



# An Evaluation of the Effects of California's Proposed Plastic Bag Ban

By Julian Morris and Lance Christensen

## Summary

Many cities and counties in California have passed ordinances banning the distribution of high density polyethylene (HDPE) plastic grocery bags and mandating fees for paper bags. State Senator Alex Padilla recently introduced a bill (SB 270) that would impose similar requirements statewide.

The premise of these laws is to benefit the environment and reduce municipal costs. In practice, the opposite is more likely to be the case.

While the impact of such legislation depends on the way consumers respond, the available evidence suggests that it will do nothing to protect the environment; quite the opposite, it will waste resources and cost Californian consumers billions of dollars. Specifically, such legislation will:

- Have practically no impact on the amount of litter generated (moreover, while banning plastic bags at small retailers might reduce plastic bag litter

by 0.5%, banning the distribution of HDPE plastic bags by large retailers is unlikely to have any impact even on the amount of HDPE plastic bag litter produced.)

- Have no discernible impact on the amount of plastic in the ocean or on the number of marine animals harmed by debris;
- Increase the use of oil and other non-renewable energy resources, including coal and natural gas;
- Result in five-fold or greater increase in the shopping bag-related use of water;
- Make little or no difference to the costs of municipal waste management;
- Impose enormous costs on California's consumers, likely over \$1 billion in both direct and indirect costs (such as time spent washing reusable bags).

## Introduction

Plastic shopping bags made from high density polyethylene (HDPE) first came into widespread use in 1982. By 1996, 80% of all grocery bags used in the United States were made from HDPE.<sup>1</sup> Concerned at the possible impact of such widespread use, environmental pressure groups have sought to ban these plastic bags.

At the time of writing, 192 municipalities in 16 states and the District of Columbia have enacted bans on HDPE plastic bags. California is the leading state for bag bans, with ordinances in nearly 100 municipalities, including San Francisco and Los Angeles.

In addition to banning plastic bags, most of the ordinances in California also require retailers to collect a fee for paper bags. In most cases, this fee is set at \$0.10, although some municipalities have higher fees (such as \$0.15) and many are scheduled to increase fees (usually to \$0.25). Most of these bag ordinances are similarly constructed.

In February 2014, California State Senators Padilla, De León and Lara introduced a bill (SB 270) that would, with some exceptions, ban the distribution of HDPE plastic bags by all stores in the state, beginning July 1, 2015 with large stores and then, one year later, extending to small stores. In that respect, the bill is similar to the many municipal ordinances throughout the state. The bill also

includes a requirement that stores charge a minimum of 10 cents for recycled paper bags, compostable bags and reusable bags.

The implicit assumption underlying SB 270—and the dozens of ordinances already passed in California restricting use of grocery bags—is that plastic bags are bad for the environment in various ways. Proponents of restrictions typically make one or more of the following claims:

- 1) Restrictions on HDPE bags would reduce litter and protect the marine environment;
- 2) Restrictions on HDPE bags would reduce our consumption of resources;
- 3) Restrictions on HDPE bags would reduce waste and save taxpayers' money;
- 4) Restrictions on HDPE bags would reduce our emissions of greenhouse gases.

This brief assesses the veracity of those claims and then considers the wider impact of SB 270 and similar municipal restrictions.

## **The Impact of Shopping Bag Regulations on Litter and the Marine Environment**

Contrary to some claims made by advocates of plastic bag bans, plastic bags constitute a minuscule proportion of all litter. A 2013 report by Steven Stein, the leading authority on litter in the country, shows that HDPE plastic retail bags represent only 0.6% of visible litter across the United States, while in the two Californian cities studied, San Jose and San Francisco, they represented 0.4% and 0.6% (before the introduction of restrictions on the use of such bags in those cities). So, even if all plastic bags were banned, the impact on overall litter would be relatively insignificant.

It is also worth looking at what has happened in practice as a result of plastic bag bans. Among the best data we have comes from San Francisco, which in October 2007 implemented a ban on the distribution of HDPE plastic bags by retail establishments (grocery stores and pharmacies) with over \$2 million in annual sales. Audits of San Francisco's litter were conducted in 2007, 2008 and 2009 and these showed that the amount of litter from plastic retail bags did not decline after the ban; as Table 1 shows, it actually *increased*. This suggests that

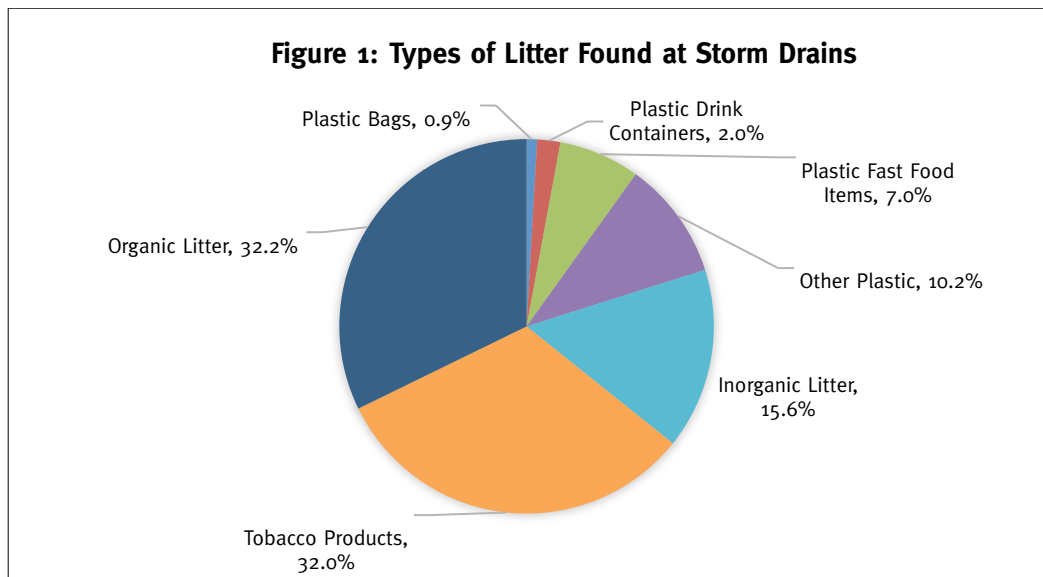
almost none of the plastic bag litter came from bags distributed by larger retailers, so restricting the distribution of bags by such retailers has no benefit in terms of litter reduction.

