

Plastic Bags:



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October 23, 2017

Dr. Erin McCance

Instructor

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Re: Negative Effects of Plastic Bags on the Environment

Dear Dr. McCance,

Attached herewith is our report on the Negative Effects of Plastic Bags on the Environment. The aim of this report is to investigate the effects that plastic bags have on the environment; from production to waste. The report examines the composition of plastic bags and how it affects the environment, what production entails and how it affects the environment, as well as its afterlife, and how plastic waste affects the environment. And finally, some solutions that can be considered.

Our team has put together a detailed account of the literature pertaining to the Negative Effects of Plastic Bags on the Environment. Through the investigation of publicly available materials and based on discussions within the team, we have put forth a summary of the literature. We look forward to receiving a response from you on your thoughts with respect to the attached report and can present our report findings for you soon. Please contact me at your convenience if you require any other information at this time.

Best regards,

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Environmental Studies
Focus: Environmental Assessment

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ACKNOWLEDGEMENT

Our team would like to acknowledge Kristina Hunter who has had to step down from being the course instructor due to medical reasons. Kristina has been awesome, supportive and impeccable. We greatly appreciate her service and devotion and wish her a very speedy recovery. We would like to acknowledge our new instructor; Dr. Erin McCance who has had to step in for Kristina, we appreciate your effort.

We would like to appreciate the Department of Environment for granting the opportunity to take this highly informative course as well as, making its contents standard enough to properly equip us to weather the challenges ahead and blaze the trail.

Finally, we would love to appreciate our parents who have always been there with and for us from inception. Their love, care and support is truly and greatly appreciated.

EXECUTIVE SUMMARY

This report looks at the ever-persisting problem of plastic bags, of which ever since its inception has been a torn in the flesh to the environment. A brief background would be provided on the subject matter; how it came about as well as its usage. Where the most issues with plastic bags lie is in its disposal stage, that is, when it becomes waste. A good examination is done on the pollution that is released to the environment from plastic waste. But pollution is not only wrought during its waste stage, but also during its production. A good examination is done on how the production of plastic bags can pollute the environment and even lead to climate change. The pollution from production is also found to affect human health.

Still on the detrimental effects which plastic bags have been found to have on the environment, we look at the effects it has on the earth's lower life-forms, particularly animals. Both marine and terrestrial. We then examine two disposal methods as well as their implications to the environment. Finally, solutions to the problem, as well as alternatives are presented.

INTRODUCTION

This report has its theme centered on plastic bags. Not just a general history of plastic bags, but the negative effects that these items and its production have had on the environment, both physical and social. The introduction of plastic bags to society can almost be likened the Arabian Camel, who requested for only a foot hold space in the tent of its master, and when offered the space, put its entire body in the tent, and thus, kick the master and his belongings out of the tent. Plastic bags are in the process of kicking not just us, but especially lower-forms of life (animals) out of their natural habitat. The major problem with plastic bags is in its waste state, where it causes all sort of environmental problems. Of which we will delve into as we proceed in this report. Notwithstanding, the pollution that emanates from the production of plastic bags cannot also be overlooked, and will be touched on in the report.

1.0 THE PLASTIC BAG

The rationale behind the manufacturing of plastic bags, was supposed to assist and aid consumers and was built as a go-to-convenience kit, however, that has now turned sour as they now pose to be highly detrimental to the environment. Prior to the late 1970's, paper bags were used by shoppers as the main medium for carrying out their goods after purchase. In 1977, the first conventional plastic bag was produced, and quickly became a staple to societies around the globe for convenience while transporting consumer goods from the supermarket or retail store to the home. Engineered for convenience, the plastic bag is water resistant, easy to carry and undergoes a single utilization method where it can simply be discarded afterwards. Serving its purpose as a single-use plastic bag, the



Fig. 1 The Age of the Plastic Bag: <https://inhabitat.com/files/bags2.jpg>

average one is used for a span of 12 minutes before it becomes obsolete and ready to be discarded as waste. The pollution does not only include disposal, but production as well. Today, plastic bags are being produced and used at a frequent rate

of approximately 500 billion to 1 trillion annually. As a single-use bag, this means that 500 billion to 1 trillion plastic bags have been building up and damaging our environment each year (Warner, 2010). As a symbol of convenience, the plastic bag will continue to have a consequential outcome on the environment and wildlife.

