and disincentives (material bans, increased taxes, and transparent labeling) could encourage the grocery industry and consumers to make this shift.

f. Internalizing the Externalities of Plastic

Plastic packaging is often viewed as the cheapest option, but this is only because many of the costs associated with using plastic packaging are externalized. If costs associated with disposal of plastic items could be factored into manufacturing budgets, the shift away from plastic packaging and towards sustainable alternatives would accelerate. Extended Producer Responsibility has already begun in New York with the state's plastic film recycling program, and expanding upon this is crucial to ensure producers take responsibility for their goods throughout the entire product life cycle. In addition, plastic's environmental costs are difficult to quantify, but a tax or other fee on food items packaged in plastic could encourage consumer shifts towards more sustainable products and make a clear statement to industry that these materials should be deprioritized.

Sponsor Memo

Bill Title: Saving Lives With Safer Food Packaging Act

Findings: Use of plastic in food packaging is widespread and produces detrimental effects on both human health and the environment. Toxic chemicals, both known and unknown, leach from plastic wrappers, films, and containers into the foods they are supposed to protect. Research has illustrated a number of chronic health issues, like infertility, cancer, and developmental disorders in children, can be caused or exacerbated by these chemicals. In addition to the human health costs, plastic is accumulating in both landfills and waterways across New York, and plastic does not biodegrade safely or in a timely manner. Consumers are largely unaware of this issue, and those who understand the harm plastic causes to their health and their environment have few alternatives.

Definitions:

- "Food Packaging" includes any substance of any kind that makes contact with food for the purpose of containing or preserving said food.
- "Plastic" or "Plastics" refers to synthetic or semi-synthetic polymers created using petroleum, natural gas, or any other fossil-fuel source.
- "Grocery Stores" include any and all retail establishments where food is regularly and customarily sold in a bona fide manner for off-premises consumption.
- "Bulk Food Grocery Stores" includes any establishment which meets the above definition of grocery stores and also (1) primarily offers products in very large containers in which customers can choose the amount they need (2) does not individually package or wrap the majority of foods available to customers and (3) actively and strongly encourages its customers to bring their own containers to fill and purchase products.
- "Bulk Conversions" are a situation in which grocery stores, as defined above, take one or more products and sell that specific or those specific products in the manner of a bulk foods grocery store as described above. To be qualified as a "bulk conversion" a grocery store must cease the sale and distribution of any and all, regardless of differing

manufacturer, brand, or non-core qualities, individually packaged alternative forms of the product or products which they are converting.

- "Bio-plastics" are materials that are not derived from natural gas or petroleum and that are biodegradable naturally in the environment.

Program: The objective of this legislation is to create a strong incentive for grocery stores to source products packaged using sustainable, safe packaging materials like bio-plastics, cardboard, and glass. This legislation is also designed to incentivize the public to bring their own containers to the grocery store, and for grocery stores to encourage and enable this behavior by selling products as bulk-goods grocery stores. Finally, this legislation seeks to penalize grocery stores who continue to source, sell, and distribute plastic food packaging.

This act amends Section 528.2 of the New York Codes, Rules, and Regulations (NYCRR) to modify food products' exemption from NY sales and compensating use tax. Rather than exempting all food and food products sold for human consumption, the exemption shall now read, "Food and food products, except those products packaged in plastic food packaging and except candy and confectionery, when sold for human consumption, are exempt from sales and compensating use tax." This change will introduce NY's 4% sales tax to food products packaged in plastic food packaging while maintaining the exemption for food products without packaging, with customer-supplied packaging, or packaged in more sustainable materials.

Revenue generated from this tax will be allocated as follows:

Approximately 60% of tax revenue must be used to expand New York State's Supplemental Nutrition Assistance Program (SNAP) in an effort to increase the maximum eligible income for this program thus easing the burden of these tax changes on low-income families.

An additional 30% of revenue generated from this tax will establish a "Bulk Conversions" program to be administered by Empire State Development. The goal of Empire State Development's program must be to encourage both grocery stores and consumers alike to adopt "Bulk Food Grocery Stores" as a new shopping and selling experience. This program may include but is not limited to targeted grant programs, loan programs, tax incentives, education

campaigns, and other incentives as deemed appropriate by the agency and given they further the goal of eliminating plastic food packaging from grocery stores. Empire State Development must implement some programming within the first six months of tax collection.