Year	2007	2008	2009
Plastic retail bags	0.6%	0.6%	1.5%
Paper retail bags	0.4%	0.4%	0.5%

Source: The City of San Francisco Streets Litter Re-Audit, 2009

### The Impact of Plastic Bag Litter: (1) Clogging of Storm Drains

Proponents of plastic bag bans claim the bags clog storm drains, but a comprehensive 2009 survey by Keep America Beautiful found that plastic bags of all kinds represented just less than 1% of visible litter items in storm drains.<sup>2</sup> By contrast, as Figure 1 shows, plastic drink containers represented about 2% and other plastic items represented over 10%.<sup>3</sup> Clearly, banning plastic bags would do little to reduce the problem of clogged storm drains, so attention should instead focus on ways to reduce the production of litter of all kinds—or mitigate its effects.



Source: Keep America Beautiful National Visible Litter Survey and Litter Cost Study, 2009.

### The Impact of Plastic Bag Litter: (2) Damage to Marine Ecosystems

Proponents of bag bans also frequently claim that large numbers of plastic bags find their way into the oceans, resulting in a giant “garbage patch” that is causing the death of millions of birds and marine mammals. But the National Oceanic and Atmospheric Administration (NOAA) points out that there is no scientific evidence to support even the first claim (that large amounts of marine debris originate on land), noting that “We know relatively little about what is lying on the ocean floor or suspended in the water column. Because of this we truly can't say what the land- and ocean-based percentages are with any certainty or accuracy.”<sup>4</sup> Nonetheless, journalists have often repeated these unsupported claims. For example, in 2009 Oprah Winfrey opined:

*Scientists believe the world's largest garbage dump isn't on land, it's in the ocean. Estimated to be twice the size of Texas, the Great Pacific Garbage Patch stretches from the coast of California all the way to Japan. In some places the manmade debris is ninety-feet deep...In some parts of the ocean there's already six times more plastic than plankton...The monumental amount of plastic trash has created an ecological disaster that has cost the lives of millions of seabirds and marine mammals...This is the most shocking thing I've seen.*<sup>5</sup>

The only shocking thing about Ms. Winfrey's rant is the absence of scientific evidence in support of her claims. Again, according to the NOAA : “The name ‘garbage patch’ is a misnomer. There is no island of trash forming in the middle of the ocean, nor a blanket of trash that can be seen with satellite or aerial photographs.”<sup>6</sup> Scientists who have studied the problem have found small pieces of plastic floating in the North Pacific and estimate that such flotsam has increased substantially over the course of the past 40 years. But that is hardly surprising, since the amount of plastic used throughout the world has increased similarly in that time. Moreover, there is simply no evidence that debris from plastic bags is a significant threat to marine animals. As David Santillo, a senior biologist with Greenpeace, told a reporter at *The Times of London*:

*It's very unlikely that many animals are killed by plastic bags. The evidence shows just the opposite. We are not going to solve the problem of waste by focusing on plastic bags.... With larger mammals it's fishing gear that's the big problem. On a global basis plastic bags aren't an issue.*<sup>7</sup>

The claim that plastic debris has been killing hundreds of thousands of marine mammals and millions of birds seems to be based on the misinterpretation of a Canadian study assessing the unintended impact of fishing gear.<sup>8</sup> David Laist, an

expert on entanglement and since 1979 an analyst for the Marine Mammal Commission told *The Times* that:

*In reality plastic bags don't figure in entanglement... The main culprits are fishing gear, ropes, lines and strapping bands. Most mammals are too big to get caught up in a plastic bag.... the impact of bags on whales, dolphins, porpoises and seals ranges from nil for most species to very minor for perhaps a few species. For birds, plastic bags are not a problem either.*<sup>9</sup>

So, to sum up, the available evidence shows that:

- Some plastic debris—including from plastic bags—certainly finds its way into the oceans, but there is no “garbage patch” in the North Pacific (or anywhere else);
- The amount of plastic in the oceans is larger than it was 40 years ago but remains relatively insignificant even where it is most concentrated; and
- There is no evidence that plastic bags are killing significant numbers of birds, whales, dolphins, porpoises or other marine animals.

By contrast, discarded or abandoned fishing gear does seem to be a serious threat to marine animals. In addition to the hundreds of millions of fish that are caught each year, such gear entraps hundreds of thousands of other animals and birds. Unfortunately, the obsessive focus of campaigns to ban plastic bags has distracted attention from this real problem.

## **The Impact of Plastic Bag Regulations on the Generation of Waste and Municipal Costs**

Data from the U.S. Environmental Protection Agency show that in 2010 (the most recent year for which data are available), the nation discarded 690,000 tons of HDPE bags. Of those, approximately 30,000 tons were recovered (i.e., recycled), meaning that a total of 660,000 tons were finally discarded—mostly into landfill.<sup>10</sup>

The same year, the nation produced a total of just less than 250 million tons of municipal solid waste, of which approximately 85 million tons were recovered and 165 million tons were discarded. So, HDPE bags constituted approximately

0.28% by weight of all waste generated and 0.4% by weight of all waste discarded.<sup>11</sup>

