

Intersections of the COVID-19 Pandemic with Sustainability and Environmental Justice: Transportation, Energy, Waste, and Food Systems

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Introduction

The COVID-19 pandemic, which has had widespread effects on humans, our behaviors, and the ways we interact with our environment, is both a health crisis and an environmental justice crisis. Human health is intricately connected to environmental health, making the pandemic a complex web of relationships between humans, social justice, and the natural world. The environmental impacts of COVID-19 are primarily anthropogenic¹. As nations have responded to the crisis, environmental changes and inequalities have been exposed and it has become clear that the impacts of the pandemic are unequally distributed across populations at a global, national, and local level.

Background and Research Goals

Declared by the World Health Organization (WHO) to be a pandemic in March of 2020, COVID-19 has drastically altered economies, healthcare, and consumer habits worldwide, and some of these changes have endured nearly 18 months (as of the writing of this report). Hospitals have adapted by requiring single-use PPE (personal protective equipment) such as masks, gowns, and gloves. Businesses have shifted to online remote-work formats, and people are spending more time in their homes and less time commuting. Air travel and public transportation faced declines during the height of the pandemic, restaurants shifted to accommodate takeout-only business models, and many governments required everyone to wear face masks in public spaces. Several 2020 papers, including *Environmental effects of COVID-19 pandemic and potential strategies of sustainability*² and *Observed and Potential Impacts of the COVID-19 Pandemic on the Environment*³ have provided an overview of the

¹ Resulting from human interference.

² Rume, T. and Didar-UI Islam, S.M. 2020. Environmental effects of COVID-19 pandemic and potential strategies of sustainability.” *Heliyon* Volume 6, Issue 9.

³ Cheval, Sorin et al. 2020. Observed and Potential Impacts of the COVID-19 Pandemic on the Environment. *International Journal of Environmental Research and Public Health* 17.11: 4140

main environmental effects of the pandemic during the spring and summer of 2020. These include both positive and negative changes, such as a reduction in PM_{2.5} (particulate matter) and greenhouse gas emissions, as well as a massive increase in PPE waste generation (hospital, business, and household) compounded by the issue of improper disposal, which led to marine pollution and risk to waste workers. One paper also notes that long-term effects, such as policy changes, disaster planning, and social behavior changes, are possible but largely still unknown.

Each of these changes has short- or long-term consequences for environmental health and social justice: PPE waste puts pressure on waste workers, access to public transit declines as transportation slows, and many other changes cause unintended anthropogenic effects on humans and the natural world. After 18 months, this crisis is still evolving; it's difficult to predict in which ways COVID-19 will interact with the environment for the years to come. However, there have already been measurable changes and lived experiences that attest to the interconnectedness of the pandemic, sustainability, and environmental justice. This research will attempt to illuminate the effects of COVID-19 on four main areas of sustainability and environmental inequality: transportation, energy, waste, and food systems. Sustainability mainly refers to practices that prioritize environmental well-being and longevity, but in the context of this research the term also pertains to every aspect of an economic system, including working conditions, human health, and living wages. When human well-being is compromised, often environmental degradation follows.

This paper, which takes into account information from the beginning of 2020 through the middle of 2021, is equipped to build on previous research by assessing changes and opportunities that have occurred between the summer of 2020 and the summer of 2021 as vaccines became available and economies came out of lockdown and by analyzing the effects of these changes on environmental justice and inequality. An environmental justice focus is necessary to understand the interactions between COVID-19, humans, and sustainability, and it will enable consideration of the more nuanced social changes that have resulted from the pandemic alongside the more obvious environmental ones.

Transportation

Transportation (including cars, trucks, buses, air travel, ships, ferries, and trains) produces over half of the nitrogen oxide (NO_x) emissions⁴ and one-third of greenhouse gas emissions in the United States. Transportation is also a cornerstone of the economy, allowing the

⁴ Gases caused by fuel combustion that react with ozone to form poisonous compounds and contribute to smog and human respiratory issues

movement of labor and goods, and it's already heavily connected to the pandemic by environmental justice issues. For example, a Harvard study⁵ found that people with historically high exposure to PM2.5 and other vehicle emissions are at an 8% higher risk of dying of COVID-19. Most neighborhoods that have highways or train tracks running through them are primarily Black, Indigenous, or People of Color (BIPOC), which connects transportation and environmental racism to COVID-19 morbidity⁶. This is a result of systemic racism built into city planning and continued segregation from historical redlining⁷.