The remaining 10% of revenue from this tax is to be allocated to the Department of Environmental Conservation for the explicit purpose of establishing a grant program for educational institutions in NY to research bioplastics and other alternatives to plastic food packaging that are biodegradable and sustainable. At the discretion of the agency, revenue received from this tax may also be used to bolster current recycling programs and otherwise mitigate plastic's impact on the environment.

Exemptions:

None

Fiscal Implications:

The average New Yorker spends close to $6,500 on food at grocery stores each year. Assuming, conservatively, that about 50% of that spending continues to be spent on items in plastic food packaging and a standard NYS Sales Tax rate of 4%, this legislation has the potential to generate almost $100,000,000 in tax revenue in its first year. It is the goal of this legislation, however, to create a strong incentive for industry to innovate away from plastic food packaging, and if this is successful revenue from this legislation will decrease as time goes by.

Effective Date: This tax change shall take effect on January 1st, 2027.

Bill Draft

Revisions to Section 528.2 of the New York Codes, Rules, and Regulations (NYCRR)

Tax Law, § 1115(a)(1)
(a) Food and food products.
(1) Food and food products, except candy and confectionery and those products packaged in plastic food packaging materials, when sold for human consumption, are exempt from sales and compensating use tax. See section 528.27 of this Part for exempt purchases of candy and confectionery when purchased with food stamps.
(2) The terms *food* and *food products* as used in this section mean edible commodities whether prepared, processed, cooked, raw, canned or in any other form, which are generally regarded as food. This category includes, but is not limited to:
meat and meat products
milk products
cereals and grain products
baked goods
vegetables and vegetable products
fruits and fruit products
poultry
fish and seafood
frozen entrees and desserts
jellying agents
fats, oils and shortenings
condiments
spices
sweetening agents
food preservatives
food coloring
frozen dinners
snacks (except candy and confections)
A list of taxable and exempt food and food products is available upon request at any district tax office or directly from the bureau's main office in Albany.
(3) The phrase *sold for human consumption* means that the items sold are, in their normal use, regarded as being for human consumption. Pet foods, which are packaged, labeled or advertised as such, are not deemed sold for human consumption.
(4) Candy and confectionery include, without limitation, candy of all types; chocolate (plain or mixed with other products); glazed or sugar-coated fruits, nuts, peanuts, popcorn or other products; chewing gum; mints; lollypops; fruit flavored sticks; fruit drops; licorice; pastilles; cotton candy; marzipan; halvah and any similar product regarded as candy or confectionery based on its normal use or as indicated on the label or in the advertising thereof.
(5) Items advertised and sold for use in cooking and baking, such as chocolate morsels and glazed fruit, are exempt from tax.
(6) The phrase *plastic food packaging materials* refers to synthetic or semi-synthetic polymers created using petroleum, natural gas, or any other fossil-fuel source and then subsequently used to package food items.

New Legislation Allocating Revenues:

AN ACT directing the sales tax revenues from food items packaged in plastic food packaging to establish programs that discourage the use of plastic packaging.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Definitions

- "Food Packaging" includes any substance of any kind that makes contact with food for the purpose of containing or preserving said food.
- "Plastic" or "Plastics" refers to synthetic or semi-synthetic polymers created using petroleum, natural gas, or any other fossil-fuel source.
- "Grocery Stores" include any and all retail establishments where food is regularly and customarily sold in a bona fide manner for off-premises consumption.
- "Bulk Food Grocery Stores" includes any establishment which meets the above definition of grocery stores and also (1) primarily offers products in very large containers in which customers can choose the amount they need (2) does not individually package or wrap the majority of foods available to customers and (3) actively and strongly encourages its customers to bring their own containers to fill and purchase products.
- "Bulk Conversions" are a situation in which grocery stores, as defined above, take one or more products and sell that specific or those specific products in the manner of a bulk foods grocery store as described above. To be qualified as a "bulk conversion" a grocery store must cease the sale and distribution of any and all, regardless of differing manufacturer, brand, or non-core qualities, individually packaged alternative forms of the product or products which they are converting.
- "Bio-plastics" are materials that are not derived from natural gas or petroleum and that are biodegradable naturally in the environment.