2.0 POLLUTION: LITTER

A description of materials that are released into the natural environment which are capable to causing adverse alteration is pollution. It describes substances or materials that are released into the atmosphere, hydrosphere or lithosphere that have the ability to

disrupt the health of ecosystems. A disruption can be in the form of physical obstructions, like obstruction of the natural flow of a stream blocked by garbage pile or obstruction in the digestive track of an animal after eating bits of plastic and choke on them, or even as chemical obstruction, like toxins being carried into the environment.

Plastic is an extremely common component in pollution today, demonstrated by the sad fact that a very huge percentage of ocean debris is plastic, and because plastic is relatively cheap to manufacture, it is produced in staggering volumes after which, it is



Fig 2 Blooms of Plastic Debris in Ocean:

http://www.firmm.org/files/firmm/news/2013/08/07-traenen_der_meerjungfrau_landen_auf_unseren_speisetellern.jpg

frequently discarded as litter. Another area plastic litter can have a devastating effect on the environment is to wildlife, and it can affect them in many ways. Plastic bags and materials many a time carry scents that easily appeal to animals, and thus attracting them to eat the plastic. A huge number of animals of all kinds – ranging from sea turtles to albatrosses to camels – die each year from the ingestion of plastic

bags. The plastic material gets stuck and becomes permanently lodged in the animals' digestive tracts, and as a result blocks the food passage and causes death either by starvation or infection. Other animals die from being entangled in plastic fishing lines and sometimes by get trapped inside plastic bottles or containers. In the sphere of commercial composting; plastic litter has posed a major challenge. Organic refuse collected from homes and small businesses arrives at commercial facilities and brings a huge volume of plastic contaminants such as plastic bags.

2.1 Emissions

Plastic bags are mainly made up of fossil fuel materials like oil and natural gas. The extraction of these materials from the earth leads to the release of toxic emissions. As we already know, the drilling of oil and gas from the earth releases tons of toxic pollutants into the atmosphere, including pollutants like carbon monoxide, sulfur dioxide, hydrogen sulfide, ethylbenzene, benzene, particulate matter, xylene, ozone, toluene, and volatile organic compounds. To add icing on the cake, through the process of fossil fuel extraction from the earth, methane gas which has a far stronger trapping capacity than carbon and most greenhouse gases can leak into the atmosphere from drilling sites. The production of plastic bags as we see can contribute greatly to global warming.



Fig 3 GHGs Emitted into the Environment from Plants:
http://www.davidsuzuki.org/blogs/panther-lounge/assets_c/2012/07/Coal%20emissions-shutterstock_7538230-thumb-1000x669-3598.jpg

These petrochemical plants have adverse deleterious effects to communities. Emissions from extraction is one thing, but emissions from refining and processing the fossil fuels into plastics is another thing, and has the ability to create even more toxic emissions. A classic example is the emission of dioxins from PVC plants, which are well-known carcinogens that bioaccumulate in humans and wildlife, not only that, but are also

associated with reproductive and immune system disorders. On the other hand, the production of supposedly “clean” plastics like PET, which is used to create clear plastic water bottles, entails the use of chemicals like paraxylene, which is derived from the highly carcinogenic chemical benzene, which is also derived from crude oil during the refining process at the refineries.

2.2 Petroleum Composite: A Finite Resource

As we have discussed, most plastic bags are made up of fossil fuel composites like oil and natural gas which are extracted from the earth. It has been established that the processes of extraction of the fossil fuels from the ground and processing the fossil fuels into plastic bags involve a lot of hazardous emission into the environment. Apart from the release of toxins and contaminants into the environment, there is also a depletion of natural resource. Petroleum which is used to make these bags is a natural resource, and not just a natural resource, but a finite one for that matter. This simply means that petroleum can be depleted, and the time it takes to renew itself is more than human lifetime. So, if we continue to deplete this resource for the purpose of making plastic bags in addition to what is already depleted for energy generation, we will be compounding the problem of oil depletion. Plastic bags do contribute to petroleum depletion.

