The Environmental Injustices of PLA
Bioplastic Production

A Supplement to:

*Bioplastics Are Trash: The Unforseen Environmental Consequences of PLA from Production to Disposal*
Executive Summary

“Bioplastics” may sound too good to be true—materials that look, feel, and perform like conventional plastics, without some or all of the fossil fuel-based ingredients, and with less impact on the climate and Earth. And that’s because they are too good to be true: Most bioplastics contain or are coated with hazardous chemicals, drive pollution and greenhouse gas emissions, do not benignly break down, and perpetuate wasteful throwaway systems and single-use habits.

What’s more, just like conventional fossil fuel plastics, bioplastics also drive serious environmental injustices all along their production, transportation, use, and disposal pipeline. The environmental injustices of bioplastic production are, sadly, frequently understudied and underacknowledged and even denied by the industries, governments, and systems that churn out these toxic single-use materials. And that’s not surprising: bioplastics are overwhelmingly produced by the same corporations that have driven industrial production, pollution, and injustices of conventional plastics and plastics’ chemical additives.

As the urgency of real solutions to plastic pollution grows, the threat of bioplastics grows as corporations ramp up production and spread greenwashing messaging around their products—which are far from green and clean. To bring attention to the growing environmental justice threats of bioplastics, we explored the environmental injustices of one of the most popular bioplastics produced today, polylactic acid (PLA).

PLA Pollution: Driving Injustices, From Croplands to Landfills

There is major risk to anyone using PLA, but the biggest risks are felt by people living on the industrial fence lines of corn and sugar fields and PLA production facilities; as well as employees working on crop fields, inside the facilities, and wherever PLA products are disposed of. In the US, communities that are Black, Indigenous, of Color, rural, and low-income are disproportionately concentrated in areas targeted for industrial development and, as a result, are more regularly exposed to industrial pollutants.

Industrial farms are intensive users of chemicals, energy, plastic, and water; and sugar fields are commonly burnt before harvest, releasing smoke and ash into surrounding communities. PLA production can emit significant quantities of hazardous industrial chemicals—including acetaldehyde, acrolein, and hydrogen cyanide—into air, soil, and water. Because PLA facilities process many volatile chemicals, they are at risk of severe fires, explosions, and major releases of toxic gasses. Many of the emissions...
from PLA production facilities are known to cause cancer, disrupt hormones and reproduction, trigger respiratory diseases, and contribute to other serious health problems. When PLA is discarded in landfills and incinera\ortors, it similarly drives serious air, soil, and water pollution that damages human and environmental health, especially in fenceline communities.

Environmental Injustice, In Detail

1. a) “...biggest risks are felt by people living on the industrial fence lines…”
   b) “drives serious...pollution, especially in fenceline communities.”

“As tens of thousands of new chemicals have been synthesized, highly unequal patterns of exposure to pollution waste streams have resulted with communities living on the fenceline of such industries being particularly at risk of harmful exposures. The past four decades have brought to light the role of policies, land use decisions, regulations, and market-based forces in contributing to social inequalities in residential proximity to industry and resultant exposures to harmful chemicals that disproportionately impact low-income communities of color.” (Johnston et. al, doi:10.1007/s40572-020-00263-8)

“Fenceline communities are directly adjacent to or near industrial facilities and mobile pollution sources, placing residents at higher magnitude and duration of exposure to toxic pollution (i.e., air, water, and soil contamination)” (Aubourg et. al, doi: 10.3389/fepid.2023.1198321)

“Extensive scholarship has demonstrated that communities of color, low-income communities, and Indigenous communities face greater environmental and health hazards compared to communities with more White or affluent people [...] Despite the mountains of evidence that demonstrate the existence and significance of the elevated toxic social and environmental exposures experienced by these communities, the inclusion of these factors into chemical evaluations has been scarce.” (Fedinick et. al, https://doi.org/10.3390/ijerph18116002)

2. “...the biggest risks are felt by people living on the industrial fence lines of corn...”

“PM [Particulate matter]-related human health damages per tonne of maize produced [and] vary widely by location. High per-tonne damages come from maize produced in the Eastern Corn Belt (for example, Indiana, Michigan and Ohio), near major Central..."
Corn Belt metropolitan areas (for example, Chicago, Milwaukee and Minneapolis/Saint Paul) and to the east and south of the Corn Belt (for example, Pennsylvania, North Carolina and Texas). These higher-than-average impacts result from: (1) closer proximity of farms to the high population densities of urban centers; (2) lower yields than in the highest maize-producing regions; and higher use of animal manures as fertilizer, which can result in higher NH$_3$ emissions than synthetic fertilizers. [...]