As transportation affects COVID-19, so does COVID-19 affect transportation. When most nations went into lockdowns during February, March, and April 2020, transportation was heavily affected by new travel restrictions and lowered demand. For example, airline travel worldwide was reduced by 60-80%, similar to 2003 levels, and isn't expected to rebound fully until 2023. Similarly, many of the first known cases of COVID-19 outside of China occurred on cruise ships, which halted cruise travel almost entirely during 2020 and the first half of 2021. The US also saw a reduction in daily travel (including car, rideshare, and public transit) with the exception of grocery outings. As a result of these changes, global carbon emissions were reduced by 7% during 2020, with road transport emissions down by 10% and air transport emissions down by 40%⁸. These changes had both positive implications, including a short-term decline in air and water pollution, as well as negative implications, such as impacts on transportation workers, a lack of funding for public transit, and reduced accessibility for the disabled community.

Given its communal nature, public transportation in the US (trains, buses, and ferries) was very quickly and heavily affected by lockdowns and the rise of telework⁹. According to one 2020 study⁹, public transit use during the first months of the pandemic decreased by an average of 70-80% nationwide. The same study expects that public transit will, in the long term, rebound rather slowly due to societal changes that have taken place during the pandemic. For example, telework is being announced as a long-term option by some employers, such as Google, Microsoft, and Facebook. However, a robust public transit system is one of the best ways to reduce individual car use, and these systems are essential for those who don't have access to cars, are unable to drive themselves, or need special

⁵ Wu, X., Nethery, R. C., Sabath, M. B., Braun, D. and Dominici, F., 2020. Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis. *Science advances*, 6(45).

⁶ Bagley, K. (2020). *Connecting the Dots Between Environmental Injustice and the Coronavirus*. Yale E360. <https://e360.yale.edu/features/connecting-the-dots-between-environmental-injustice-and-the-coronavirus>

⁷ Redlining refers to systematically denying insurance or loans in a discriminatory way based on the race or ethnicity of residents in an area.

⁸ Kim, K. (2021). Impacts of COVID-19 on transportation: Summary and synthesis of interdisciplinary research. *Transportation Research Interdisciplinary Perspectives*, Volume 9.

⁹ Liu L, Miller H.J., Scheff J (2020) The impacts of COVID-19 pandemic on public transit demand in the United States. PLoS ONE 15(11): e0242476. <https://doi.org/10.1371/journal.pone.0242476>

accommodations. As a result, the pandemic-related shift from public transit to personal vehicles could lead to more emissions in the long term and could harm communities that rely on public transit for access to essential services. For example, a 2021 report for the American Public Transportation Association estimates that “public transit agencies still face a projected shortfall of \$39.3 billion through the end of calendar year (CY) 2023”¹⁰ due to reduced ridership and loss of tax revenue. This loss of funds will prevent public transit agencies from providing adequate and reliable services for essential workers and others who need regular access to public transit.

Personal vehicles experienced a severe but short reduction in use during the spring of 2020, but recovered much more quickly than other forms of transportation. For example, one study¹¹ found that car travel in the United States was reduced by 77% from 2019 levels during April 2020, but recovered to only an 11% reduction by July 2020. In March 2020, Uber reported that their ridership was down by 94%, representing an even steeper decrease in ride-share services than in personal car use. Given the convenience of cars during the pandemic as a private and socially distant method of transportation, the coming years will prove an interesting experiment to see whether personal vehicle use rebounds past 2019 levels as the pandemic tapers off, or whether public transit services will make a recovery and become more resilient.

