




Regulation Trends on Plastic Bag Bans and Preemptions

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Abstract

Single-use plastic and waste management of plastic products is part of the Nexus discussion. Plastic is in our air, our water, our soil. Macro plastics kill marine life and can decrease biodiversity. Fossil fuels used to create plastic damage our environment by emitting greenhouse gases in the production cycle. While many applications of plastic can help reduce fossil fuel consumption, for example lighter products in transportation require less fuel needed to power them, single-use plastics are having a large negative impact on our environment.

Just as the climate, water, food, and energy are not a country concern but a global concern, the reduction of single use plastic should also be a global concern. Interconnections of the Nexus have become necessary parts of policy-making in the world, and in many areas of the world, plastic use is an increasing part of environmental discussions. However, while there is momentum outside of the United States to ban single-use plastic bags, compulsory reduction of these bags in the US is left in the hands of local municipalities.

This paper reviews policies that will enable and hinder progress towards reducing greenhouse gases caused from manufacturing single-use plastic containers from fossil fuels and the related plastic waste on an international, national, and local level. Studies referenced in this paper have shown a positive impact on human behavior when plastic use is decreased, demonstrating the opportunity for further reduction of fossil fuel use.

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Introduction

Increasing population growth, higher living standards, and the rapidly increasing move to urban areas are intensifying the demand for water, food, and energy, and subsequently the impact on the climate from producing these essentials. The term Nexus has been established for these four areas (water, food, energy, and climate) as it is “increasingly clear that there is no place in an interlinked world for isolated solutions aimed at just one sector” (Dodds and Bartram, 2016). The interconnections of the Nexus have become necessary parts of policy-making in the world.

One polluter is gaining more attention and rightfully so: single-use plastic. Ninety-nine percent of plastics are produced from substances obtained from fossil fuels. Oil and natural gas is not only used in the plastic product as feedstock, but also in the plastic manufacturing process (CIEL, 2017). With the growth in US production of shale gas via fracking, net plastic resin exports are estimated to triple by 2030. (American Chemistry, n.d.). Throughout the lifecycle, there is the potential for plastic to enter into water sources and soil in production, use, and waste. Regulations reducing plastic use and production are essential when looking at the entire picture of reducing greenhouse gases. With plastic production increasing, ignoring it as part of climate policy is irresponsible.

Because of the widespread environmental concern with plastic production and microplastic consumption, scientists are calling for an international agreement to address this issue (Haward, 2018).

This paper examines why plastic bag bans are an important policy component when looking to reduce fossil fuel use and how local bans on plastic bags can help change human behavior towards the environment. First, I examine the link between plastics use, fossil fuel consumption, and the Nexus. Second, I present peer-reviewed studies demonstrating how limiting plastic pollution has enabled greater action towards preventing further damage to the environment. Finally, I look at laws helping to reduce the negative environmental impact of single-use plastic, and those laws hindering progress. To do so, I compare policies in the United States focused on

fossil fuels and plastics, contrasting national and state level initiatives. This includes the limitations states are placing on municipalities seeking to reduce the local plastic footprint.

Plastics, Fossil Fuels, and the Nexus

Oil and gas production negatively impacts the climate through greenhouse gas emissions, and given that fossil fuels are a limited resource, fossil fuels may be unable to provide energy for 9 billion people on the planet by 2050. Compounding this pressure on long term supply, fossil fuels are used for more than energy production: According to the Center for International Law (2019), “if trends in oil consumption and plastic production continue as expected, the consumption of oil by the entire plastics sector will account for 20% of the total consumption by 2050.”

In the United States, natural gas liquids (NGL) are the preferred input for ethylene production, a key chemical in plastic production¹. While plastic production is not the largest greenhouse gas emitter, petrochemical projects would account for a 7% increase in gas demand between 2017 and 2030, and 4 percent of the increase projected for 2050 (CIEL, 2019). Over the past six decades, plastic production increased from around 0.5 million metric tons in 1950 to 348 million metric tons in 2017; from 1950 to 2017 a total of 8.3 billion metric tons of plastics has been created, the majority of it has been discarded (CIEL, 2019; Geyer, 2017).