![Illustrative results of PM$_{2.5}$ impact assessment using the top maize-producing county in each of the top five maize-producing states.](https://doi.org/10.1038/s41893-019-0261-y)

Although agriculture is known to impact air quality, our work shows that maize-dependent reductions in air quality are a surprisingly large source of harm to human health. The approach we have taken here can be extended to other food crops, animal agriculture and other countries, to better understand the full suite of health consequences of dietary choices.” (Hill et. al, [https://doi.org/10.1038/s41893-019-0261-y](https://doi.org/10.1038/s41893-019-0261-y))
3. a) “...the biggest risks are felt by people living on the industrial fence lines of...sugar”
   b) sugar fields are commonly burnt before harvest, releasing smoke and ash into surrounding communities

The area is home to migrant field workers from Central America and the Caribbean, as well as Black and Hispanic American families who have lived in the Glades for generations. “ (ProPublica: The Smoke Comes Every Year. Sugar Companies Say the Air Is Safe.)

“Each burn lasted less than an hour, but an average of 25 fields were burned every day in the four months analyzed by The Palm Beach Post and ProPublica. The practice disproportionately affects residents in Pahokee, Belle Glade and South Bay, where about a third of the population lives in poverty. The smoke rarely reaches wealthier, whiter cities like West Palm Beach. [...]

“To harvest over 50 percent of its US production, cane sugar producers set fire to approximately 400,000 acres of sugarcane fields in and around the Everglades Agricultural Area (EAA), affecting over 100,000 residents in and around Lake Okeechobee in South Florida. Every year, from October through May, the burning removes the leaves and tops of the sugarcane plant so only the sugar bearing stalk is harvested and processed. The result is devastating for nearby residents.

And yet, not all South Floridians are being impacted in the same way: sugarcane burning is disproportionately harming the health and economy of low-income communities and communities of color. Discriminatory burn regulations based on wind direction make sure more affluent communities to the east receive prioritized protection and are spared when the wind blows their way.

Meanwhile residents in and around the Glades, who are predominantly lower-income communities of color, are not spared. [...] the predominantly Black and Brown communities in western Palm Beach County, which are surrounded by over 75 percent of the total sugarcane acreage in Florida, disproportionately bear the harmful effects of sugarcane burning.” (Sierra Club: Stop the Burn: How Sugarcane Field Burning is Devastating Communities in South Florida)

4. “....the biggest risks are felt by people living on the industrial fence lines of...PLA production facilities”
CASE STUDY 1: Cargill/NatureWorks — Blair, Nebraska

- **Justice Map** (searched: Cargill/NatureWorks, 650 Industrial Park Dr, Blair, NE 68008)
  - Cargill/NatureWorks is a major producer of PLA in the US
  - Evonik, located nearby on Cargill’s site produces PLA-PEG (a PLA bioplastic-and-plastic material)
  - Note: Communities closest to the plant are primarily Latino even if industrial tracts on the whole are mostly white

  - The tracts that envelope the facility show up as primarily white, but the residences are further afield than the primarily Latino communities (denoted as Hispanic on the Justice Map) closer to the industrial operations

(From Justice Map, [http://www.justicemap.org/](http://www.justicemap.org/))
Note: The average income level within these industrial tracts per household spans $52,197 ± $12,633, as compared to areas immediately outside these tracts, which have average household incomes of between $76,597 ± $14,809, to $101,310 ± $7,302.

(From Justice Map, [http://www.justicemap.org/](http://www.justicemap.org/))

- See Census Data
- Search the Toxic Release Inventory: zip 68008
- See Toxic Release Data for facility-specific data

(From EPA TRI Toxics Tracker | Toxic Release Inventory, [https://www.epa.gov/toxics-release-inventory-tri-program](https://www.epa.gov/toxics-release-inventory-tri-program))

- Justice Map (searched: ADM Decatur Complex, 4666 Faries Parkway, Decatur, IL 62526)
  - In 2022, ADM and the Illinois Department of Commerce announced that ADM is set to establish two PLA production plants with LG Chem on ADM’s existing industrial property, called “The Demeter Project”
  - The industrial zone where this project is planned abuts a major Norfolk Southern rail hub (which serves to carry grains and chemicals by rail to ADM) and other industrial operations
  - Note: Communities closest to these industrial operations are multiracial and/or primarily Black

(From Justice Map, http://www.justicemap.org/)
Note: The average income level within these industrial tracts per household spans $20,699 plus/minus $7,683, to $47,637 plus/minus $8,381, as compared to areas immediately outside these and nearby industrial tracts, which have average household incomes of between $68,728 plus/minus $11,498, to $76,771 plus/minus $4,844.

See Census Data

Search the Toxic Release Inventory: zip 62526

See Toxic Release Data for existing ADM facility that would connect with new join LG Chem facility

(From Justice Map, http://www.justicemap.org/)

(From EPA TRI Toxics Tracker | Toxic Release Inventory, https://www.epa.gov/toxics-release-inventory-tri-program)
5. BIPOC, rural, and low income communities are overrepresented in areas targeted for industrial development and...are more regularly exposed to industrial pollutants

“In answer to the question 'Which came first?', our findings show that rather than hazardous waste Treatment, Storage, and Disposal Facilities (TSDFs) 'attracting' people of color, neighborhoods with already disproportionate and growing concentrations of people of color appear to 'attract' new facility siting. The body of distance-based research...suggests that government policies, industry practices, and community empowerment measures are needed to ensure fairness in the siting process and to address disparities in risks associated with existing facilities.” (Mohai et. al, DOI: 10.1088/1748-9326/10/11/115008)

“Blacks and respondents at lower educational levels and, to a lesser degree, lower income levels were significantly more likely to live within a mile of a polluting facility. Racial disparities were especially pronounced in metropolitan areas of the Midwest and West and in suburban areas of the South [...]