The shipping and maritime transportation sectors also experienced significant changes during COVID-19 due to reduced movement of people and goods between coastal economies¹². Fishing vessels, ferries, and cruise ships had the most marked and longest lasting decreases, with cruises just beginning to recover as of summer 2021 and many ferry systems still operating at reduced capacity. The oceans also carry around 80% of the world’s trade, and the shipping system experienced an intense shock during the pandemic that exposed weaknesses in the lengthy supply chains that drive global economies. For example, online shopping experienced significant growth (around 14% during the first quarter of 2020 and 32% by the end of 2020)¹³ as people were less able to go shopping in person. This in turn led to unprecedented air, ground, and maritime shipping demand, which industry was unable to keep up with due to lockdowns and understaffing. Human rights issues also

¹⁰ EBP US, Inc. (2021). The Impact of the COVID-19 Pandemic on Public Transit Funding Needs in the U.S. *APTA*.

¹¹ National Academies of Science, Engineering, and Medicine. (2021). *COVID-19 trends impacting the future of transportation planning and research*.
<https://www.nationalacademies.org/trb/blog/covid-19-trends-impacting-the-future-of-transportation-planning-and-research>

¹² March, D., Metcalfe, K., Tintoré, J. *et al.* 2021. Tracking the global reduction of marine traffic during the COVID-19 pandemic. *Nat Commun* 12, 2415.

¹³ Digital Commerce 360. (2021). *COVID’s impact on online shopping*.
<https://www.digitalcommerce360.com/article/coronavirus-impact-online-retail/>

abounded in the maritime sector during the pandemic, with lockdowns and local restrictions leaving crews stranded on ships or on land or working well beyond their contracts¹⁴. The long supply chains associated with many products and markets exposed weaknesses and a potential for human rights violations during the pandemic, which serves as a reminder that short, local supply chains provide benefits for resilience and sustainability for humans, the environment, and businesses, especially during times of crisis.

Energy

Energy is another sector that is historically connected to environmental justice issues¹⁵. For example, energy plants burning fossil fuels tend to be located near BIPOC¹⁶ neighborhoods, contributing to higher levels of dangerous emissions that contribute to respiratory comorbidities of COVID-19. Secondly, the inability to access energy services is exacerbated by crises like the pandemic and further contributes to a widening equality gap and negative health consequences. And finally, the pandemic may even provide opportunities for corporations and governments to increase fossil-fuel reliant energy processes during efforts to rebound the economy to pre-pandemic levels.

Lockdowns changed patterns of energy consumption, including domestic and industrial electricity use as well as petroleum and other fossil fuels. One study¹⁷ reported that “the weekly energy demand was estimated to be cut by ~9% under limited restrictions, ~17% under partial lockdown and ~24% under full lockdown”. The United States Energy Information Administration (EIA) also collected data¹⁸ on US energy consumption patterns, and found that US total energy consumption fell by 7% during 2020 from 2019 levels, an unprecedented decline (for comparison, the next largest decline was during the 2008 recession, in which a 5% decline in energy use was recorded). According to the EIA report, the transportation sector experienced the largest overall energy use decline during 2020, at 15%, followed by the commercial and industrial sectors at 7% and 5% respectively. Despite record numbers of employees working from home, residential energy use did not increase significantly during 2020 (the EIA estimates a change between -1% and -4%), likely due to unusually warm winter months requiring less heat. Petroleum use (consistent with the above

¹⁴ *Maritime human rights risks and the COVID-19 crew change crisis: a tool to support human rights due diligence*. 2021. United Nations Global Compact.

¹⁵ Brosemer, Kathleen et al. 2020. The energy crises revealed by COVID: Intersections of Indigeneity, inequity, and health. *Energy Research & Social Science*, Volume 68.

¹⁶ “BIPOC” refers to Black and Indigenous People of Color.

¹⁷ Jiang, P., Van Fan, Y., Jaromír Klemeš, J. 2021. Impacts of COVID-19 on energy demand and consumption: Challenges, lessons and emerging opportunities. *Applied Energy* Volume 285.

¹⁸ Energy Information Administration. (2021). *U.S. energy consumption fell by a record 7% in 2020*. Today in Energy. <https://www.eia.gov/todayinenergy/detail.php?id=47397>

section on Transportation) decreased significantly during lockdowns, with US motor gasoline consumption falling by 40% during April 2020 and jet fuel consumption falling by over 60%.

