

Analysis of the Region-Specific Environmental and Social Impacts of Waste Management Strategies within Patagonia's Supply Chain

AUTHORS

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CLIENT

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OBJECTIVES

- Determine the region-specific social impacts of existing waste management methods for pre-consumer cotton, nylon, and polyester in Patagonia's supply chain.
- Conduct an analysis of the environmental impacts of existing waste management methods utilizing LCA data, including a comparison of greenhouse gas emissions produced during waste disposal in a landfill and incineration compared to emissions produced through mechanical and chemical recycling.
- Evaluate the magnitude of predetermined environmental and social impacts on communities local to manufacturers in Patagonia's supply chain - at a minimum, an analysis would be conducted for one of the countries they operate within and if time allows, a maximum scope would include each of their manufacturing facilities.

SIGNIFICANCE

The apparel industry alone accounts for 6.7% of global GHG emissions¹ with companies' supply chains being their largest source of emissions². In addition to GHG emissions, apparel production produces waste throughout its supply chain which has negative environmental and social impacts on local communities³. Textile recycling is in development, but is struggling to scale due to technical and economical hurdles⁴. Unlike clear plastic bottles, textiles require at least some chemical treatment to remove the dye and finishes, if not full chemical deconstruction (advanced recycling)⁴. Advanced recycling has higher GHG emissions than mechanical recycling, but this does not account for the fact that most waste that requires advanced recycling is currently landfilled or burned⁴.

This leaves companies like Patagonia choosing between their GHG emission reduction targets and protecting communities from waste buildup and pollution. It also highlights how GHG emissions are not the only metric to analyze when determining the full impact of a product. There are trade-offs to be considered and measured, especially in regards to the impacts to the communities that bear the burden of waste, such as soil and drinking water contamination from leachates, exposure to landfill gas, and a decrease in land value⁵. The results of comparing the end-of-life options of landfill, manual recycling, and chemical recycling and the social impact would benefit not just apparel companies, but any organization

struggling to justify the adoption of advanced recycled goods into their supply chain despite the higher GHG emissions when compared to rPET from plastic bottles.

BACKGROUND

Patagonia, a retailer of outdoor clothing located in Ventura, California, has a global supply chain. Currently, Patagonia works to minimize waste in the design and production of their products. According to their 2021 fiscal report⁶, they focus on designing and fabricating the highest quality products, using repairable or recyclable materials, and partnering with customers to take mutual responsibility in minimizing the impact of the use and end-of-life stages through repair, reuse, and recycling.

So far, Patagonia has quantified the amount of waste produced in the supply chain of their products, but does not yet know the region-specific impacts of their waste. They have focused efforts on using rPET from sources that are not clear plastic bottles. In doing so, their greenhouse gas emissions are increasing, which is in conflict with their reduction goals. Current LCA analyses of recycling lack information on the social costs to local communities when waste is landfilled versus recycled. This has led to two important questions: what is the impact of the waste to a community and does it vary by region? Knowing the answer to these questions will be a launching point for Patagonia to decide how to best process the waste and determine best practices for recycling textile waste. This project will focus on their most-used materials which are cotton, nylon, and polyester.

EQUITY

This project addresses environmental justice issues by focusing on better understanding the impacts of pre-consumer waste on the environment and people of the global communities that Patagonia's supply chain operates within. Patagonia's supply chain includes their factories and mills and of the 17 countries they fall within, 14 are within the Global South⁷. The Global South does not refer to countries simply south of the equator, but is a term used to describe countries that are low-income and politically or culturally marginalized, typically in Latin America, Asia, Africa, and Oceania⁸. While operating in the Global South, Patagonia engages in a range of due diligence activities to promote and sustain fair labor practices and safe working conditions, as well as environmental responsibility of the finished-goods factories, farms, and mills⁶. In doing so, Patagonia hopes to take this one step farther by addressing the impacts of waste and recycled products after they leave the factories. By better understanding what the impacts are, they can work to reduce their contributions to negatively impacting local communities and promote these efforts for other apparel companies.

DATA

Patagonia has material use and material identification data for all of their products and estimated waste per product type. This data includes waste totals by factory based on the goods produced there which can be used in tandem with waste management data based on Higg FEM modules for this project. Data will be shared from their product line management software and will contain the amount of material purchased, weight of material, and material content. This can be used to calculate the waste and impact by specific material type.

The client will also share the countries of production and assumptions based on factory disclosures to support data calculations, however students will need to research waste policies in the regions of operations to better understand common practices in waste management. The Social Hotspots Database (SHDB) will likely be used to fill in data gaps for regions that lack visibility of social impacts in product supply chains⁹. The SHDB incorporates data from 300 publicly available data sources and provides data on 133 indicators of social risks in countries and industrial sectors. Additionally, Patagonia will provide access to the Higg Index and LCA's that have been commissioned by them in the past. Students will receive this data when the project begins.