While no one agency tracks emissions or consumption of fossil fuels used in plastic, in 2010, the US Energy Information Administration estimated:

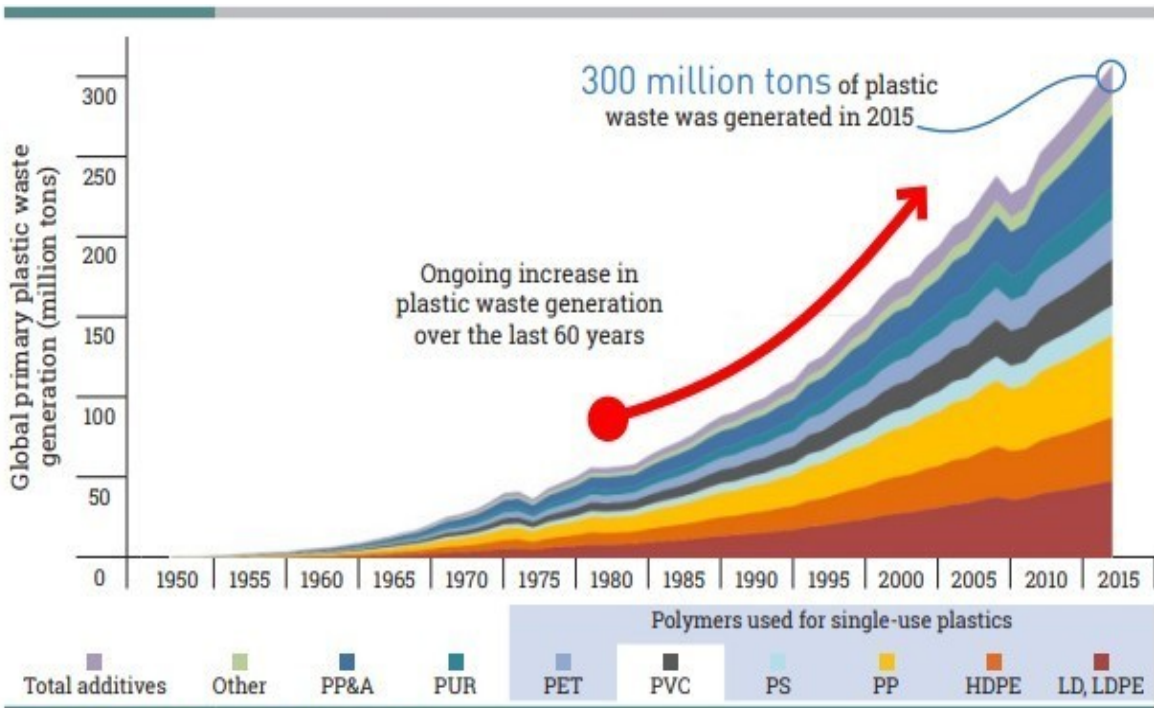
¹ Liquefied natural gas and natural gas liquids are defined by the US Energy Information Administration as: “Liquefied natural gas is natural gas that has been cooled down to liquid form for ease and safety of non-pressurized storage or transport. Natural gas liquids (NGLs) are hydrocarbons in the same family of molecules as natural gas and crude oil, composed exclusively of carbon and hydrogen.” (EIA, 2012)

- “191 million barrels of liquid petroleum gases (LPG) and natural gas liquids (NGL) were used in the United States to make plastic products; about 2.7% of total U.S. petroleum consumption;
- 412 billion cubic feet (Bcf) of natural gas were used to make plastic materials and resins in 2010. This was equal to about 1.7% of total U.S. natural gas consumption;
- 65 billion kilowatt hours of electricity were used to manufacture plastics in 2010, equal to about 1.7% of total U.S. electricity consumption.”

Outside of using fossil fuels in the production of plastics, plastic waste also has the potential to harm all elements on the Nexus including food and water supplies through polluting oceans and lakes, ultimately impacting wildlife and food sources. Figure 1 shows the increasing global primary plastic waste generation from 1950 to 2015. Additionally, plastics create “unwanted human exposure to endocrine-disrupting bisphenol-A (BPA) and di-(2-ethylhexyl) phthalate (DEHP), problems arising from the large quantities of plastic being disposed of, and depletion of non-renewable petroleum resources” (North and Halden, 2014). PCB leaches from landfills into ground water (Teuten et al, 2009). Studies have also found that when humans and mussels ingest microplastics, it may cause disruption to cellular processes and degrade tissues (Rochman, 2013).