3.0 PERSISTENCE

Plastic bags have been accumulating around the globe for thirty years now ever since the single-use bag was first produced in 1997. When disposed into landfills, plastic bags, along with everything else thrown away will be buried and very unlikely to decompose.



Fig 4 Detrimental Effect Plastic Persistence on Environment:
http://i.dailymail.co.uk/i/pix/2008/02_04/005plasticbag1DM_468x558.jpg

Although, still polluting the environment, the bags remain centralized and controlled, and unlikely to pose as an imminent threat to wildlife and other ecosystems. When the bags are not disposed of properly they have many negative effects on the environment. The light weight bags imitate a sail in the wind and can be picked up off the ground in the streets, parking lots, garbage bins and even landfills where they are carried great distances away from the source, often ending up in water ways. Taking approximately 1000 years for the conventional plastic bags to decompose, all plastic bags ever made persist scattered and clustered throughout the

globe. Plastic bags do not biodegrade, instead the bags photodegrade. This is the process where ultraviolet rays penetrate the bag causing it to become brittle. The bag then breaks down into smaller and smaller fragments (Warner, 2010). This process is more likely to occur in a terrestrial environment rather than in a marine environment due to temperature differences and ultraviolet ray accessibility. As with all plastics, the bags pollute and form hazards creating adverse effects on the different marine and terrestrial ecosystems.

3.1 Terrestrial Effects

Plastic bags have very often been found lingering all around cities where they are caught in trees, littered on the ground, or rolling on the streets. Not only do they impair the visual aesthetics of the surrounding environment, they also pose as a threat to the health of the



Fig 5 Plastic Bag Seen Clustering City Drainage:
http://www.factorydirectpromos.com/wordpress/wp-content/uploads/2013/08/plasticbag_gutter.jpg2.jpeg

environment. The photodegrading of these plastic bags causes them to breakdown into small fragments in most terrestrial environments. The breakdown of the bags may also be as a result from various human activities. All the various conditions and shapes the plastic bag persists in, makes its threat to the environment more dynamic in nature. Some of the effects caused by plastic bags on terrestrial life include increased risk of flooding when they act as barriers to storm drains, choking hazards to various animals,

and further pollution as they act as toxins in the ground – this will be further expatiated on in the coming sections of this report.

3.1.1 Toxins in Soil

The degrading process of the single-use plastic bag causes it to be broken down into smaller and smaller pieces. The smallest of these pieces can't even be seen with the naked human eye. With the life expectancy of a plastic bag to be basically infinite, some scholarly literature says approximately a thousand years, these plastic pieces will persist in the soil for an unsettling amount of time. With more plastic bags continuing to be filtered through the environment the fragments found in the soil will continue to accumulate and cause harm. These fragments are harmful as they remain a toxic substance even after



Fig 6 Plastic Bag Litter Sip into Soil: <http://s1.firstpost.in/wp-content/uploads/2014/12/plastic-bags-AFP.jpg>

being broken down into smaller plastic bits. Now scattered throughout the soil, the toxins leach into the ground hurting the integrity and contaminating the environment. In communities around the world, more extreme circumstances exist. Plastic bags dominate and cover the land creating an environment where they are not only just toxic plastic

particle in the soil, but an abundance of plastic bags covering the soil. This will deprive the land of oxygen, sunlight and other necessary nutrients needed in order to prosper.

3.1.2 Choking Hazards

The lightweight nature of plastic bags causes them to be easily transported by aeolian and hydraulic agents and deposited far from the original source. Both animals within and outside city limits are victims of the hazards from single-use plastic shopping bags. After the photodegrading process, the small toxic plastic fragments may cause serious choking

hazards. The dispersed fragments can also be a result of plastic bags being driven over by cars and lawn mowers. The small fragments found in the ground are mistaken as food and accidentally ingested by animals. As a result, many animals die from these occurrences. Sudden deaths of certain species can have inadvertent ramifications within the ecosystem. Further consequences arise when the carcass of the slain begin to decompose, but the plastic bag responsible for the death stays intact. The plastic bag fragments remain and continues to be a peril to other animals within the vicinity.