POSSIBLE APPROACHES

- **Data Collection and Calculations:** Utilize data provided by Patagonia and independent research on regional averages to quantify the amount of pre-consumer waste in the supply chain, categorized by the type of waste.
- **Landscape Research:** Conduct research on waste management programs to better understand the flow of waste that leaves Patagonia's operations in the communities where their operations exist.
- **Social Impact Analysis:** Utilize the SHDB and elements of the Social Life Cycle Assessment (SLCA) methodology to analyze the social impacts of waste in operation regions based on indicators of social risks in countries, such as health and safety, community infrastructure, and human rights.
- **Life Cycle Assessment:** Conduct a life cycle assessment (LCA) of end-of-life options for pre-consumer textile waste (advanced recycling, incineration, and landfill) of polyester, cotton, and nylon to identify the trade-offs of each option. This analysis would include the impact to local communities of each option by region.
- **Evaluation of Waste Management Methods:** Compare and contrast the calculated environmental and social impacts between disposal via landfill with that of recycling.

DELIVERABLES

In addition to the required Bren School deliverables, this group project should result in a:

- Comparative LCA of different waste management and intervention strategies.
- Report comparing the impact of leaving Patagonia's waste untreated in the regions where they produce their goods to the impact of recycling their waste in those regions.
- Recommendation that Patagonia can implement into its strategy to minimize the environmental and social impacts of their waste in all areas they operate, including steps for future SLCAs.
- Presentation of findings through a slide deck and, if time allows, a map or ShinyApp that demonstrates waste flow.

INTERNSHIP

Patagonia can sponsor one full-time summer internship with payment up to \$10,000 for the duration of the internship. The internship length and location will be determined with the clients closer to the summer. Please see the attached client letter of support for confirmation.

SUPPORTING MATERIALS

BUDGET AND JUSTIFICATION

It is not anticipated that the proposed project would require additional funding beyond the \$1,000 for project purposes and \$300 for printing contributed by the Bren School.

ACKNOWLEDGEMENTS

We would like to thank Richard Chen (Patagonia), who connected Karina with Ciara during a tour of Patagonia's headquarters. We would also like to thank Sean Kerr for providing preliminary guidance on the scope of the project and Dr. Roland Geyer for reviewing our proposal with thoughtful consideration to the recommended approach. We genuinely appreciate the support you each provided to make this project proposal a reality.

LETTER OF SUPPORT

Please see attached document.

REFERENCES

- ¹ Quantis. (2018). Measuring Fashion: Insights from the Environmental Impact of the Global Apparel and Footwear Industries study. https://quantis.com/wp-content/uploads/2019/11/measuringfashion_globalimpactstudy_quantis_2018.pdf
- ² Cummis, C., & Akopian, Y. (2019, June 25). How Fashion Companies Can Collaborate to Tackle Their Biggest Source of Carbon Pollution. World Resources Institute. <https://www.wri.org/insights/how-fashion-companies-can-collaborate-tackle-their-biggest-source-carbon-pollution#:~:text=However%2C%20the%20largest%20source%20of,the%20finished%20product%20is%20assembled.>
- ³ Enes, E., & Kipöz, L. (2020). The role of fabric usage for minimization of cut-and-sew waste within the apparel production line: Case of a summer dress. *Journal of Cleaner Production*, 248, 119221. <https://www.sciencedirect.com/science/article/abs/pii/S0959652619340910#preview-section-references>
- ⁴ N. Banakis, personal communication, January 5, 2023
- ⁵ Danthurebandara, M., Van Passel, S., Nelen, D., Tielemans, Y., & Van Acker, K. (2012). Environmental and socio-economic impacts of landfills. *Linnaeus Eco-Tech*, 2012, 40-52.
- ⁶ Patagonia. (2022, February 15). Annual Benefit Corporation Report. <https://www.patagonia.com/on/demandware.static/-/Library-Sites-PatagoniaShared/default/dw18ad9c7c/PDF-US/Patagonia-2021-BCorp-Report-Updated-2-15-22.pdf>
- ⁷ Patagonia. (n.d.). Factories, Farms and Mills. <https://www.patagonia.com/factories-farms-mills/>
- ⁸ University of Virginia College and Graduate School of Arts & Sciences. (n.d.). What/Where is the Global South? Global South Studies (University of Virginia, College and Graduate School of Arts & Sciences). <https://globalsouthstudies.as.virginia.edu/what-is-global-south>
- ⁹ Social Hotspot Database (SHDB). (n.d.). Themes and Data. <http://www.socialhotspot.org/for-more-information.html>



Group Project Committee
Bren School of Environmental Science & Management
University of California, Santa Barbara

January 24, 2023

To Whom it May Concern:

Patagonia is a retailer of high-quality outdoor apparel, with a Mission Statement that "We are in Business to Save Our Home Planet." Environmental matters such as waste, carbon, chemistry, and other aspects of our Product Footprint are our most actionable contributions to the climate crisis. These impacts, among others, are the subjects of short- and long-term R&D and exploration.

Please find this letter of support for the Bren School design project entitled, "Analysis of the Region-Specific Impacts of Waste within Patagonia's Supply Chain." Patagonia is happy to support this project, and we look forward to interacting in the near future. In addition, we are able to sponsor a summer intern up to \$10k.

Thank You,

A handwritten signature in black ink, appearing to be "Matt Dwyer", with a long horizontal line extending to the right.

Matt Dwyer

VP, Product Impact & Innovation

Patagonia, Inc.