While the impact of microplastics on food, water, and human health are still being researched, there is ample research to show the negative impact on marine life and marine ecosystems when plastic waste is present. In 2012, a study of a liter of water in the Arctic Ocean found that 67% of the plastic liter found was either “entangled or colonized” by benthic invertebrates, a species used as an indicator of the health of the ecosystem (Bergmann and M Klages, 2012). Beaumont et. al (2019) reviewed 1191 data points and found “plastic has a global impact on all ecological subjects reviewed”, most marine ecosystems reviewed, and a negative impact on fisheries and human wellbeing. The impact of marine plastic is not just environmental, Beaumont also estimated a ton of marine plastic has an economic impact of \$3300–\$33,000 per year, based solely on the “reduced marine natural capital.” Natural capital can include the reduced food sources and resource drain on the marine ecosystem.

Figure 1: Global Primary Plastic Waste Generation 1950-2015.
Adapted from Geyer, Jambeck, and Law (2017)



When looking at the factors that impact the Nexus, it is impossible to ignore how plastic waste can impact all four elements: production effects the energy and climate, and disposal impacts food and water supplies. The lifecycle “of plastic is estimated to be hundreds to thousands of years, and may be even longer” in deep sea environments (Barnes, 2009). In order to reduce fossil fuel reliance, minimize any further possible damage to marine biodiversity, and stop plastic additives from leeching into soil and waters, eliminating single-use plastic is a necessary policy step.

Banning Single-use Plastics Changes Behavior

“In 2015, England introduced a mandatory five pence (US\$0.06/€0.06) charge to customers for each single-use plastic bag taken from large stores. Results indicate a broad and positive effect of the bag charge, which appears to have catalyzed

wider waste awareness among the British public. This may facilitate the introduction of other policies to eliminate avoidable single-use plastics and packaging.” (Poortinga, 2016).

Banning plastic bags will reduce single-use plastic pollution and its impact on the Nexus. Studies, like those done following the British regulation, have also found plastic bag bans change attitudes and behaviors towards the environment. This creates a greater opportunity for further reduction of fossil fuel use by linking similar financial motivations to other single-use products, including Styrofoam containers and plastic bottles. While a plastic bag may be a small share of the single use plastic consumed in a day by the average consumer, the per bag fee and the reminder to reduce the use of plastic bags via re-usable bags can serve as a frequent reminder to the consumer of the need to reduce other consumption of single-use plastic.

According to Thomas, et al (2019), after a plastic bag charge was implemented in the UK in 2015, plastic bag use decreased by 90%. The fee also led to a change in opinions that further bans of single use plastic could help reduce waste. Researchers at Cardiff University found that the UK plastic bag fee “led to a sharp decline in the number of shoppers who take single-use bags at checkout, from 25 percent to 7 percent” (Poortinga, 2016). “In Wales, single-use plastic bag consumption declined by 71% between 2011 and 2014”, immediately after the five pence levy was introduced in 2011 (Xanthos and Walker, 2016). The “overwhelming positive” acceptance on placing a tax on plastic bags in Ireland has reduced use by 90% and reduced littering (Convery, et. al. 2007). In the first year of the Ireland fee, 2002, plastic bag use went from an estimated 328 bags to 21 bags per capita annually (ibid).

While cost avoidance has worked in countries with plastic bag bans, offering affordable alternatives to single-use plastic appears to also change single-use consumption behavior. A University of California Berkeley study found that while plastic bag bans can increase paper use, plastic waste could also be reduced by offering inexpensive reusable options (Taylor and Villas-Boas, 2016). While financial incentives worked to reduce plastic use in Portugal, reusable alternatives provided by stores were seen as “critical to reduce consumption” (Martinho, 2017).

One area in need of further research is incentives for using alternatives to single-use plastics. For example, the Boulder, Colorado plastic bag fee program gives consumers a \$.10 credit for using alternatives such as reusable bags. At least one Boulder store has taken up the practice of handing customers their bag credit in the form of tokens, which the consumer can then place into donation boxes for charitable causes upon exiting the store. This practice creates more layers of positive reinforcement than simply a \$.10 credit on the receipt. One study in the Washington, DC area (Homonoff, 20185) found some incentives work for changing consumption behavior, however, cost avoidance is a significantly larger indicator of behavioral change towards plastic use.