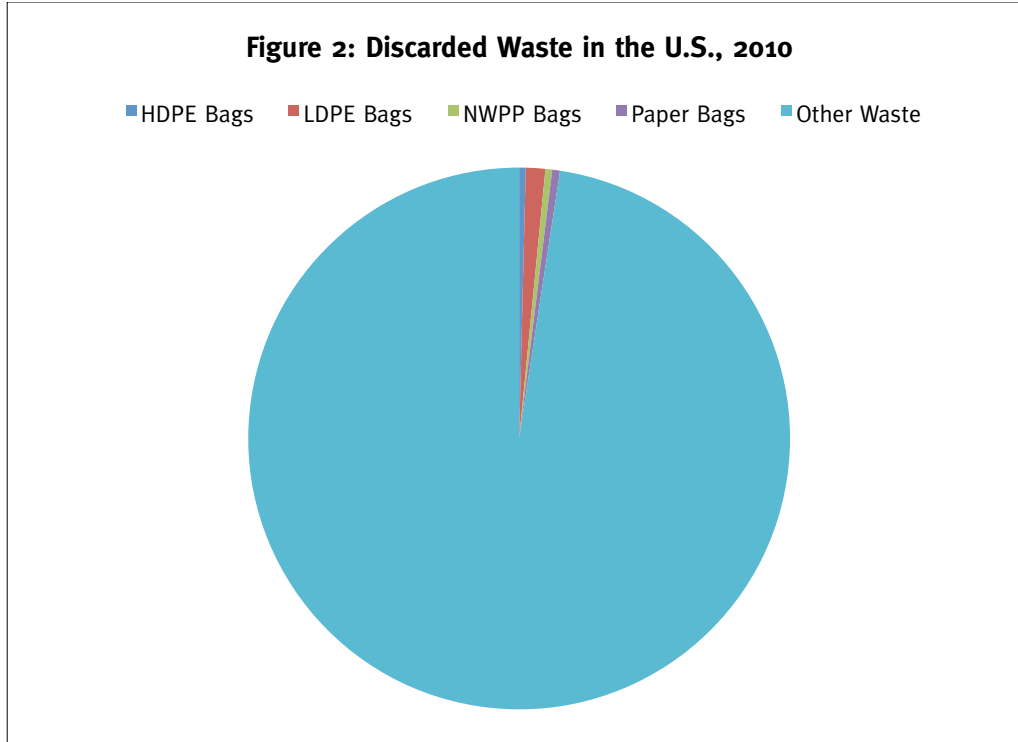
By comparison, in the same year, the nation discarded almost exactly the same amount of reusable polypropylene bags (680,000 tons), of which none were recovered. So, polypropylene actually constituted a slightly higher proportion of all bags going to landfills (at 0.41%).<sup>12</sup>

The nation also threw away approximately 2.38 million tons of LDPE bags, of which about 420,000 tons were recycled and 1.96 million tons discarded. As such, LDPE bags constituted about 1% of the nation's discarded waste—more than HDPE and NWPP bags combined.

Meanwhile, also in the same year, the nation discarded just over one million tons of paper bags and sacks, of which approximately 25% was estimated to have been recovered and 75%, or 750,000 tons, discarded.<sup>13</sup> Not only is that a larger weight, but because paper is less dense than plastic, it takes up considerably more space in landfills.

As these data show—and as can be seen in Figure 2—HDPE plastic bags do not constitute a significant proportion of the nation's waste. Since all alternative bags—including LDPE, NWPP and paper—are significantly heavier than HDPE bags, and since consumers would likely switch to some combination of these alternatives, it is quite possible that eliminating HDPE bags would result in an *increase* in the amount of waste discarded.

Moreover, as noted above, the amount of non-renewable energy consumed by using only HDPE bags would be about half the amount consumed for an average household using NWPP, LDPE or paper bags. Meanwhile the amount of water consumed during the life-cycle of an HDPE bag is one-fifth that of the next closest bag (paper). So, banning HDPE bags results in a significant increase in waste of energy and water.



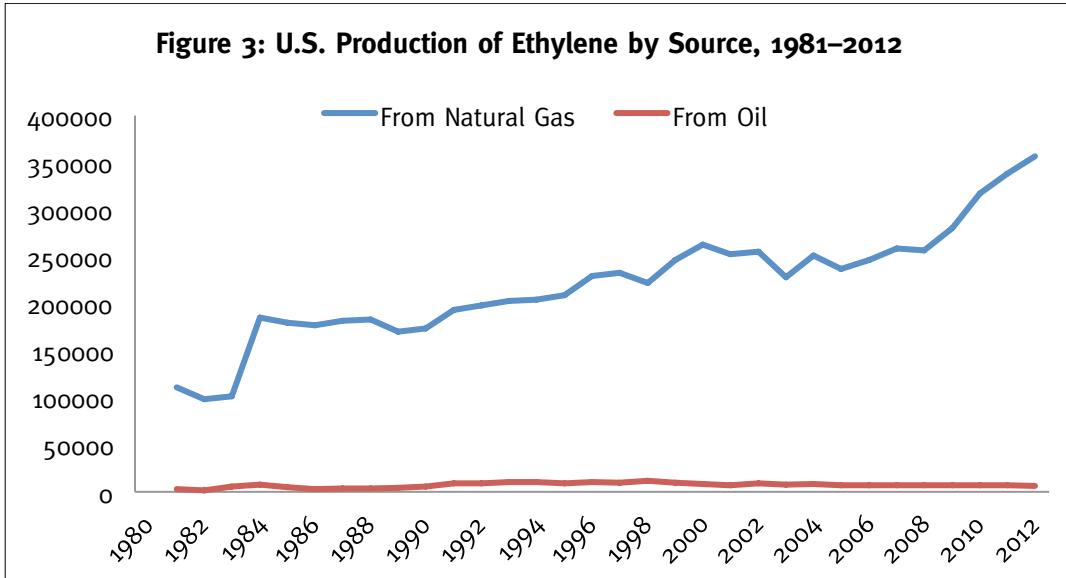
Source: U.S. Environmental Protection Agency: Municipal Solid Waste Generation, Recycling, and Disposal in the United States Tables and Figures for 2010

## The Impact of Plastic Bag Regulations on Consumption of Resources

It is commonly assumed that plastic bags are made from oil and that banning plastic bags will reduce oil consumption. Ross Mirkarimi, a member of San Francisco City Council and chief protagonist of the city's bag ban, reportedly asserted in 2007, "You're talking about twelve million barrels of oil that are used nationally to produce 30 billion plastic bags in the United States...."<sup>14</sup>

In fact, nearly all HDPE bags are produced from natural gas, not oil. Indeed, between 1981 and 2012, on average only 3.2% of ethylene—the feedstock for polyethylene—was made from oil, as shown in Figure 3. Ironically, one of the primary substitutes for HDPE bags, non-woven polypropylene (NWPP) bags *is* derived from oil.<sup>15</sup> So, restricting the use of HDPE bags would likely increase oil consumption.





Source: U.S. Energy Information Administration: 2012. U.S. Refinery and Blender Net Production of Ethane-Ethylene.