§ 2. New tax revenue from the sales tax collected when food items packaged in plastic food packaging are sold shall be placed by the Department of Taxation and Finance into a dedicated fund and allocated as follows:

- 60% of tax revenue must be used to expand New York State's Supplemental Nutrition Assistance Program (SNAP) in an effort to increase the maximum eligible income for this program thus easing the burden of these tax changes on low-income families. The Department of Health is tasked with administering these funds and this program expansion.
- 30% of revenue generated from this tax will establish a "Bulk Conversions" program to be administered by Empire State Development. The goal of Empire State Development's program must be to encourage both grocery stores and consumers alike to adopt "Bulk Food Grocery Stores" as a new shopping and selling experience. This program may include but is not limited to targeted grant programs, loan programs, tax incentives, education campaigns, and other incentives as deemed appropriate by the agency and given they further the goal of eliminating plastic food packaging from grocery stores. Empire State Development must implement some programming within the first six months of tax collection.
- 10% of revenue from this tax is to be allocated to the Department of Environmental Conservation for the explicit purpose of establishing a grant program for educational institutions in NY to research bioplastics and other alternatives to plastic food packaging that are biodegradable and sustainable. At the discretion of the agency, revenue received from this tax may also be used to bolster current recycling programs and otherwise mitigate plastic's impact on the environment.

§ 3. This act shall take effect January 1st, 2027.

Bibliography

15 USC Ch. 39: FAIR PACKAGING AND LABELING PROGRAM. (n.d.). Retrieved November 6, 2024, from http://uscode.house.gov/view.xhtml?req=granuleid%3AUSC-prelim-title15-chapter39&edition=prelim

21 U.S.C. § 348 (a)(1), (b)(2) (2018) (2018).

Adewumi, F. D., Ogona, D. F., Ogundolie, F. A., Ogunmodede, O., Peters, O., & Idowu, O. (2024). Starch-Based Composites: An Eco-Friendly Alternative for Food Packaging. *2024 International Conference on Science, Engineering and Business for Driving Sustainable Development Goals (SEB4SDG)*, 1–6. https://doi.org/10.1109/SEB4SDG60871.2024.10629865

Adler, R. W., & Wells, C. E. (2023). PLASTICS AND THE LIMITS OF U.S. ENVIRONMENTAL LAW. *Harvard Environmental Law Review*, *47*(1), 1–62.

Alamri, M. S., Qasem, A. A. A., Mohamed, A. A., Hussain, S., Ibraheem, M. A., Shamlan, G., Alqah, H. A., & Qasha, A. S. (2021). Food packaging's materials: A food safety perspective. *Saudi Journal of Biological Sciences*, *28*(8), 4490–4499. https://doi.org/10.1016/j.sjbs.2021.04.047

American Chemistry Council. (2024). *Distribution Of Plastic Resin Sales & Captive Use By Major Market*. https://www.americanchemistry.com/chemistry-in-america/data-industry-statistics/statistics-on-the-plastic-resins-industry/resources/pips-resin-sales-by-major-market-2023-graphic

American Chemistry Council, ACC Spray Foam Coalition, AmSty, Alkylphenols & Ethoxylates Research Council, Alliance for Automotive Innovation, American Apparel and Footwear Association (AAFA), American Coatings Association, American Fuel and Petrochemical Manufacturers (AFPM), AGC Chemicals Americas, Association of Equipment Manufacturers (AEM), Association of Home Appliance Manufacturers (AHAM), Association of the Nonwoven

Fabrics Industry(INDA), Berry Global, The Business Council of New York State, Buffalo Niagara Partnership, Braskem, Braven Environmental, Carlisle Spray Foam Insulation, Capital Region Chamber of Commerce, … Upstate United. (2023, June 5). *Re: Oppose S. 4246-A/ A. 5322-A – Packaging Reduction and Recycling Act* [Personal communication].

American Frozen Food Institute. (2023). *2023 Annual Report*. American Frozen Food Institute. https://cloud.3dissue.net/30312/30205/32623/106287/index.html

AMERIPEN. (2023). *Annual Report 2022*. https://ameripen.growthzoneapp.com/ap/CloudFile/Download/rADd5MeL

Angela Logomasini. (2022, January 13). *The High Costs of the Break Free from Plastic Pollution Act*. Competitive Enterprise Institute. https://cei.org/studies/the-high-costs-of-the-break-free-from-plastic-pollution-act/

Backhaus, O., & Benesh, M. (2022, April 13). *EWG analysis: Almost all new food chemicals greenlighted by industry, not the FDA*. Environmental Working Group. https://www.ewg.org/news-insights/news/2022/04/ewg-analysis-almost-all-new-food-chemicals-greenlighted-industry-not-fda

Bag Waste Reduction Act (2019). https://www.nysenate.gov/legislation/laws/ENV/A27T28

Bellino, K. (2023, October 25). Merkley, Huffman Introduce Bold Legislation to Take on the Growing Plastic Pollution Crisis. *Merkley*. https://www.merkley.senate.gov/merkley-huffman-introduce-bold-legislation-to-take-on-the-growing-plastic-pollution-crisis/

Berkman, T. (2020, October 8). *A.4739-C/ S.8817- Member of Assembly Fahy/ Senator Kolb Reccomendation: Approval*. New York State Department of Environmental Conservation Office of Legislative Affairs. https://digitalcollections.archives.nysed.gov/index.php/Detail/objects/88554

Best, D. (2022a). Packaging claims under fire for “greenwashing.” *Just-Food.Com*, NA-NA.

