A Qualitative Life Cycle Analysis of a Grocery Bag

Riley Williams, Simon Fraser University

Course Information

This paper was originally written for Pascal Haegeli's REM 100 course, Global Change. The assignment asked students to conduct a Life Cycle Analysis of a paper, plastic or biodegradable grocery bag. The paper uses APA citation style. The assignment asked students to conduct a Life Cycle Analysis of a paper, plastic or biodegradable grocery bag. The paper uses APA citation style.

Abstract

This research investigates a life cycle analysis (LCA) of paper grocery bags to assess their social and environmental effects across raw material procurement, manufacturing, and disposal. It looks at the social consequences, including employment and community repercussions, and the significant environmental impacts of paper bag manufacturing, including energy and water consumption, emissions, and waste management. The report also emphasizes worldwide differences in regulatory policies and recycling inefficiency. The results encourage a rigorous evaluation of paper bags' usage and lifetime management as they provide a complex picture of whether they are a sustainable substitute.

Article

1. Introduction

Discussing whether paper or plastic grocery bags are better for the environment often takes centre stage in climate advocacy circles, but it overlooks an important fact: neither option is sustainable. The common belief that paper bags are better because they're biodegradable and made from renewable resources simplifies their actual environmental impacts. Paper bags have ecological challenges, including deforestation, energy-intensive production processes, and water usage. Additionally, the end-of-life stage for paper bags

requires a lot of energy for recycling or takes a long time to break down in landfills, making their overall advantage compared to plastic quite uncertain.

This divide between plastic and paper doesn't address the main problem: consumption and waste, particularly when looking at it through the lens of climate justice. Communities that are most affected by climate change, especially those that are marginalized and low-income, face the worst of these environmental issues. Still, they have little influence over the broader consumption habits contributing to these problems. True climate justice means focusing on solutions that completely cut down on waste, such as using reusable bags, which help reduce resource use when we use them regularly. Moreover, the success of reusable options hinges on how committed shoppers are to reusing them over time. This is a crucial change that requires everyone to take responsibility and have support from the systems in place.

This paper investigates the drawbacks of presenting paper bags as an environmentally friendly option compared to plastic. It shows that pushing for paper bags as a green choice takes away from the more significant aim of sustainable consumption. The focus should be on reusables as the best way to reduce waste, promote climate justice, and create a more equitable distribution of environmental benefits and challenges.

2. Production of grocery bag

2.1 Description of the production process of grocery bags

The first step in making paper bags is sourcing and harvesting timber. The bark is removed to make paper, and the lumber is milled into small chunks (Muthu, 2014). These wood pieces are treated with limestone and sulphurous acid chemicals to remove cellulose (Muthu, 2014). The cellulose will then be washed and bleached where required. Once dried, this product will be pressed and cut into its final form, paper (Muthu, 2014). In the case of paper bags, a spray application is applied, and possibly inks are used to add company names (Muthu, 2014). This final process has implications for the paper recycling industry since these final additions are required to be removed (Mirković, Bolanča, & Medek, 2024). Paper manufacturing facilities worldwide have adequate resources (forestry/freshwater) to support production (Esmaeeli & Sarrafzadeh, 2023). To better comprehend the size of this

industry, in 1999 in the USA, 14 million trees were used to produce 10 billion paper bags (Tripathi, 2014).

2.2 Environmental effects

Lumber used to make paper bags is considered a renewable resource, assuming the trees are replaced using sustainable practices. However, lumber is not the only product used in production. Enormous amounts of fresh water, energy, and other chemicals are required. One kilogram of fibre production requires 21.6 Milli-joules of energy and 300 litres of fresh water, producing 3.24 Milligrams of CO_2 (Muthu, 2014). Paper manufacturing is the world's third-largest water usage industry (U.S. Environmental Protection Agency [EPA], 2010), creating tremendous amounts of effluent in sludge. Some of this sludge can be treated and recycled into the paper-making process, but left untreated will hurt the local environment(Mirković, Bolanča, & Medek, 2024). Unfortunately, the most common practice is to use landfills for this waste product (Monte et al., 2009). In recent years, government regulation has been implemented by banning this practice, leading to less negative environmental impacts for this vital industry (Molina-Sanchez, Layva-Diaz, Cortez-Garcia & Molina-Moreno, 2018).