Fig 7 Animals Feasting on Plastic Bag:
http://farm9.staticflickr.com/8247/8589805900_5ca400b4ee.jpg



Fig 8 Animal Carcass with Plastic Still Intact:
<https://www.elsevier.com/data/assets/image/0006/179664/albatross-thumb.jpg>

3.2 Negative Effects On Marine Life

At this juncture, we will now proceed to examine the negative effects that plastic bag waste pose to marine life. Such has been very dire, however, we believe a paradigm shift from business as usual that tilts to positivity in behaviour will change the present sardonic situation for the better.

3.2.1 Marine Animals

There is an adage that “plastic never goes away”, and it is more frequently being found in our oceans and washed unto our beaches. Plastic is very durable in nature, that even the Environmental Protection Agency reports that “every bit of plastic ever made still

exist". A lot of the ocean contaminants of plastic starts out on the land and is then driven by wind and rain into the ocean, and once in there, the accumulation is continuous. Because of the low density of plastic waste, they are easily and readily transported over long distances from the source areas and concentrates in gyres, systems of circling ocean



Fig 9 Sea Animal Ingesting Plastic Waste:

<https://ecochicccayman.files.wordpress.com/2013/03/turtle-eating-plastic.jpg>

currents, and all five of the Earth's major ocean gyres are obstructed with plastic waste. Just like the gyres, all the oceans too are polluted, from the equator to the poles, and from arctic ice sheets to the sea floor. A great number of animals die careless deaths from both eating and getting caught in plastic waste; from the minutest

sea animals to great white sharks. Fishes ingest tons of plastic every single year, this causes them intestinal injury which results in death. When death occurs, these fishes are preyed upon by bigger sea creatures, and thus transfers plastic up the food chain. Cases abound where Sea Turtles will mistake floating plastic waste for food. Sea turtles have also been found with soft plastic and ropes in their stomachs. The ingestion of plastic materials by these animals leads to a blockage in the gut, which leads to ulceration, which leads to internal perforation, which results in death. Another victim of plastic waste ingestion are Seabirds, as hundreds of them ingest plastic every year. This reduces the storage capacity of their stomachs, thereby causing the birds to consume less food and ultimately die of starvation. Parent birds mistakenly feed their chicks with plastic waste material which is mistaken for food, and as a result plastic pieces have been found in the stomachs of a lot of chicks. An estimate has it that about 60 percent of all seabird species have accidentally ingested pieces of plastic waste, and the number is tipped to increase by 2050 because the amount of plastic waste in our oceans has been on a rapid increase. Marine mammals fall victim of both ingesting plastic and getting entangled in them. Take for example, a large amount of plastic debris can be found in the habitat of an endangered specie: the Hawaiian monk seals, these debris also reach areas of their habitat that serve

as pup nurseries. Deaths because of entanglement are severely hindering the recovery efforts of these seals, a specie that is already on the brink of extinction. Another tragic case of the entanglement in plastic debris crisis is the endangered Steller sea lion, where entanglement has led to injury and mortality.

3.2.2 Negative Effects of Plastic Sea Debris on People

Pollution caused by plastic waste doesn't just only have a negative effect on marine species, but is also harmful to people. When plastic debris begin to float in the seawater, it absorbs dangerous polluting substances like DDT, PAH, and PCBs which are highly toxic chemicals that have a wide spectrum of chronic effects, which includes endocrine disruption and even cancer-causing mutations. It has been documented, that the



Fig 10 Shows Plastic Wastes Found in Major Ocean Gyres:
<https://wastewatchers.files.wordpress.com/2013/05/5-gyres.jpg>

concentration of PCBs in plastics which float in the ocean is about 100,000 to 1 million times that of surrounding waters. In the situation where animals eat these plastic pieces and debris, they toxins will be absorbed into their body and

then passed way up the food chain. Also, as plastics break apart in the water, they will release toxic chemicals like bisphenol A (BPA), which then enters the food web. In the normal scenario when fish and other marine animals mistake the plastic debris for food, they will ingest the particles and pass these toxic chemicals up through the food chain and ultimately to us through our dinner plates.