Best, D. (2022b). Packaging: The carbon dilemma for food companies. *Just-Food.Com*, NA-NA.

Biryol, D., Nicolas, C. I., Wambaugh, J., Phillips, K., & Isaacs, K. (2017a). High-throughput dietary exposure predictions for chemical migrants from food contact substances for use in chemical prioritization. *Environment International*, *108*, 185–194. https://doi.org/10.1016/j.envint.2017.08.004

Biryol, D., Nicolas, C. I., Wambaugh, J., Phillips, K., & Isaacs, K. (2017b). High-throughput dietary exposure predictions for chemical migrants from food contact substances for use in chemical prioritization. *Environment International*, *108*, 185–194. https://doi.org/10.1016/j.envint.2017.08.004

Blau, R. (2023, November 16). *New York’s Plastic Bag Ban Yields Warnings, Minor Fines for Those Flouting Law*. THE CITY - NYC News. http://www.thecity.nyc/2023/11/16/new-york-plastic-bag-ban-flouting/

Bodor, A., Feigl, G., Kolossa, B., Mészáros, E., Laczi, K., Kovács, E., Perei, K., & Rákhely, G. (2024). Soils in distress: The impacts and ecological risks of (micro)plastic pollution in the terrestrial environment. *Ecotoxicology and Environmental Safety*, *269*, 115807. https://doi.org/10.1016/j.ecoenv.2023.115807

Brian Kennedy & Alec Tyson. (2024, March 1). How Republicans view climate change and energy issues. *Pew Research Center*. https://www.pewresearch.org/short-reads/2024/03/01/how-republicans-view-climate-change-and-energy-issues/

Bruggers, J. (2024, June 17). *The Pro-Plastics Lobby Just Helped Kill an Ambitious New York Packaging Bill*. Civil Eats. https://civileats.com/2024/06/17/an-effort-to-reduce-plastic-waste-just-died-in-the-new-york-legislature/

California v. Exxon Mobil (Superior Court of San Francisco County). https://oag.ca.gov/system/files/attachments/press-docs/Complaint_People%20v.%20Exxon%20Mobil%20et%20al.pdf

Carey, R. N., Connell, L. E., Johnston, M., Rothman, A. J., de Bruin, M., Kelly, M. P., & Michie, S. (2019). Behavior Change Techniques and Their Mechanisms of Action: A Synthesis of Links Described in Published Intervention Literature. *Annals of Behavioral Medicine*, *53*(8), 693–707. https://doi.org/10.1093/abm/kay078

Center for Food Safety. (2024, October 3). *Center for Food Safety Endorses Toxic Free Foods Act To Overhaul FDA Chemical Regulations* [Press Release]. https://www.centerforfoodsafety.org/press-releases/6961/center-for-food-safety-endorses-toxic-free-foods-act-to-overhaul-fda-chemical-regulations

Cordier, M., Uehara, T., Jorgensen, B., & Baztan, J. (2024). Reducing plastic production: Economic loss or environmental gain? *Cambridge Prisms: Plastics*, *2*, e2. https://doi.org/10.1017/plc.2024.3

Dalzell, J., & Lynch, A. J. (2020). Thinking Beyond the Plastic Bag Ban: Reusable Bag Habits and Motivators in Athens, Ohio. *Geographical Bulletin*, *61*(2), 71–83.

Davis Allen, PhD, Chelsea Linsley, Naomi Spoelman, & Alyssa Johl. (2024). *Fraud of Plastic Recycling*. Center for Climate Integrity. https://climateintegrity.org/uploads/media/Fraud-of-Plastic-Recycling-2024.pdf

de Sousa, F. D. B. (2024). Plastic effects on marine and freshwater environments. *Water Biology and Security*, *3*(1), 100228. https://doi.org/10.1016/j.watbs.2023.100228

Di, J., Reck, B. K., Miatto, A., & Graedel, T. E. (2021). United States plastics: Large flows, short lifetimes, and negligible recycling. *Resources, Conservation & Recycling*, *167*, N.PAG-N.PAG. https://doi.org/10.1016/j.resconrec.2021.105440