## Non-Renewable Energy Resources

The wider question of whether restrictions on the use of HDPE bags would reduce consumption of resources has been addressed by various life-cycle analyses (LCAs). These LCAs seek to account for the environmental impact of a product throughout its life-cycle, from cradle to grave. A recent Reason Foundation study analyzed the main LCAs of grocery bags that have been undertaken and used those to assess the impact of HDPE bags relative to other bags on various measures, including use of non-renewable energy resources (i.e., coal, oil and natural gas).<sup>16</sup>

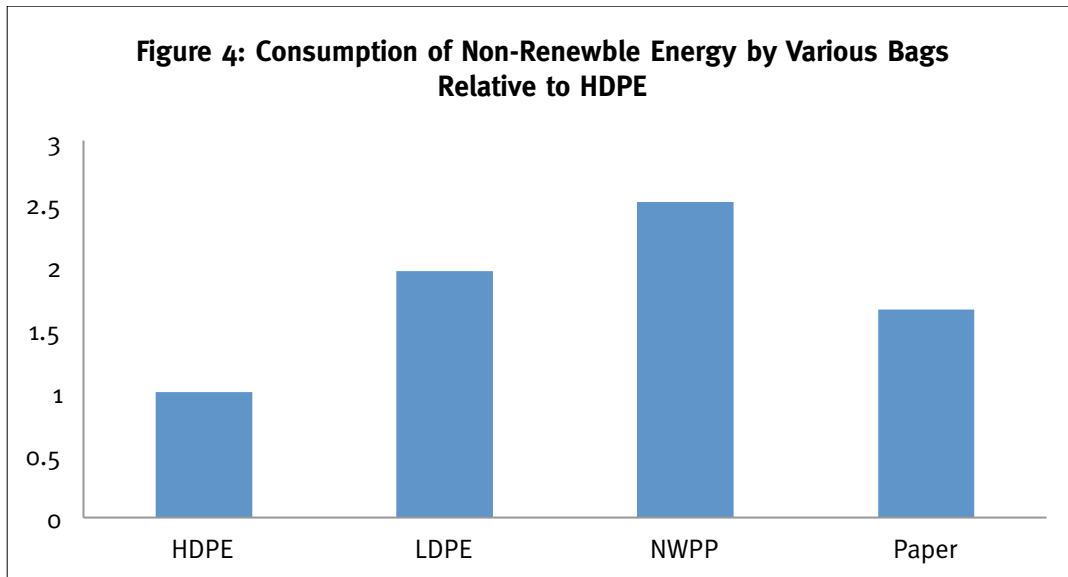
A main alternative type of bag that would be permitted under SB 270 is one made from low density polyethylene (LDPE). In principle, the LCAs show that if LDPE bags were reused a sufficient number of times, they might on net consume fewer non-renewable energy resources than HDPE bags. But how many times? Making the reasonable assumption that about 60% of HDPE bags are reused in ways that avoid the use of other bags,<sup>17</sup> we calculated that an LDPE bag would have to be reused at least six times in order to achieve the same or lower consumption of non-renewable energy resources.<sup>18</sup>

While a recent survey found that most people who reuse LDPE bags for shopping say they use the bag five or more times, many people reuse the bags for other purposes.<sup>19</sup> The survey designers estimate that, in practice, LDPE bags

are on average reused 3.1 times.<sup>20</sup> That is about half the number of uses necessary to achieve parity with an HDPE bag.

A similar analysis can be applied to non-woven polypropylene (NWPP) bags, another alternative bag that has been promoted heavily by opponents of HDPE bags. Assuming again that 60% of HDPE bags are on average reused, a NWPP bag would have to be used a minimum of 37 times in order to consume the same or less energy than the HDPE bags it replaces.<sup>21</sup> In practice, United States consumers use NWPP bags an average of 14.6 times.<sup>22</sup> That is less than half the number of uses that would be required to achieve parity with an HDPE bag.

Finally, paper bags use about twice the energy of an HDPE bag over the course of their life (assuming again that 60% of HDPE bags are reused).



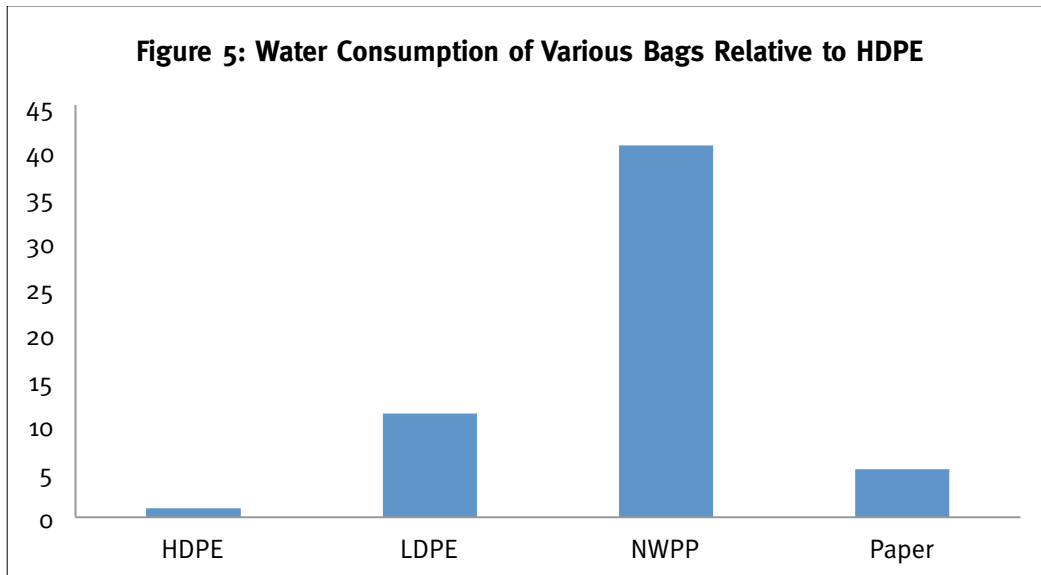
Source: authors' calculations

Figure 4 shows the relative amounts of non-renewable energy that would be consumed as a result of an average consumer exclusively using each of the bag types. It is clear that using HDPE bags exclusively would result in the consumption of far *fewer* non-renewable energy resources than if one of the alternative bag types were used. Any policy restricting the use of HDPE plastic bags would thus increase the total amount of non-renewable energy associated with shopping bag use. If HDPE plastic bags are banned statewide under SB 270, it is estimated that non-renewable energy use relating to shopping bags in California would rise by 50% or more.