2.3 Social effects

Communities located near paper mills enjoy the beneficial aspects of employment either directly at the mill or as a secondary opportunity in areas such as forestry, transportation, re-forestry, tree planting and land management. In recent years, Indigenous communities have laid claim to forested lands, which has created conflict. One local example is the 2014 Supreme Court of Canada decision in Tsilhqot'in Nation v. British Columbia. This ruling recognized an Indigenous title over Indigenous community lands. This means that consent is needed from Indigenous groups before engaging in forestry operations on this land (Mandell Pinder LLP, 2014). In addition, the Fairy Creek protests on Vancouver Island displayed tensions between Indigenous land defenders and the forestry sector (Gordon, 2021). Many studies have documented the link between paper mills and environmental damage. Shakil and Mostafa (2023) conducted a survey analyzing mill effluent and its ecological impact. They determined that untreated waste may harm aquatic life and the local environment and made several recommendations based on their research. These included better monitoring, improved technologies, sustainable water resource management, and not using agricultural land.

3. End-of-life

3.1 Description of end-of-life situation for a grocery bag

Many, but not all, paper bags can be recycled and are biodegradable. Unfortunately, according to one study, only 10-15% of paper bags are recycled (Tripathi, 2014), and the bags that end up in landfills rarely decompose faster than plastic due to the lack of light and moisture (Tripathi, 2014). In BC, paper is collected curbside or dropped at a local recycling depot (Recycle BC). The paper is then sorted, shredded, and mixed with chemicals, similar to making paper products from pulp (Muthu, 2014). Paper bags weigh more than plastic and take up more space, so more resources are needed to transport this product (Muthu et al., 2011). More space is required if sent to a landfill, resulting in paper recycling using 91% more energy per pound than plastics, but the recycling rate for paper bags is higher than for plastics (Tripathi, 2014). Consumers have been encouraged and, in some cases, required to recycle paper products, which is encouraging behaviour, but the recycling process needs to be improved to enhance the recycling benefits.

3.2 Environmental effects

Bags are not created equal, meaning that some bags require glue for the finished product, some require that ink be used, staples may be used or perhaps a composition where recycling is not even an option, like paper bags made with any type of waxed paper additive. Recycling paper bags requires energy and chemicals almost on par with making a new bag; bags sent to the landfill can take almost as long as plastic bags to compost, assuming the composition is fully biodegradable (United Nations Environment Programme, 2020). Paper bags that are disposed of do not pose a significant health threat to children or wildlife, particularly compared to other bag products, particularly plastic bags (Tripathi, 2014). The available research does not consistently determine or demonstrate the true nature of environmental damage. There are many factors to consider: how the bags were initially made, their composition, whether the bags are soiled and thus unrecyclable, and whether there are recycling facilities everywhere paper bags are being used. What role does government regulation account for in the recycling and manufacturing processes for these products? Under ideal conditions, recycling paper bags is the optimal solution with the most benefit. However, paper bags should be viewed by the consumer much like plastics and be regulated with limited use as the life cycle and disposal/recycling process vary globally.

3.3 Social effects

As the environmental damage of the products used in everyday life becomes more apparent, society is starting to question the use of products that are the heaviest contributors. Plastic bags are being banned in communities, and shoppers are often offered paper bags or are encouraged to bring their reusable bags. It is unclear exactly how many times a paper bag needs to be used to minimize its environmental impact, but according to some studies, that number is between 3 and 43 times (Bisinella, Albizzati, Astrup & Damgaard, 2018). The likelihood of a paper bag being reused that many times is very slim; once a bag gets wet or tears, it can no longer be used. Consumers are not getting the complete picture of the impact of paper bags, the environmental effects of the original production, and the equally damaging effects of recycling.

4. Conclusion

Exclusively examining paper versus plastic to solve environmental issues is narrow-minded and keeps the focus on consumption, which is a significant component of the climate crisis. Paper bags are often seen as a more sustainable option but have critical environmental costs that individuals frequently ignore. Their production uses natural resources, adds to pollution, and depends on energy-heavy methods, while their disposal usually reflects the same inefficiencies and damage linked to plastics. The hidden costs affect how people see paper bags as a green choice and don't tackle the more significant problems that lead to waste and environmental damage.

