Global Plastic Material Flow Characterizing Plastic Packaging and Plastics Lost to the Environment

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Motivation

In 2015, global plastic production reached over 388 million metric tons, all of which is ultimately bound to be recycled, incinerated, landfilled, or lost to the environment [1]. Annually, over 8 million metric tons of plastic waste are lost to the environment, causing tremendous harm to ecosystems of land and sea [1]. Initiatives to reduce plastic waste have gained much traction over the last five years, but the focus areas of such initiatives don't always align with notable positive impacts. However, through in-depth research focused on the major contributors to plastic waste pollution, guidance can be granted to plastic waste reduction efforts to maximize a positive impact.

Process

Background research & literature review → Data collection & analysis → Estimates & data organization → R-studio & Sankey diagram production

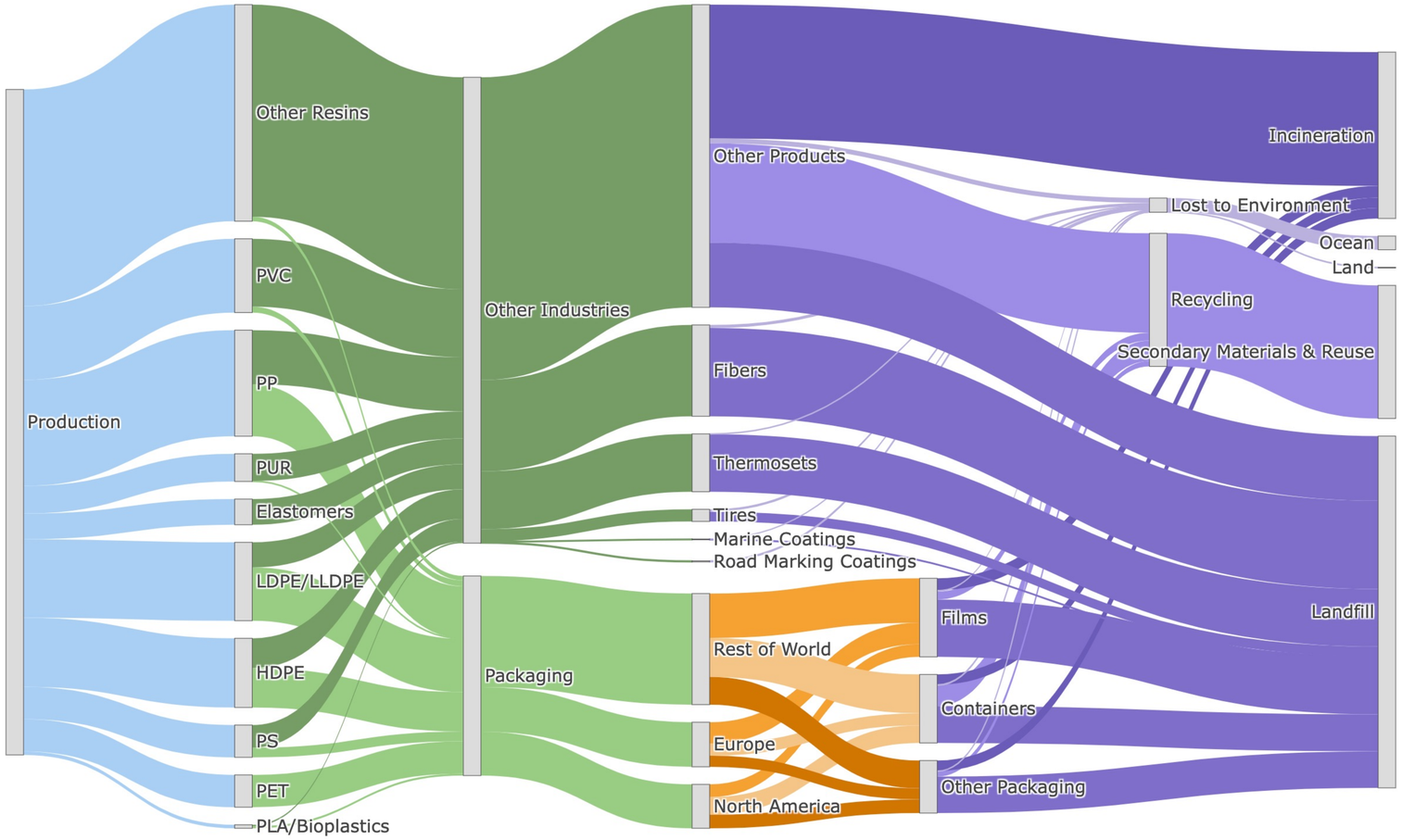
Material Flow Data

Category	Mass of Plastic (metric tons)
Production Total	388,173,501.00
Packaging Total	116,452,050.30
Other Industries Total	271,721,450.70
Incinerated Total	97,043,375.25
Lost to Environment Total	8,283,000.00
Recycled Total	77,634,700.20
Landfilled Total	205,212,425.55

Takeaways

- Plastic material flow data on a global scale is limited. Calculations relied heavily on the United Nations report.
- Although plastics that end up "Lost to Environment" only amounts to approximately 2%, addressing this loss is critically important [1].
- Approximately 30% of all plastic produced goes into packaging. Packaging is the largest industry consumer of plastic [1].
- Reducing demand for plastic production through decreased use has great potential to reduce plastic waste. Packaging is a significant contributor, but more research is required to better understand what types of packaging.

Results



Global Plastic Material Flow in metric tons, based on the year 2015 [1-4]
Flow arrow width corresponds to amount of mass, wider indicating more mass. The color coding signifies sections of the MFA. The intention of the color coding was to make the individual flows of the MFA easier to understand. The difference in color darkness is used to differentiate flows within the same section.

Abbreviations: PVC (polyvinyl chloride), PP (polypropylene), PUR (polyurethane), LDPE/LLDPE (low-density polyethylene), HDPE (high-density polyethylene), PS (polystyrene), PET (polyethylene terephthalate), PLA (polylactic acid).

Future Work

- Improve packaging specifications, alter categorization, detail more packaging types
- Incorporate recycling loops that flow back into an industry, accounting for products produced from recycled plastics
- Expand upon "Other Industries" category
- Further analyze data from various sources to improve calculated estimates

References

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4. Ritchie, H. and M. Roser, Plastic Pollution. Our World in Data, 2018.