Dolci, G., Puricelli, S., Cecere, G., Tua, C., Fava, F., Rigamonti, L., & Grosso, M. (2024). How does plastic compare with alternative materials in the packaging sector? A systematic review of LCA studies. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, 0734242X241241606. https://doi.org/10.1177/0734242X241241606

Durrant, M. (2024, May 15). *Op-Ed | The Bottle Bill is bad for the industry and bad for consumers*. https://politicsny.com/2024/05/15/op-ed-the-bottle-bill-is-bad-for-the-industry-and-bad-for-consumers/

Empire State Development. (2022a, January 27). *Empire State Development Announces Bison Bag Company Will Expand Operations, Creating 10 New Jobs in Niagara County | Empire State Development*. https://esd.ny.gov/esd-media-center/press-releases/esd-announces-bison-bag-company-expand-operations-10-new-jobs-niagara-county

Empire State Development. (2022b, September 16). *Empire State Development Announces Applications Open for the New York State Advanced Materials Innovation Challenge | Empire State Development*. https://esd.ny.gov/esd-media-center/press-releases/esd-announces-applications-open-nys-advanced-materials-innovation-challenge

Empire State Development. (2023, January 13). *Empire State Development Announces PM Plastics Expansion in Erie County | Empire State Development*. https://esd.ny.gov/esd-media-center/press-releases/esd-announces-pm-plastics-expansion-erie-county

Eriksen, M., Cowger, W., Erdle, L. M., Coffin, S., Villarrubia-Gómez, P., Moore, C. J., Carpenter, E. J., Day, R. H., Thiel, M., & Wilcox, C. (2023). A growing plastic smog, now

estimated to be over 170 trillion plastic particles afloat in the world's oceans—Urgent solutions required. *PLOS ONE*, *18*(3), e0281596. https://doi.org/10.1371/journal.pone.0281596

Expanded Polystyrene Foam Container and Polystyrene Loose Fill Packaging Ban (2024). https://www.nysenate.gov/legislation/laws/ENV/A27T30

Federal Food, Drug and Cosmetic Act (FFDCA), § 21 U.S.C. 371 (1934).

Fiallos-Núñez, J., Cardero, Y., Cabrera-Barjas, G., García-Herrera, C. M., Inostroza, M., Estevez, M., España-Sánchez, B. L., & Valenzuela, L. M. (2024). Eco-Friendly Design of Chitosan-Based Films with Biodegradable Properties as an Alternative to Low-Density Polyethylene Packaging. *Polymers (20734360)*, *16*(17), 2471. https://doi.org/10.3390/polym16172471

Garber, N. (2024, May 10). Businesses rail against plastic-waste crackdown as Albany session winds down. *Crain's New York Business*. https://www.crainsnewyork.com/politics-policy/new-york-businesses-rail-against-plastic-waste-bill-pushed-environmentalists

Geueke, B. (2024, March 19). Overview of use, migration, and hazards of PFAS in food contact materials | Food Packaging Forum. *Food Packaging Forum*. https://foodpackagingforum.org/news/overview-of-use-migration-and-hazards-of-pfas-in-food-contact-materials

Gorman, M., DeSantis, E., & Faist, T. (2020, November 11). *Re: LETTER-IN-OPPOSITION*. https://digitalcollections.archives.nysed.gov/index.php/Detail/objects/88554

Groh, K., Geueke, B., & Muncke, J. (2020). *FCCdb: Food Contact Chemicals database. Version 5.0* (Version 5.0) [Dataset]. Zenodo. https://doi.org/10.5281/zenodo.4296944

Howard, H. (2024, May 27). The Push to Control Plastic Waste in New York: What to Know. *The New York Times*. https://www.nytimes.com/2024/05/27/nyregion/plastic-packaging-waste-bill.html

Ipsos. (2022). *OCEANA PLASTIC POLLUTION SURVEY: NEW YORK*.

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R., & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, *347*(6223), 768–771.