To progress, we must go past simply arguing about paper versus plastic and start regarding reusables as central to sustainable practices. Using reusable bags regularly can cut down on the environmental impact that comes from single-use options. However, making this change happen needs more than just what one person can do; it requires changes in the system that make sustainable options easy to access. Climate justice emphasizes the need for fair solutions, considering how waste and pollution affect marginalized communities more than others. Reducing waste production at its source and promoting reusables is a significant step in tackling these inequalities.

The goal isn't to swap out one single-use item for another; it's about questioning the culture of disposability. Creating a future focusing on sustainability and fairness means we all must work together to choose long-lasting solutions instead of quick fixes. If we concentrate on using reusable items and promote a mindset of caring for the environment, we can get closer to a world where sustainability goes hand in hand with justice, helping both people and the planet.

References

Bisinella, V., Albizzati, P. F., Astrup, T. F., & Damgaard, A. (2018). Life Cycle Assessment of grocery carrier bags. Danish Environmental Protection Agency.

Esmaeeli, A., & Sarrafzadeh, M. H. (2023). Reducing freshwater consumption in pulp and paper industries using pinch analysis and mathematical optimization. Journal of Water Process Engineering, 53, 103646. https://doi.org/10.1016/j.jwpe.2023.103646

Gordon, H. (2021, April 9). The Fairy Creek blockade, explained from the ground. Capital Daily. https://www.capitaldaily.ca/news/fairy-creek-blockade-explained

Mandell Pinder LLP. (2014). Tsilhqot'in Nation v. British Columbia – Case Summary. https://www.mandellpinder.com/tsilhqotin-nation-v-british-columbia-2014-scc-44-case-summary/

Mirković, I. B., Bolanča, Z., & Medek, G. (2024). Impact of aging and recycling on optical properties of cardboard for circular economy. Recycling, 9(6), 112. https://doi.org/10.3390/recycling9060112

Molina-Sánchez, E., Leyva-Díaz, J., Cortés-García, F., & Molina-Moreno, V. (2018). Proposal of Sustainability Indicators for the Waste Management from the Paper Industry within the Circular Economy Model. Water.

Monte, M. C., Fuente, E., Blanco, A., & Negro, C. (2009). Waste management from pulp and paper production in the European Union. Waste Management, 29(1), 293–308. https://doi.org/10.1016/j.wasman.2008.02.002

Mostafa, G., & Shakil, S. Z. (2023). Characterization of Paper Mill Effluent and Its Impacts on the Environment. Journal of Chemistry and Environment.p.109-122.

Muthu, S.S., Li, Y. (2014). Life Cycle Assessment of Grocery Shopping Bags. In: Assessment of Environment Impact by Grocery Shopping Bags. EcoProduction, Springer.

Province of British Columbia (n.d.). Plastics. https://www2.gov.bc.ca/gov/content/environment/waste-management/zero-waste/plastics

Muthu, S. S., Li, Y., Hu, J. Y., & Mok, P. Y. (2011). Carbon footprint of shopping (grocery) bags in China, Hong Kong and India. Atmospheric Environment, 45(2), 469–475. https://doi.org/10.1016/j.atmosenv.2010.09.054

Recycle BC (n.d.). What Can I Recycle? https://recyclebc.ca/what-can-i-recycle-2/#1489678746756-a838ed57-c78d

Tripathi, J. G. (2014). COMPARATIVE STUDY OF PAPER BAGS AND PLASTIC BAGS. International Journal of Management and Social Sciences.

United Nations Environment Programme. (2020). Single-use plastic bags and their alternatives: Recommendations from Life Cycle Assessments. https://www.lifecycleinitiative.org/wp-content/uploads/2021/03/SUPP-plastic-bags-meta-study-8.3.21.pdf

WWF (n.d.). Pulp and Paper. World Wildlife Fund. https://www.worldwildlife.org/industries/pulp-and-paper

By submitting this essay, I attest that it is my own work, completed in accordance with Simon Fraser University regulations.