## Water

Water is another important resource that is consumed during production, transportation, use and disposal of shopping bags. The use of water is of particular significance in California, given the aridity of the state, frequency of droughts and current restrictions on water use. Unfortunately, only two of the full LCAs calculated water consumption and neither included estimates for NWPP bags. Moreover, although the California Department of Public Health advises consumers to wash their reusable bags frequently in order to avoid contamination, neither LCA included water consumed during the washing of reusable bags. Fortunately, however, we were able to use other estimates to infer water usage for NWPP bags and to estimate usage for washing of both NWPP and LDPE bags.<sup>23</sup>

Making the same assumptions as above regarding the number of reuses of each bag type, we calculated the relative amounts of water consumed by each bag type.<sup>24</sup> These are given in Figure 5. The conclusion is clear: HDPE bags use far less water than other bag types. In our estimates, compared with using only HDPE bags, using only paper bags would result in the use of at least five times as much water, while using only LDPE bags would require about 10 times as much water, and using only NWPP would require about 40 times as much water.



Source: authors' calculations

Since SB 270 would ban the use of HDPE bags, it would result in a dramatic increase in shopping-bag-related water consumption, likely increasing it five-fold or more as consumers switch to a combination of paper, LDPE and NWPP bags.

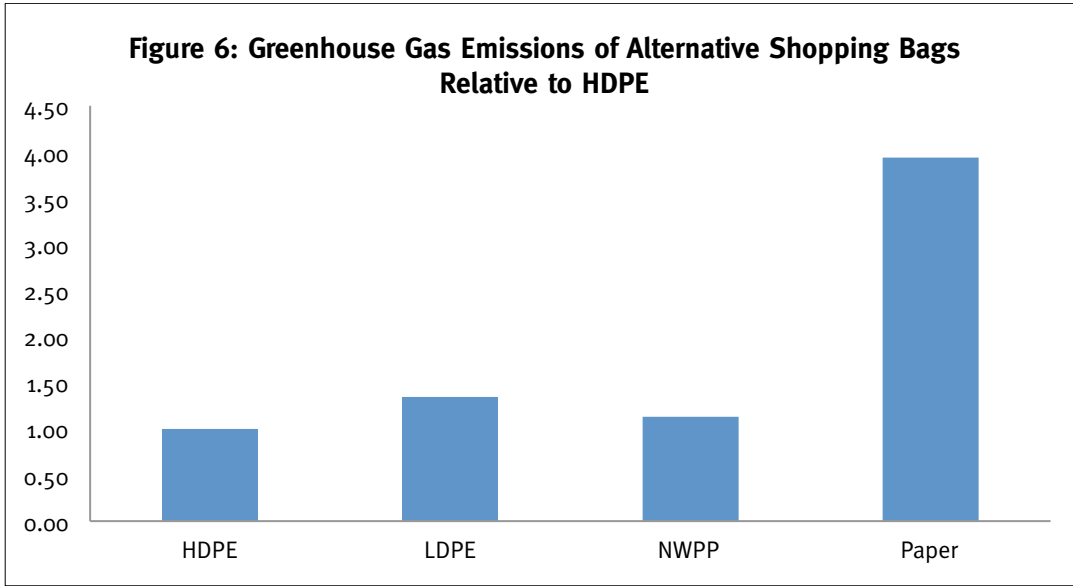
## The Impact of Plastic Bag Regulations on Greenhouse Gas Emissions

Anthropogenic global warming, aka “climate change,” has become the dominant concern for most national environmental groups. So it is no surprise that stopping global warming is touted as one of the main justifications for banning plastic bags. But would banning plastic bags actually do anything to reduce greenhouse gases (GHG) and/or prevent global warming?

The various LCAs came to slightly different conclusions regarding the emissions of GHGs by various bags. So, in order to err on the side of caution, for each type of bag we took the estimate with the *lowest* life-cycle GHG emissions relative to those produced by an HDPE bag of equivalent volume. We then estimated the relative emissions expected based on the assumptions we used for the assessment of non-renewable energy use (i.e., NWPP bags used 14.6 times, LDPE bags used 3.1 times, HDPE bags use 1.6 times, paper bags used once).

The outcome of this analysis is shown in Figure 6. From this, it is immediately apparent that paper bags are responsible for considerably higher levels of GHG emissions. However, both reusable bags—LDPE and NWPP—result in similar emissions of GHGs.

But remember that the LCAs did not take into account washing of the reusable bags. If people use warm water to hand wash their bags, or if they use a washing machine for their NWPP bags, then the GHG emissions would increase significantly.



Source: authors' estimates

Given that SB 270 is likely to result in some people switching from plastic to paper, the net effect is likely to be an increase in GHG emissions. So, once again, the claims made by environmental groups appear to lack empirical support and in fact are contradicted by the evidence.

## Other Effects of Banning Plastic Bags

Banning plastic bags and imposing mandatory fees on paper bags would likely have numerous unintended but foreseeable consequences, ranging from health effects on consumers to security risks for retailers. Some of these likely consequences follow.

### Health Effects for Consumers

In 2010, nine members of a soccer team in Oregon were infected with norovirus—a severe, but usually non-fatal stomach virus—as a result of eating food from a reusable bag that had become contaminated with the virus.<sup>25</sup> Numerous other instances of food-borne illnesses have been traced to reusable bags contaminated with bacteria and other pathogens.<sup>26</sup> Researchers at the Universities of Arizona and Loma Linda, California found that half the bags they surveyed were contaminated with coliform bacteria and noted that users

indicated they rarely washed their bags.<sup>27</sup> A recent survey found that only 16% of shoppers cleaned their reusable NWPP bags “once a week or more.”<sup>28</sup>

To address these risks, the California Department of Public Health recently issued the following advice concerning the use of reusable shopping bags:

*At home:*

- *Reusable grocery bags should be machine or hand-washed frequently! Dry the bags in a clothes dryer or allow them to air dry.*
- *After putting groceries away, clean the areas where the bags were placed while un-bagging your groceries, especially the kitchen counter and the kitchen table where food items may later be prepared or served.*
- *If food residues from any food products have leaked into the bag, make sure to wash and dry the bag thoroughly before reuse.*
- *If reusable grocery bags have been used to transport non-food items, such as detergents, household cleaners, and other chemicals, wash and dry the bags before using them to transport food items. Alternatively, you may wish to use bags of one color for food items and bags of a different color for non-food items.*
- *Store grocery bags away from sources of contamination, such as pets, children, and chemicals. Storing reusable grocery bags in the trunk of cars is not recommended. During the warmer months, the increased temperatures can promote the growth of bacteria that may be present on the bags.*

*At the store:*

- *Place reusable bags on the bottom shelf of the grocery cart (below the cart basket where food products are placed).*
- *When selecting packages of meat, poultry, or fish, consider putting the packages in clear plastic bags (often available in the meat and produce sections) to prevent leaking juices from contaminating other food items and the reusable grocery bags.<sup>29</sup>*

## **Additional Costs for Consumers**

If every user of reusable bags followed these instructions, the risk of food-borne disease being transmitted by such bags would likely be eliminated, or at least

drastically reduced. However, if even a small proportion of users fail to undertake such measures, bacteria can be spread from dirty bags to clean bags, as well as directly onto food, via the checker's hands, shopping carts and checkout counters.

But undertaking these actions entails: expenditure of time and resources on cleaning; additional space at home for storing the bags; the use of additional lighter weight (LDPE) plastic bags for meat and produce, and the purchase of large numbers of reusable bags (the number will likely be larger if the bags are washed and dried by machine, due to the damage inflicted by such machines). By making a few reasonable assumptions, these costs can be quantified.

In California, in 2012, there were 12.4 million households, with median household income of approximately \$61,400. If each household spends an additional five minutes per week washing, drying and organizing its reusable bags, the average "opportunity cost" (i.e., the value of time spent undertaking these activities) is approximately \$2.56 per week per household.<sup>30</sup> If the entire state were to switch to reusable bags only, the opportunity cost would be approximately \$1.66 billion per year.

Of course, it is possible that consumers in general and lower-income consumers in particular might increase their use of reusable bags in response to plastic bag bans without increasing the frequency with which they wash the bags. That would then likely result in a significant increase in food-borne diseases. If that were to happen, bag bans could be considered highly regressive.

Shoppers in the U.S. on average make around two visits to a grocery store each week. A recent survey by Edelman Berland suggests that each household typically uses each NWPP bag 14.6 times and each LDPE bag 3.1 times.<sup>31</sup> Assuming shoppers use three NWPP bags and three LDPE bags per grocery store visit, that would mean each household on average uses about 21 NWPP bags per year and about 100 LDPE bags per year.<sup>32</sup> If a NWPP bag costs \$1.15 (the number used by the San Francisco controller) and a LDPE bag costs \$0.25 (the bulk price on LDPE bags with the characteristics required by SB 270 is about \$0.21,<sup>33</sup> so this allows only a slim markup by retailers), the cost per household will be \$50 per year. That adds approximately \$613 million per year.

In addition, the main purpose for which households currently reuse HDPE bags is as garbage bin liners and for the disposal of animal litter and waste. Survey data suggest that about half of all NWPP bags are used for those purposes.<sup>34</sup> Where plastic bags have been banned, consumers have instead bought

alternative plastic bags (typically, small LDPE bags) for those purposes. It seems reasonable to assume that households would on average use about five such bags per week (i.e. about one-third the number of HDPE bags consumed by an average household) at a cost of about \$12 per household per year.<sup>35</sup> That would add approximately \$78 million statewide.

So, counting only the direct cost of purchasing additional bags and the opportunity cost of consumers' time (that is, not including the cost of water, electricity and detergent used in cleaning the bags), the cost to California's consumers of switching to reusable bags would be approximately \$2.35 billion.

The experience of San Francisco suggests that many (perhaps most) consumers are unlikely to switch to reusable bags. If shoppers realize the likely cost (especially including the opportunity cost necessary to avoid contamination) associated with reusable bags, the proportion using such bags would likely remain small. At 10 cents per paper bag, an average week's shop might cost \$1.50 in bags for an average household.<sup>36</sup> That's a saving of about \$2 per week compared to the total cost of reusable bags.

Even shoppers who intend to use reusable bags are likely often to end up using other types of bags, and may buy more from the store: In a recent survey by Edelman Berland, 40% of shoppers forgot their reusable bags.<sup>37</sup>

But averages often hide important details. Plastic bag bans likely have a disproportionate impact on lower income households. For such households, the cost of paper bags would represent a relatively larger proportion of income. At the same time, the opportunity cost of managing reusable bags would be lower and the cost of forgetting reusable bags higher, so they might be more likely to reuse such bags.

For a household of four people with one wage earner on minimum wage, the opportunity cost of reusable bags might be as low as \$0.25 per week,<sup>38</sup> though the direct costs of purchasing and washing renewable bags would remain about \$1 per week. This would make the net costs of reusing bags for such a household about the same as the cost of purchasing 12 paper bags at \$0.10 per bag. In addition, such a household would likely have to purchase additional garbage bin liners at a cost of perhaps \$0.25 per week.

By contrast, middle- and high-income households would be less likely to use reusable bags, especially once they realize the measures necessary to prevent contamination. However, some higher-income households may elect to use reusable bags in order to signal their environmental credentials. Given the high



opportunity costs of manually washing and drying bags, such households are likely to use cloth bags that can be machine washed. That might, ironically, be among the worst environmental outcomes, especially in California, due to the large amounts of water used during washing.

## Effects on Retailers

Under SB 270, retailers would no longer distribute HDPE plastic bags to consumers, no longer incurring a nominal expense for shopper convenience and practical use, “free” to the consumer. Since the free distribution of such bags represents a cost to retailers, this cost would be reduced. In addition, the introduction of mandatory fees on paper, compostable and reusable bags will increase retailers’ revenue, both through sales of these bag types and through increased sales of garbage can liners.