Jones, R. R., Madrigal, J. M., Troisi, R., Surcel, H.-M., Öhman, H., Kivelä, J., Kiviranta, H., Rantakokko, P., Koponen, J., Medgyesi, D. N., McGlynn, K. A., Sampson, J., Albert, P. S., & Ward, M. H. (2024). Maternal serum concentrations of per- and polyfluoroalkyl substances and childhood acute lymphoblastic leukemia. *JNCI: Journal of the National Cancer Institute*, *116*(5), 728–736. https://doi.org/10.1093/jnci/djad261

Kataria, A., Trasande, L., & Trachtman, H. (2015). The effects of environmental chemicals on renal function. *Nature Reviews Nephrology*, *11*(10), 610–626. https://doi.org/10.1038/nrneph.2015.94

Kete Group. (2023, September 13). How Much Does Packaging Cost for Food Products? Industry-Specific Guide. *KETE GROUP LIMITED*. https://www.ketegroup.com/how-much-does-packaging-cost/

Kim, J. (2020, October 20). What to Know About N.Y.'s Plastic Bag Ban. *The New York Times*. https://www.nytimes.com/2020/10/20/nyregion/what-to-know-new-york-state-ban-plastic-bags.html

Kokkuvayil Ramadas, B., Rhim, J.-W., & Roy, S. (2024). Recent Progress of Carrageenan-Based Composite Films in Active and Intelligent Food Packaging Applications. *Polymers (20734360)*, *16*(7), 1001. https://doi.org/10.3390/polym16071001

Laville, S. (2022). Coca-Cola among brands greenwashing over packaging, report says; Research "exposes litany of misleading claims" by household names, including Coca-Cola and Unilever. *The Guardian (London, England)*, NA-NA.

Magnier, L., & Crie, D. (2024). Communicating packaging eco-friendliness: An exploration of consumers' perceptions of eco-designed packaging. *ResearchGate*. https://doi.org/10.1108/IJRDM-04-2014-0048

Mansfield, I., Reynolds, S. J., Lynch, I., Matthews, T. J., & Sadler, J. P. (2024). Birds as bioindicators of plastic pollution in terrestrial and freshwater environments: A 30-year review. *Environmental Pollution*, *348*, 123790. https://doi.org/10.1016/j.envpol.2024.123790

Marsh, K., & Bugusu, B. (2007). Food Packaging—Roles, Materials, and Environmental Issues. *Journal of Food Science*, *72*(3), R39–R55. https://doi.org/10.1111/j.1750-3841.2007.00301.x

Mayuri, T., Shukla, R. N., & Balaji, J. (2023). Biobased Food Packaging Materials: Sustainable Alternative to Conventional Petrochemical Packaging Materials: A Review. *Asian Journal of Dairy & Food Research*, *42*(2), 137–143. https://doi.org/10.18805/ajdfr.DR-1841

McAuliffe, H. (2020, August 19). *RE: Veto Request NY A.4739-C/S.8817*. https://digitalcollections.archives.nysed.gov/index.php/Detail/objects/88554

McKinley, J. (2019, March 28). Plastic Bags to Be Banned in New York; Second Statewide Ban, After California. *The New York Times*. https://www.nytimes.com/2019/03/28/nyregion/plastic-bag-ban-.html

McTiernan, E. (2014, July 27). *A.191-B/S.5817-A - Member of Assembly Kavanagh/ Senator Grisanti Recommendation: Approval*. https://digitalcollections.archives.nysed.gov/index.php/Detail/objects/49459

Misdary, R. (2024, June 4). *NY lawmakers reach deal on bill to reduce plastic packaging on shelves*. Gothamist. https://gothamist.com/news/ny-lawmakers-reach-deal-on-bill-to-reduce-plastic-packaging-on-shelves

Morris, B. A. (2024). Flexible packaging past, present and future: Reflections on a century of technology advancement. *Journal of Plastic Film & Sheeting*, *40*(2), 151–170. https://doi.org/10.1177/87560879241234946

Moss, S. (2019, April 21). The zero-waste revolution: How a new wave of shops could end excess packaging. *The Guardian*. https://www.theguardian.com/environment/2019/apr/21/the-zero-waste-revolution-how-a-new-wave-of-shops-could-end-excess-packaging

Muncke, J., Andersson, A.-M., Backhaus, T., Boucher, J. M., Carney Almroth, B., Castillo Castillo, A., Chevrier, J., Demeneix, B. A., Emmanuel, J. A., Fini, J.-B., Gee, D., Geueke, B., Groh, K., Heindel, J. J., Houlihan, J., Kassotis, C. D., Kwiatkowski, C. F., Lefferts, L. Y., Maffini, M. V., … Scheringer, M. (2020). Impacts of food contact chemicals on human health: A consensus statement. *Environmental Health*, *19*(1), 25. https://doi.org/10.1186/s12940-020-0572-5

Muposhi, A., Mpinganjira, M., & Wait, M. (2022). Considerations, benefits and unintended consequences of banning plastic shopping bags for environmental sustainability: A systematic literature review. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, *40*(3), 248–261. https://doi.org/10.1177/0734242X211003965