United States Fossil Fuel Policy

With the growth in US production of shale gas via fracking, net plastic resin exports are estimated to triple by 2030, and US policy does not seem to be committed to reducing fossil fuels nor address reducing single-use plastic. This is different than the views of President Barack Obama's Administration's stronger push to track and curb emissions. US President Barack Obama was an active proponent of reducing greenhouse gases and signed the Paris Agreement in 2015. Under the Trump Administration, Trump stated he would back out of it when legally allowed to do so in 2020. His policy trends are focused on rolling back almost all of the Obama Administration's push to create guidelines and regulations on clean energy and reducing the US's carbon footprint. One of the first rollbacks occurred just months after the current administration took office. During President Barack Obama's last year in the White House, in August 2016 the Council on Environmental Quality (CEQ) published guidelines for National Environmental Policy Act (NEPA) to require proposals to list both the effects of a proposed action on climate change and the effects of climate change on a proposed action (Climate Tracker, 2019). In March 2017, Trump signed an executive order directing CEQ to repeal this guidance(*ibid*). Since the Trump Administration took office, 71 agency deregulations, orders, and policies, 12 executive orders, and more than 40 other congressional actions, project

approvals, and guidance from agencies and lawmakers have rolled-back regulations or proposed environmental deregulations (ibid). These include reducing energy efficiency standards on appliances, weakening regulation requiring decreases in or tracking of greenhouse gases, and removing laws that protect wildlife, all while increasing the oil and gas development. All these efforts negatively impact the Nexus and are an indicator that the Trump Administration has no plans to help reduce plastic pollution impacting water, food, and energy.

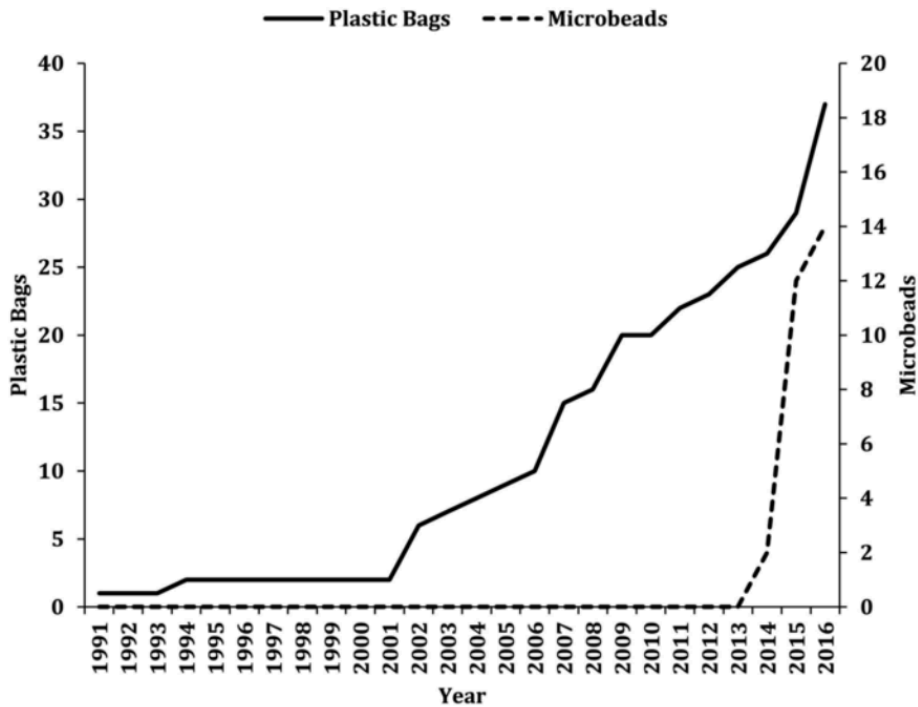
With the absence of any US policy that might encourage reduction of fossil fuel consumption in the manufacture of single use plastic bags, policy and action is in the hands of local and state governments.

Policies Banning and Limiting Single-use Plastics

Plastic regulation is emerging, and trends in environmental regulations may provide insight into what is next for single-use plastic laws. Policies regulating the recycling and use of single use plastic bags began in 1991, when Maine enacted a law requiring plastic bag recycling bins to be placed by store entrances (NCSL, 2019). Figure 2 shows the global increase in plastic use regulations from 1991 to 2016.