However, this would likely be offset in part by the need to change bagging processes and systems and also likely increases in the amount of time taken to bag items. Moreover, for many retailers, reusable bags represent a security risk, a theft risk and a liability risk. The security risk arises from the potential for reusable bags to be used to hide weapons. The theft risk arises from the potential to use such bags to hide stolen goods. These risks mean stores will likely have to increase expenditures on security and theft prevention.<sup>39</sup> The liability risk arises from the possibility that inadequately washed bags will contaminate food purchased by other customers, who then sue the store. (Another potential liability issue pertains to the risk of injury to customers and store workers from lifting heavy, fully laden reusable bags.<sup>40</sup>)

## Conclusions

Proponents of SB 270 and of California’s various shopping bag ordinances claim that banning HDPE plastic bags and charging for paper bags will result in significant environmental benefits. This brief shows that, to the contrary, banning plastic bags is likely to result in increased use of non-renewable energy resources, increased emissions of greenhouse gases, and increased use of water. At the same time, they are unlikely to reduce litter, litter collection costs or waste management costs significantly. And they would have no discernible impact on marine animals.

The various shopping bag ordinances already enacted impose considerable costs on consumers, forcing them either to pay for paper bags or to spend precious time washing, drying and managing reusable bags. SB 270 would extend these costs to cities and counties that so far have chosen not to impose expensive and counterproductive restrictions on shopping bags. Statewide, SB 270 and the many ordinances that are “grandfathered” in are likely to impose costs on consumers of over \$1 billion and possibly close to \$3 billion.

## About the Authors

**Julian Morris** is vice president for research at the Reason Foundation and a visiting professor at the University of Buckingham (UK). Before joining Reason, Julian was executive director of International Policy Network, a London-based think tank which he co-founded. Before that, he ran the environment and technology program at the Institute of Economic Affairs.

Julian graduated from Edinburgh University with a degree in economics. He then took an MSc in environment and resource economics at University College London and an MPhil at Cambridge University, where his thesis looked at the economics of waste management. Julian is the author of dozens of scholarly articles and the editor of several books, including *Sustainable Development: Promoting Progress or Perpetuating Poverty* (Profile Books, 2002). He also co-edits, with Indur Goklany, the *Electronic Journal of Sustainable Development* ([www.ejsd.co](http://www.ejsd.co)). His research focuses on the relationship between institutions, economic development and environmental protection.

**Lance Christensen** is director of Reason Foundation's Pension Reform Project. Before joining Reason, Lance spent nearly a decade working as a legislative consultant in the California State Senate and as a finance budget analyst for the Department of Finance. Christensen worked on implementing Assembly Bill 32—the Global Warming Solutions Act, improving the Green Chemistry Initiative regulatory process, and proposed reforms of the California Environmental Quality Act.

Lance graduated from Brigham Young University with a Bachelor of Arts degree in English and received a Master of Public Policy degree, with an emphasis in international relations, from Pepperdine University. Lance is based in Sacramento, California.

## Endnotes

- <sup>1</sup> *History of the Plastic Bag*, not dated, SPI (the plastics industry trade association). Available at <http://www.plasticsindustry.org/IndustryGroups/content.cfm?ItemNumber=521>, accessed September 9, 2013.
- <sup>2</sup> *Keep America Beautiful, National Visible Litter Survey and Litter Cost Study*, (Stamford, CT: Keep America Beautiful, 2009). Available at: [http://www.kab.org/site/DocServer/Final\\_KAB\\_Report\\_9-18-09.pdf?docID=4561](http://www.kab.org/site/DocServer/Final_KAB_Report_9-18-09.pdf?docID=4561), accessed 6/11/2014.
- <sup>3</sup> The KAB study also notes that while metal, glass, paper and beverage carton litter decreased significantly, litter from plastic increased. This likely reflects a shift to the use of plastic in everyday products in place of glass, metal and paper. Since neither glass nor metal are readily biodegradable and are also capable of causing problems when lodged in storm drains, it is not clear that there is any reason to be specifically concerned about the increase in plastic litter relative to those items. (One caveat: plastic tends to be lighter than the metal and glass materials it replaces, which has obvious merits in terms of reducing transportation costs, but may also increase the likelihood of it being transported into storm drains and generally away from highways.) Meanwhile, to the extent that plastic has replaced paper for certain uses (such as grocery bags), there would seem to be an obvious trade-off, since, as noted, HDPE bags are particularly useful as repositories for litter, in a way that paper bags are not (since paper bags are ill-suited to contain items that are damp or may leak, such as half-eaten cartons of yogurt and unfinished drink cans).
- <sup>4</sup> National Oceanic and Atmospheric Administration, *Frequently Asked Questions: All about Marine Debris*, October 2009, p.2.
- <sup>5</sup> Oprah Winfrey, Oprah Winfrey Show, April 22, 2009.
- <sup>6</sup> National Oceanic and Atmospheric Administration, “What We Know About the ‘Garbage Patches’,” July 2011. Available at <http://marinedebris.noaa.gov/sites/default/files/gpposter.pdf>, accessed May 7, 2014.
- <sup>7</sup> Alexi Mostrous, “Series of Blunders Turned the Plastic Bag into a Global Villain,” *The Times*, March 8, 2008. Available at: <http://www.thetimes.co.uk/tto/environment/article2143689.ece>, accessed May 7, 2014.
- <sup>8</sup> The study is: John F. Piatt and David N. Nettleship, “Incidental Catch of Marine Birds and Mammals in Fishing Nets off Newfoundland, Canada,” *Marine Pollution Bulletin*, Vol. 18 no.6B, pp. 344–349, at p.348. It was cited by Environment Canada: *Marine Debris in Canada: Facts and Figures*, December 2002, available at <http://web.archive.org/web/20021218022816/http://www.ec.gc.ca/marine/debris/ENG/Facts.htm>, accessed September 16, 2013, which in turn was cited by Nolan-ITU, “Plastic Shopping Bags—Analysis of Levies and Environmental Impacts, Final Report, Department of the Environment and Heritage, Government of Australia, 2002, at p. 30, (<http://web.archive.org/web/20041111133541/http://www.deh.gov.au/industry/waste/plastic-bags/pubs/analysis-final.pdf>, accessed May 7, 2014)
- <sup>9</sup> Mostrous, “Series of Blunders Turned the Plastic Bag into a Global Villain.”
- <sup>10</sup> EPA, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States Tables and Figures for 2010*, (Washington, D.C.: U.S. Environmental Protection Agency, 2011), Table 7. Available at: [http://www.epa.gov/waste/nonhaz/municipal/pubs/2010\\_MSW\\_Tables\\_and\\_Figures\\_508.pdf](http://www.epa.gov/waste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf), accessed 3/12/2014
- <sup>11</sup> Ibid.