Murphy, P. (2021, November 19). *Examining recycling before, after plastic bag ban*. https://www.buffalo.edu/ubnow/stories/2021/11/atkinson-plastic-bag-ban.html

Mwita, C. S., Muhammad, R., Nettey-Oppong, E. E., Enkhbayar, D., Ali, A., Ahn, J., Kim, S.-W., Seok, Y.-S., & Choi, S. H. (2024). Chitosan Extracted from the Biomass of Tenebrio molitor

Larvae as a Sustainable Packaging Film. *Materials (1996-1944)*, *17*(15), 3670. https://doi.org/10.3390/ma17153670

Neltner, T. (2021, August 12). *Beyond paper, part 2: PFAS intentionally used to make plastic food packaging - EDF Health*. Environmental Defense Fund. https://blogs.edf.org/health/2021/08/12/beyond-paper-part-2-pfas-intentionally-used-to-make-plastic-food-packaging/

Nerin, C., Canellas, E., Vera, P., Garcia-Calvo, E., Luque-Garcia, J. L., Cámara, C., Ausejo, R., Miguel, J., & Mendoza, N. (2018). A common surfactant used in food packaging found to be toxic for reproduction in mammals. *Food and Chemical Toxicology*, *113*, 115–124. https://doi.org/10.1016/j.fct.2018.01.044

New York Department of Labor. (2024). *Current Employment Statistics* [Dataset]. https://dol.ny.gov/current-employment-statistics-0

New York State Department of Environmental Conservation. (2023). *New York State Solid Waste Management Plan*.

New York State Department of Health. (2022, October 4). *State Department of Health to Issue Proposed Regulations for PFAS in Drinking Water Systems*. https://www.health.ny.gov/press/releases/2022/2022-10-04_proposed_regulations_pfas_drinking_water.htm

NYS Department of Taxation and Finance. (2021). *Publication 718-B*. https://www.tax.ny.gov/pdf/publications/sales/pub718b.pdf

Packaging Reduction and Recycling Infrastructure Act, S4246A, NY Senate 2023–2024.

Pew Charitable Trusts. (2013). *Fixing the Oversight of Chemicals Added to Our Food* (Food Additives Project). Pew. http://pew.org/2yJXHbu

Plastic Bag And Film Plastics Recycling For Consumers—NYSDEC. (n.d.). Retrieved October 3, 2024, from https://dec.ny.gov/environmental-protection/recycling-composting/bag-waste-reduction-law/plastic-bag-film-plastics

Plastic Bag Reduction, Reuse, and Recycling Act, Environmental Conservation (ENV) CHAPTER 43-B, ARTICLE 27 (2014). https://www.nysenate.gov/legislation/laws/ENV/A27T27

Plastic Pollution | Sierra Club. (n.d.). Retrieved December 5, 2024, from https://www.sierraclub.org/plastic

Pokalsky, K. (2020, August 24). *Re: S.8817 (Hoylman)/ A.4739-C (Fahy)*. https://digitalcollections.archives.nysed.gov/index.php/Detail/objects/88554

Popovic, I., Bossink, B. A. G., & van der Sijde, P. C. (2019). Factors Influencing Consumers' Decision to Purchase Food in Environmentally Friendly Packaging: What Do We Know and Where Do We Go from Here? *Sustainability*, *11*(24), Article 24. https://doi.org/10.3390/su11247197

Pricewaterhouse Coopers. (2024, May 15). *Voice of the Consumer Survey 2024: Shrinking the consumer trust deficit*. PwC. https://www.pwc.com/gx/en/issues/c-suite-insights/voice-of-the-consumer-survey.html

Redman, R. (2019, July 22). Wegmans to phase out single-use plastic bags in New York. *Supermarket News*. https://www.supermarketnews.com/sustainability/wegmans-to-phase-out-single-use-plastic-bags-in-new-york

Rexam. (2011). *Rexam Consumer Packaging Report 2011/12*.

Rosengren, C. (2024, June 17). *5 packaging priorities in the federal food waste strategy*. Packaging Dive. https://www.packagingdive.com/news/biden-food-waste-strategy-packaging-epa-fda-usda/719079/

SANTA CRUZ, J. (2024). The Rise of the Zero-Waste Grocery Store: The challenge in the movement to make it mainstream. *Today's Dietitian*, *26*(9), 30–33.

Schlegel, I., Cray, C., Hocevar, J., Melges, K., & Pinsky, D. (2020). *The Making of an Echo Chamber: How the plastic industry exploited anxiety about COVID-19 to attack reusable bags*.