It is estimated that 40% of plastic production is for single use containers (UN, 2018). Banning plastic bags is a first step to eliminating single-use plastic, and many countries and municipalities are taking action against the plastic crisis and eliminating single use plastic altogether. “As of July 2018, 127 out of 192 countries have adopted some form of legislation to regulate plastic bags” (ibid). In 2016, France became the first county to ban plastic cups, plates, and cutlery, which will take effect January 1, 2020. The EU followed suit, and is banning single-use plastic cutlery, cotton buds, straws, balloon sticks and stirrers by 2021 (Cuff, 2019). According to the United Nations report on banning single-use plastic, 25 African countries have banned plastic bags (UN, 2018).

Figure 2: Timing and Number of Plastic Bag and Microbeads Bans, Internationally.
 From Xanthos and Walker, 2017

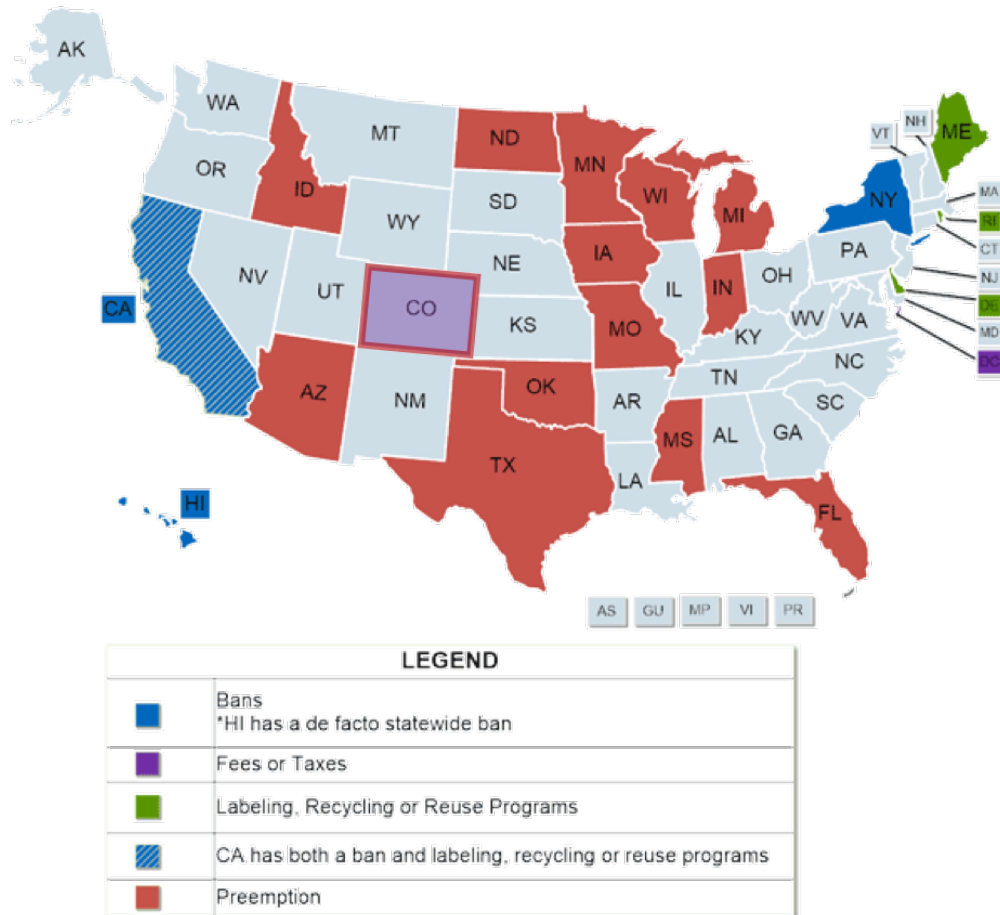


With the Trump Administration retreating from environmental concerns, states must step up regulations to decrease plastic use. Some have done so: four Hawaii counties have banned plastic bags, New York State’s ban on plastic bags takes effect in 2020, Maine bans single-use polystyrene containers, and California was the first state to ban most single-use plastic bags in 2014, which took effect in 2016 (Xanthos and Walker, 2017). Many local municipalities followed these examples including Aspen, Boston, Boulder, Chicago, Seattle, Montgomery County (Maryland), and Washington, D.C. (NCSL, 2019)

While some cities and states are taking action against single-use bags, other states have put preemptions prohibiting any municipality from banning any bag or container. Figure 3 compares plastic bag laws across the United States that have been passed by state and local governments, ranging from states that have enacted laws banning plastic bags to state governments with preemptions that ban the banning of plastic bags.