Fig 11 Kamilo Beach, Hawaii: https://lh3.googleusercontent.com/-dDvIBKm09cg/V0CN-jqoLr/AAAAAABNjs/Uvx7Dc_T-U0/w1200-h630-p-k-no-nu/kamilo-beach-16.jpg?imgmax=1600

Plastic pollutants also have detrimental effects on our economy, costing us huge sum of money spent in cleaning the beach, loss of tourism opportunities and even damages to fishing and the aquaculture industries. Today, the beaches and oceans have

been turned into landfills, and prime tourist destinations and hotspots are now littered with garbage. A perfect example of a destroyed beach is Kamilo Beach, which can be found in a remote corner of Hawaii, this beach is now known as “Plastic Beach” because of the tons of plastic debris that has accumulated and still accumulates on its shores.

4.0 DISPOSAL

We now proceed to looking at the various disposal techniques that are currently practiced. We will briefly examine the process and how it negatively affects the environment.

4.1 Landfills

According to Earth Institute, Columbia University, *“Today Americans discard about 33.6 million tons of plastic each year, but only 6.5 percent of it is recycled and 7.7 percent is combusted in waste-to-energy facilities, which create electricity or heat from garbage.”*

The rest of the plastic waste will eventually end up in landfills where they take an astonishing amount of time to decompose, up to 1,000 years, and in the process, will potentially leak pollutants into the soil and groundwater. A little amount of all plastic waste is recycled because of the variation with plastic types with different chemical compositions, and because recycled plastics can be contaminated when different types are mixed. One question is usually asked, and that is if plastics can biodegrade in a

landfill? It has been noted that there are several plastic products already out in the market that have been said to have passed the ASTM D5511 test for biodegradability.



Fig 12 Plastics in Landfill, Photo credit: *Arts Electronica*

To be made biodegradable, they use a certain additive called “EcoPure”, which is added to the material during the normal manufacturing process. This additive will not affect the strength of the product, however, If the product were to be recyclable to begin with, it remains so. But if placed in a landfill, it will biodegrade.

The problem with biodegradation of such plastic in a landfill is the production of “landfill gases” such as carbon dioxide and methane. All modern landfills today are made to install and operate landfill gas collection and control systems.



Fig 13 Plastics Heap in Landfill, Photo credit: *Samuel Mann*



Fig 14 Plastics in Landfill: <http://pebble.net.nz/cms/wp-content/uploads/2015/11/landfill-plastic.jpg>

Some ask if composting is better? But in opposition to popular understanding, composting sites likewise generate methane. It is

only in a few cases where the compost sites have ample controls set in place to receive and then filter the volatile organic compounds (VOCs) and methane that is generated. In a case where the landfill converts the methane generated to energy, then landfilling

would have been a preferred option. However, it is said that less than 10% of compost sites have these adequate controls set up because these controls are very expensive to implement.

4.2 Incineration

It is estimated that about 4% of plastic waste are incinerated in municipal facilities. The problem with incinerators is that trash incineration is highly polluting as it releases acid gases into the environment, carbon monoxide, particulate matter, nitrogen oxides, dioxins, metals, and furans, and at least 190 volatile organic compounds – of which many are not even monitored. So much rubbish is released into the environment in the name of incineration of plastic waste. As a matter of fact, the burning of trash is the most expensive solid waste management technology that exist today, with over a quarter of the capital costs spent trying to control the pollution from the incinerators. These facilities also have to support adjacent landfills, because about a quarter of the volume of plastic trash that is burned in incinerators remains as ash, which has to be disposed.

Except carried out under closely controlled condition, at very high temperatures, the burning of plastic can release over 90 different compounds into the atmosphere, including dioxins, as well as dangerous chlorine-based chemicals, and styrene-based toxins. Human exposure to these toxins can trigger skin diseases, reproductive problems, damage to immune system, liver damage, as well as cancer. Plastic is a durable substance and resists easy disposal.

Plastic is hard to recycle, it is noxious to burn, and bulky to transport. And once it is placed in a landfill, the actions of the elements such as the sun, wind, water, and time can break it loose and cause it to enter the environment again, but this time as pollution.