Racial disparities in the distribution of the ACL sample around polluting industrial facilities remained statistically significant even after we controlled for socioeconomic and other variables. Nevertheless, socioeconomic and other demographic variables were also found to be significantly associated with proximity to a polluting facility.

Lower-income people were found to be significantly more likely than were higher-income people to live near a polluting industrial facility.” (Mohai et. al, doi: 10.2105/AJPH.2007.131383)

“Comparing fenceline and neighboring communities, we conclude that Black and Latinx populations are disproportionately located near industrial facilities, potentially contributing to inequitable exposure to unintended chemical releases. Our work lends support to the value of considering of sociodemographic composition of fenceline communities when evaluating industrial facility hazards.” (Southerland et. al, doi: 10.1088/1748-9326/ad0136)

6. “Industrial farms are intensive users of chemicals, energy, plastic, and water...”

“Exposure to many, if not most, pollutants fall along racial, ethnic, or sociodemographic lines in the USA – and pesticides are no exception. Disparities in exposure and harm from pesticides are widespread, impacting BIPOC and low-income communities in both...
the rural and urban settings and occurring throughout the entire lifecycle of the pesticide from production to end-use.” (Donley et. al, https://doi.org/10.1186/s12889-022-13057-4)

“Though natural fertilizers made from treated sewage sludge are used to reintroduce nutrients onto agricultural fields, they bring along microplastic pollutants too. And according to a small-scale study published in ACS’ Environmental Science & Technology Letters, more plastic particles get picked up by the wind than once thought. Researchers have discovered that the microplastics are released from fields more easily than similarly sized dust particles, becoming airborne from even a slight breeze.” (ACS: Microplastics from natural fertilizers are blowing in the wind more often than once thought)

“The use of plastic products in today’s agriculture is becoming increasingly commonplace all around the world. The versatility and variety of plastic polymers, their ease of manufacture, physical properties and affordability make them the material of choice for many applications in agriculture.” (FAO: Assessment of agricultural plastics and their sustainability: A call for action)

“The current corn production system in the United States Corn Belt is producing a largely unsustainable yield from finite fossil energy sources.” (Bernau, Energy in the Corn Belt: Is Maize Production Sustainable?)

“One of the main concerns for future irrigated agriculture is if there will be sufficient freshwater to supply the increasing requirements of both agricultural and non-agricultural consumers […]

In the United States, agriculture is a major user of both ground and surface water, accounting for 80% of the national consumptive water use and for over 90% in many western States.” (Salazar et. al, https://doi.org/10.1016/j.agwat.2012.01.015)

7. “PLA production can emit significant quantities of hazardous industrial chemicals—including acetaldehyde, acrolein, and hydrogen cyanide—into air, soil, and water.”

Sourced via EPA Toxics Release Inventory (TRI) Program. See #4.

8. “Many of the emissions from PLA production facilities are known to cause cancer, disrupt hormones and reproduction, trigger respiratory diseases, and contribute to other serious health problems.”
See effects of Acetaldehyde (Delaware HSS), Acrolein (WHO) and Hydrogen Cyanide (CDC).

9. “When PLA is discarded in landfills and incinerators, it similarly drives serious air, soil, and water pollution that damages human and environmental health.”

“Landfill and incineration options [for polylactic acid (PLA)/flax fibres biocomposites] have notable human toxicity and freshwater ecotoxicity impacts. Indeed, incineration is at the origin of the emission of metallic elements into the water, while landfill leads to water pollution during leaching.” (Beigbeder et al, DOI: 10.1016/j.wasman.2018.11.012)

“A comprehensive literature review shows that polylactic acid is compostable rather than biodegradable in the natural environment, leading to the formation of microplastics. Recent research has clearly identified that microplastics originating from polylactic acid are emerging environmental contaminants, similar to microplastics from petroleum-based plastics. They are severely toxic to aquatic biota and might pose a threat to the human population as well through the food chain.” (Ali et al., doi: 10.1007/s10311-023-01564-8)
References

- **Agricultural Exceptionalism, Environmental Injustice, and U.S. Right to Farm Laws**
- **Fumes Across the Fence-Line: The Health Impacts of Air Pollution from Oil & Gas Facilities on African American Communities**
- **Neglected: Environmental Justice Impacts of Marine Litter and Plastic Pollution**
- **Pollution Is Killing Black Americans, This Community Fought Back**
- **Redlining and Environmental Racism**
- **Understanding Disenfranchised and Underserved Communities in the U.S.**