Figure 3: Comparison of state and local laws banning plastic bags and state governments with preemptions that ban the banning of plastic bags.²

From: Adapted from National Conference on State Legislatures, 2019



The American Plastic Association has a strong interest in ensuring plastic bags remain in the hands of consumers. Thirteen states have banned banning plastic bags since 2015, all pushed and funded by the American Plastics Council. The states with preemptions that do not allow local governments to ban plastic bags include Idaho, Arizona, North Dakota, Minnesota, Oklahoma, Iowa, Missouri, Wisconsin, Michigan, Indiana, Mississippi, and Florida³.

² The State of Colorado has a pre-emption for plastic bags, but also had allowed taxes or fees on bags in certain municipalities.

³ Florida prohibits future legislation that limits the use of polystyrene products, while a lawsuit over the validity of a statute preempting local Florida bag laws is pending. (Gibbens, 2019)

Two more states have laws from 1993 banning plastic bag bans, Colorado and Texas. Colorado has a preemption from 1989 and revised in 1993, which bans municipalities from banning plastic containers. However, fees are allowable for bags in Colorado and as mentioned above, Boulder, Denver (as of October 2019), and Aspen have implemented bag fees. Cities in Texas have not seen this success in banning plastic bags. In 2014, the Texas Supreme Court upheld a 1993 Texas law banning cities from banning plastic bags.

Colorado Statewide Potential to Ban Plastic Bags

While national policies under the current administration are making it easier to use fossil fuels and increase the emission of greenhouse gases, Colorado appears to be going in the opposite direction. This is a significant goal for Colorado, as emissions from 1990 to 2010 rose steadily in the state, from 83 (MMTCO₂e) in 1990 to 130 (MMTCO₂e) in 2010 (Arnold, 2014). However, the Polis Administration wants to change this trend and strive for 100 percent renewable electricity on the state's electric grid by 2045; in 2016, 20% of the energy generated in Colorado came from renewable sources, and Xcel Energy, the state's largest power supplier, plans to get to 55% of generated power from renewables by 2026. (Morehouse, 2019).

Colorado has a convincing opportunity to reverse the 1993 statute with newly elected officials in an environmentally focused Governor and Democratic Legislature. During the first General Assembly in 2019, the legislature passed a number of policies to help Colorado become a leader in the fight against climate change (Woodruff, 2019). During his first month in office, Governor Polis signed an executive order to launch the effort to adopt Zero Emission Vehicle (ZEV) standards, originally set by California; these standards require automakers to sell 5% of their new cars as electric vehicles by 2023. This is one of 11 environmental laws Governor Polis signed into law in 2019 (Morehouse, 2019). There may be an appetite to improve on these laws in the second legislative session, scheduled to begin in January 2020. In 2019, Senate bill SB19-192 passed, creating the Front Range Waste Diversion Enterprise Grant Program and establishing a goal for front range communities to divert 51% of waste by 2036 (Colorado General Assembly,

2019). By contrast, two years earlier, House Bill 17-1275 (which was focused on reducing solid waste) failed (ibid). While eliminating statute 25-17-10 would not ban plastics, it would provide communities with the opportunity to do so.

While the energy focus of the Nexus is increasing discussions about climate and environmental policy in Colorado, the harm done by plastic is not receiving as much attention. If Colorado wants to lead the fight against plastic pollution and the impact of plastics on the environment, it will have to change statutes first. To do so, Colorado has an initial hurdle to overcome on its way to reducing reliance on fossil fuels by eliminating plastic use. Section 7 of the Colorado Revised Statutes, 25-17-10 states: “No unit of local government shall require or prohibit the use or sale of specific types of plastic materials or products or restrict or mandate containers, packaging, or labeling for any consumer products” (FindLaw, 2019). The policy was created to help Colorado create standard recycling programs in 1989 (revised in 1993), but 30 years later, when Colorado is trying to reduce rather than just recycle it is becoming a hindrance to advancement. While Aspen, Denver, and Boulder have successfully imposed a plastic bag fee (which was heard at the Colorado Supreme Court), there is little else that appears to be possible at a local level to eliminate plastic in Colorado communities. The statute written to standardize recycling in 1989 stands in the way of cities that want to ban straws, plastic grocery bags, and Styrofoam containers.