5.0 SOLUTIONS

Conventional single-use plastic bags have generated many negative environmental effects throughout the years. However, several options are available to reduce the damage from plastic bags. Besides recycling and proper disposal, acknowledging the harm of plastic bags on the environment is paramount to the solution. Once the issue has been accepted, effective strategies towards solving the problem can be created. These strategies can include developing programs for adults and youths, and educating them on the negative effects of the plastic bags on the environment. An important lesson may also include; teaching people that convenience is not the most important value in society. Further devising campaigns promoting sustainable development such as “Reduce. Reuse. Recycle.” to effectively create awareness of the issues. Other effective solutions are forming government legislations to reduce plastic bag use and promote alternatives to the constant use of plastic bags.

5.1 Regulations

Regulations have the capacity to develop and control plastic bag outputs and use within a society if the members cannot do so voluntarily. Once governments put forward legislation to regulate plastic bag use, consumers will have no choice but to comply. Involving government may be interpreted as extreme but, it simply shows the extent of harm plastic bags have had on the environment. Placing limits on the production of the plastic bags could significantly decrease emissions and use of finite resources. Implementing limits or fees on the distribution of the bags to retailers and shoppers can reduce consumer inclination to plastic bag use. Many countries have already gone forward implementing regulations on the single-use shopping bag. Some countries, such as China, have gone as far as banning the sales and production of plastic bags altogether.

5.2 Conventional Vs. Biodegradable

Biodegradable single-use plastic bags have been established as an eco-friendlier replacement to the conventional single-use plastic bag. It is a switch from petroleum based polymer to biopolymers which are biodegradable (Accinelli, 2012). However, still harmful in landfills. We know that the conventional plastic bags persist in the environment and do not degrade easily as they do not decompose. Studies have shown that biodegradable plastic bags deteriorate quickly in ideal conditions buried in soil or compost. Within three months noticeable deterioration can occur. However,



Fig 15 Biodegradable Plastic Bag: https://4.bp.blogspot.com/-P-0F60mfvNU/WaLvc6EPb-I/AAAAAAAAFTpg/w4_i9dv1Be09jHqGOSkZNEemrIvHXV2ACLcBGAs/s1600/bolsa-plastico-degradable-gallery.jpg

biodegradable plastic bags still seem to persist longer in the environment when buried only few centimeters underneath field soil and when submerged in water. Since the destination of the majority of plastic bag terminates in the ocean, where it is submerged in water, and the effects of the biodegradable bags are still unknown to marine sediments and plant, it remains not

a strong solution to environmental issues.

5.3 Alternatives

Alternatives that may eventually cause plastic bags to become obsolete will be the most successful. One of the first steps of this action plan will be voluntary lifestyle changes to replace plastic bags. The reduction or elimination on the demand for plastic bags that will prevent additional damages to the environment. These alternatives include reusable fabric bags when shopping at supermarkets and retail stores; fabric or mesh bags that are ideal for produce or items in bulk; and, using plastic or glass containers when storing food and other objects at home. There are also many practices that utilize plastic bags already existing in the environment. Such practices are usually taken on by artisans in the countries of the world that are most affected by the pollution of plastic bags. Their work includes the weaving of plastic bags into baskets and other useful textiles. By

adopting some of the various sustainable methods listed above will help manage and decrease the negative effects of plastic bags in the environment.



Fig 16 Reusable Fabric Bag: <https://www.familyhandyman.com/wp-content/uploads/2017/06/DFH17APR020->



Fig 17 Weaved Bag: <https://inhabitat.com/wp-content/blogs.dir/1/files/2016/09/crochet-plastic-bags-sleeping-mats-1-537x403.jpg>

6.0 CONCLUSION

In conclusion, society's dependency on single-use plastic bags of any sort directly generates and pumps a wave of detrimental effects to the environment. The effects of plastic bag pollution range throughout its life cycle from the start of production to the disposal and release into the environment. Emissions, contamination, and hazardous by-products are only some of the consequences caused from the use of plastic bags. As stated earlier in the report, plastic bags were produced to create benefits for the consumer like adding convenience to one's shopping experience. However, the negativity clearly supersedes the benefits. Biodegradable plastic bags were also brought forward as a solution, but showed little improvement in the light of the more extensive harmful effects. Some countries have even gone as far to banning the product entirely to impose this notion. This mitigation strategy will be the most effective in the objective of reducing or even eliminating the deleterious footprint plastic bags have left on the environment.

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