<sup>12</sup> Ibid.

<sup>13</sup> Ibid., Table 4.

<sup>14</sup> Ned Potter, “Saving the World, One Plastic Bag at a Time,” *ABC News*, March 8, 2007. Available at <http://abcnews.go.com/Technology/story?id=2935417>, accessed May 7, 2014.

<sup>15</sup> Jared Spaniol, Jack Rulander and Mike Leo, “Polypropylene,” February 2007. Available at: <http://www.personal.psu.edu/users/j/m/jms5157/Polypropylene%20Paper%20Part%20I.pdf>, accessed May 7, 2014.

<sup>16</sup> Julian Morris and Brian Seasholes, *How Green is that Grocery Bag Ban?*, (Los Angeles: Reason Foundation, 2014).

<sup>17</sup> This is almost certainly a low estimate, since the vast majority of documented reuses are for items that would otherwise have entailed using another bag of some kind.

<sup>18</sup>  $3.8 \times 1.6 = 6.1$

<sup>19</sup> <http://www.slideshare.net/EdelmanBerland/reusable-bag-study-results>

<sup>20</sup> Ibid.

<sup>21</sup>  $22.9 \times 1.6 / 1.2 = 30.6$

<sup>22</sup> <http://www.slideshare.net/EdelmanBerland/reusable-bag-study-results>

<sup>23</sup> We relied upon an analysis by the Chico Research Foundation to make inferences regarding the water used during the “cradle to gate” stages of NWPP bags. (See Joseph Greene, *Life Cycle Assessment of Reusable and Single-use Plastic Bags in California*, California State University Chico Research Foundation, January 2011, available at [http://www.trueusablebags.com/pdf/lca\\_plastic\\_bags.pdf](http://www.trueusablebags.com/pdf/lca_plastic_bags.pdf), accessed May 7, 2014). Since the California Department of Health recommends “frequent” washing of reusable bags, we assumed half the bags should be washed each time they are used.

<sup>24</sup> The estimates of non-washing water consumed assume the base amount estimated by Bousted Consulting’s LCA for HDPE but use the relative amounts found by Ecobilan-PWC’s LCA.

<sup>25</sup> Kimberly Repp and William Keene, “A Point Source Norovirus Outbreak Caused by Exposure to Fomites,” *Journal of Infectious Diseases*, 2012, pp. 1639–1641, available at: <http://jid.oxfordjournals.org/content/205/11/1639.full.pdf+html>, accessed 5/27/2014

<sup>26</sup> See e.g.: <http://www.usatoday.com/story/news/nation/2014/01/06/reusable-grocery-bag-germs/4341739/>, accessed 5/27/2014.

<sup>27</sup> David L. Williams, Charles P. Gerba, Sherri Maxwell and Ryan G. Sinclair, “Assessment of the Potential for Cross-contamination of Food Products by Reusable Shopping Bags,” *Food Protection Trends*, Vol. 31(8), 2011, pp. 508–513. Available at [http://www.foodlegal.com.au/uploads/Cross%20contamination%20of%20reusable%20shopping%20bags\\_i171.pdf](http://www.foodlegal.com.au/uploads/Cross%20contamination%20of%20reusable%20shopping%20bags_i171.pdf), accessed April 24, 2014.

<sup>28</sup> <http://www.slideshare.net/EdelmanBerland/reusable-bag-study-results>

<sup>29</sup> Ron Chapman, “Practical tips for the use and care of reusable grocery shopping bags,” California Department of Public Health, no date. Available at: <http://www.cdph.ca.gov/pubsforms/Documents/fspnu04ReusableBags.pdf>, accessed May 13, 2014.

<sup>30</sup> Assuming the household income is derived from the household working for 40 hours per week, 50 weeks per year, average hourly household income is \$30.70.

- <sup>31</sup> <http://www.slideshare.net/EdelmanBerland/reusable-bag-study-results>, accessed 5/21/2014.
- <sup>32</sup>  $6x2x52/14.6=42.74$
- <sup>33</sup> Such as the larger bags here: [http://www.papermart.com/glossy-soft-loop-plastic-handle-bags/id=42336?origin=product\\_ads&id=7717040&Product\\_Type=Bags&utm\\_source=google&utm\\_medium=adwords&utm\\_campaign=product\\_ads&gclid=CN2t7LSm4L4CFWNqOgod4VMAjQ](http://www.papermart.com/glossy-soft-loop-plastic-handle-bags/id=42336?origin=product_ads&id=7717040&Product_Type=Bags&utm_source=google&utm_medium=adwords&utm_campaign=product_ads&gclid=CN2t7LSm4L4CFWNqOgod4VMAjQ).
- <sup>34</sup> <http://www.bagtheban.com/assets/content/bag-recycling-signage-testing.pdf>
- <sup>35</sup> 500 trash can liners currently can be purchased online for about \$25 including shipping.
- <sup>36</sup> Assuming the average shopper would need 15 paper bags to carry the same amount as 12 reusable NWPP bags.
- <sup>37</sup> <http://www.slideshare.net/EdelmanBerland/reusable-bag-study-results>, accessed 5/21/2014.
- <sup>38</sup> Assuming as above that consumers spend five minutes per week managing their reusable bags and assuming that in the case of a household with only one wage earner the opportunity cost is one-third of the wage earner's wage.
- <sup>39</sup> Safeway has already introduced some additional security measures, such as receipt checkers at the exit of some of its stores in locations where plastic bags have been restricted. See: <http://www.washingtoncitypaper.com/blogs/housingcomplex/2011/11/01/safeway-bag-tax-causes-theft/>
- <sup>40</sup> Anthony van Leeuwen, "Negative Health an Environmental Impacts of Reusable Shopping Bags," December 2012, Available at: [http://fighttheplasticbagban.files.wordpress.com/2013/04/negative\\_health\\_and\\_environmental\\_impacts\\_of\\_reusable\\_shopping\\_bags.pdf](http://fighttheplasticbagban.files.wordpress.com/2013/04/negative_health_and_environmental_impacts_of_reusable_shopping_bags.pdf), accessed 6/5/2014.