Colorado actively moving from supporting the oil and gas industry through energy policy to supporting environmental health may ultimately have a positive impact on food and water sources. With the passage of State Bill 181 (Colorado General Assembly, 2019), the governing body’s role in oil and gas becomes more focused on health and safety, and less on development. The bill also allows local governments to create laws that would require developers and oil and gas companies to complete habitat restoration as part of their projects. In doing so, biological diversity and watershed may be protected, leading to greater diversity in the food web and safer water sources. While this bill does not impact plastic use, it does set the stage for local authorities having more control over environmental concerns, which could lead to greater local authority in banning plastics across Colorado.

Discussion

While the United States government is working towards increasing fossil fuel production, the state of Colorado and other countries and municipalities are taking steps towards improving factors that improve the Nexus. Colorado is challenging national trends in deregulation, and making progress towards reducing its carbon footprint, improving air quality, and actively fighting the negative impacts of climate change on the environment.

If fossil fuel consumption is to decrease, not only will renewable energy sources be needed to provide power to 9 billion people by 2050, but plastic production and consumption will also need to decrease. By decreasing single-use plastic consumption, the harmful additives that can leach into the soil and water can be reduced and marine ecosystems will have a greater chance of survival. All these steps require changes to policy and to consumer behavior.

Environmentally conscious consumers, partnered with social pressure, tend to reduce the use of plastic bags and switch to using cloth and other reusable bags when fees are introduced for single-use plastic bags. Plastic bag bans can help educate the public on the importance of reducing plastic and fossil fuel use. The success of the plastic bag charges and affordable alternatives have changed behaviors and reduced waste, and similar policies could see comparable results on reducing other single-use plastic consumption. While plastic bag bans may not be the answer to solving plastic pollution, they can be a starting point to educate consumers on the importance of reducing their plastic footprint.

Reducing plastic bag use is just one small piece of the puzzle when it comes to improving all the areas of Nexus. There have been many studies to show how cost-avoidance for bag fees can reduce use of plastic bags quickly. Unfortunately, while many US states and countries are limiting the use of plastic bags, the plastic industry has a strong interest in ensuring plastic bags remain in the hands of consumers. Removing preemptions may not be feasible with the resistance from the plastic industry, so states must come up with alternative ideas to reduce single-use plastic.

Alternative ideas for reducing packaging material, redesigning single-use plastic products, and rethinking recycling of plastics are also needed. One alternative to traditional plastic bags are biodegradable bags. However, one study in Ireland (Green, 2015) found that biodegradable plastics still can create anoxic “conditions within the sediment along with reduced primary productivity and organic matter and significantly lower abundances of infaunal invertebrates.” Anoxic conditions are considered present when dissolved oxygen concentration is less than 0.5 milligrams per liter, indicating that simply changing the materials used for single-use bags may not necessarily decrease the bag’s environmental footprint. Additionally, the environmental costs in manufacturing biodegradable bags needs to be evaluated.

China’s waste policy may be an enabler to take more action towards reducing the use of single-use plastic. China has taken in almost half of the plastic waste of the world since 1992, but its new policy banning this practice took effect in 2018. This leaves the question: where will the plastic go? “An estimated 111 million metric tons of plastic waste will be displaced with the new Chinese policy by 2030” (Brooks, 2018). New ideas on how to reuse plastic and reduce plastic, as well as improve domestic waste recycling facilities are needed.

States like Colorado need to stand up against plastic industry efforts to keep single-use plastic bags in production. With multi-use and industry-quality plastics used in everything from wind turbines to sports equipment, and from medicine to fuel-efficient transportation, there is an opportunity for the plastics industry to grow without unnecessary damage to our environment through disposal single-use bags. Policies focused on increasing the economic benefits of reusable and durable plastics could offset the plastic industry opposition to single-use bans.

State and national action, paired with community involvement are needed to save the many ecosystems on Earth already suffering from the damages of climate change. If plastic use is only handled on a local or national level, will it be enough? While a handful of US cities, the EU, and many African countries are taking action against plastic pollution, simple plastic bag bans will not be enough by themselves, but could serve as the spark to change public attitudes about all single use plastics. Strong coalitions need to be formed in order to mitigate plastic pollution and

its impact on the Nexus. Just as the EU has banned a number of single-use plastics, other coalitions need to be formed to protect the environment against single-use plastic damage.

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