Soroudi, R. R. (2020). Government Repudiation of Americans' Safety: A Call for Reformulation of FDA's GRAS Notification Program. *Food and Drug Law Journal*, *75*(1). https://www.fdli.org/wp-content/uploads/2020/08/2-Soroudi-Final.pdf

Stevens, S., Bartosova, Z., Völker, J., & Wagner, M. (2024). Migration of endocrine and metabolism disrupting chemicals from plastic food packaging. *Environment International*, *189*, 108791. https://doi.org/10.1016/j.envint.2024.108791

Tasneem, S. (2023, October 12). *What Is Styrofoam? An In-depth Look*. GreenCitizen. https://greencitizen.com/blog/what-is-styrofoam/

The New Plastics Economy: Rethinking the future of plastics. (2016, January 1). https://www.ellenmacarthurfoundation.org/the-new-plastics-economy-rethinking-the-future-of-plastics

The White House. (2024). *National Strategy for Reducing Food Loss and Waste and Recycling Organics*. https://www.usda.gov/sites/default/files/documents/NATIONAL-STRATEGY-FOR-REDUCING-FOOD-LOSS-AND-WASTE-AND-RECYCLING-ORGANICS.pdf

Toxics in Packaging Act, Pub. L. No. Environmental Conservation (ENV) CHAPTER 43-B (2024). https://www.nysenate.gov/legislation/laws/ENV/37-0205

Trasande, L., Krithivasan, R., Park, K., Obsekov, V., & Belliveau, M. (2024). Chemicals Used in Plastic Materials: An Estimate of the Attributable Disease Burden and Costs in the United States. *Journal of the Endocrine Society*, *8*(2), bvad163. https://doi.org/10.1210/jendso/bvad163

Trasande, L., Shaffer, R. M., Sathyanarayana, S., COUNCIL ON ENVIRONMENTAL HEALTH, Lowry, J. A., Ahdoot, S., Baum, C. R., Bernstein, A. S., Bole, A., Campbell, C. C., Landrigan, P. J., Pacheco, S. E., Spanier, A. J., & Woolf, A. D. (2018). Food Additives and Child Health. *Pediatrics*, *142*(2), e20181408. https://doi.org/10.1542/peds.2018-1408

United States Department of State Office of the Spokesperson. (2022, February 28). U.S. Actions to Address Plastic Pollution. *United States Department of State*. https://www.state.gov/u-s-actions-to-address-plastic-pollution/

US EPA, O. (2017, September 7). *Containers and Packaging: Product-Specific Data* [Data and Tools]. https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/containers-and-packaging-product-specific

U.S. Food & Drug Administration. (2017, December 14). *Regulatory Background of the Food Contact Substance Notification Program*. FDA; FDA. https://www.fda.gov/food/packaging-food-contact-substances-fcs/regulatory-background-food-contact-substance-notification-program

U.S. Food & Drug Administration. (2023, July 6). *Food Ingredients & Packaging*. FDA; FDA. https://www.fda.gov/food/food-ingredients-packaging

U.S. Food & Drug Administration. (2024a, July 24). *Microplastics and Nanoplastics in Foods*. FDA; FDA. https://www.fda.gov/food/environmental-contaminants-food/microplastics-and-nanoplastics-foods

U.S. Food & Drug Administration. (2024b, September 9). *Recycled Plastics in Food Packaging*. FDA; FDA. https://www.fda.gov/food/packaging-food-contact-substances-fcs/recycled-plastics-food-packaging

U.S. Food & Drug Administration. (2024c, December 9). *List of Available Datasets* [Data Set]. https://www.hfpappexternal.fda.gov/scripts/fdcc/index.cfm

Vannela, R. (2012). Are We "Digging Our Own Grave" Under the Oceans?: Biosphere-Level Effects and Global Policy Challenge from Plastic(s) in Oceans. *Environmental Science & Technology*, *46*(15), 7932–7933. https://doi.org/10.1021/es302584e

Vieira, M. G. A., Da Silva, M. A., Dos Santos, L. O., & Beppu, M. M. (2011). Natural-based plasticizers and biopolymer films: A review. *European Polymer Journal*, *47*(3), 254–263. https://doi.org/10.1016/j.eurpolymj.2010.12.011

Villeneuve, M. (2020, August 21). *NY's plastic bag ban survives lawsuit, but not unscathed*. AP News. https://apnews.com/general-news-d16e172627519780ced6767937ee0954