According to the International Energy Agency (IEA), electricity consumption worldwide dropped very quickly during lockdowns due to the rapid halting of most commercial and industrial activities, but in most places were back to pre-pandemic levels by August 2020. Additionally, the share of electricity generated by renewable energy sources increased by around 7% during lockdowns as the demand for coal-generated electricity declined, but this change did not last beyond 2020¹⁹. However, renewable energy sources proved their resilience to economic crisis during the pandemic²⁰, and this could lead to further government investment in renewables.

This leads to an important question: what will our post-COVID energy future look like? The IEA found that investment in energy efficiency fell by around 9% during the pandemic as resources were directed towards the global health crisis. Similarly, stimulus packages designed to quickly get economies back on their feet could lead to higher than pre-COVID energy demand and fossil fuel use. As a result, the years spent emerging from the COVID crisis have the potential to incite either more sustainable and resilient energy action through policy-supported investments, or to lead nations away from sustainable energy sources and energy efficiency and toward even heavier fossil fuel usage to attain pre-COVID economic goals. A deeper issue is the persistent commodification of energy in a way that makes it a tool of profit. As long as energy decisions are in the hands of corporations and governments without adequate accountability to communities, there is no clear path toward a sustainable and equitable system that guarantees energy access to everyone and distributes energy burdens (such as pollution) equally. Energy sovereignty, the idea that communities should have control over local sources of energy, their placements, and access to them, should be incorporated into post-COVID policies to ensure that everyone has access to energy that they need for essential services; this would narrow the disparities that COVID-19 has shown to exist in energy access.

PPE and Plastic Waste

Waste and waste management is a pressing environmental issue in the United States, which has 4% of the world's population but produces over 12% of the world's municipal solid

¹⁹ *Covid-19 impact on electricity – Analysis*. (2021, January). IEA.
<https://www.iea.org/reports/covid-19-impact-on-electricity>

²⁰ IEA (2020), *Renewables 2020*, IEA, Paris <https://www.iea.org/reports/renewables-2020>

waste²¹. Waste contributes to emissions, requires space, and leaches toxic pollutants into soil, water, and air (and often these effects are disproportionately concentrated in low-income, non-white areas). A public health crisis such as the COVID-19 pandemic, which required the use of billions of disposable masks, gloves, and gowns, as well as their plastic packaging, worsens the garbage problem and puts significant pressure on both the environment and on low-income and POC (people of color) communities. According to the American Chemical Society, an estimated 129 billion face masks and 65 billion gloves were used *every month* in 2020 due to the pandemic, and many are disposed of improperly²².

The environmental impacts of the increase in PPE waste are concentrated in soil and waterways due to the materials used to make face masks as well as the lack of proper disposal of PPE materials. Single-use face masks are made up of polypropylene, polycarbonate, polyurethane, or another similar polymer²³. These polymers are thermoplastics, which are convenient because they are moldable at high temperatures, and they are strong, lightweight, and non-absorbent, making them ideal for disposable masks. However, these materials take 20-30 years to decompose in landfills, and up to 450 years to break down if not disposed of properly. For example, the polymers in face masks are insoluble and break down into microplastics in soil or water. These plastic particles are small enough to enter marine food chains and can eventually become concentrated in organisms. Because disposable face masks have never been used so widely before, people were uninformed on how to properly dispose of them, and many masks ended up outside of landfills or in waterways. To compound the issue, face masks are not easily recyclable because they contain thermoplastics, metal (nosepieces), and cloth (earloops) which are difficult to separate. Estimates suggest that in 2020, coastal countries (which are the major contributors to plastic ocean pollution) produced 2.37 million tons of mismanaged face mask waste²⁴; even 1% of masks, if disposed of improperly, could cause an enormous environmental strain.

While the effects of microplastics are still being researched and may take years to manifest in ecosystems, there are more immediate effects of mismanaged PPE waste that have been documented, primarily among aquatic species. For example, there have been reports of organisms tangled, injured, or asphyxiated in mask ear-loops, fish caught in disposable

²¹ Turrentine, J. (2019). *The United States Is the Most Wasteful Country In the World*. NRDC. <https://www.nrdc.org/onearth/united-states-most-wasteful-country-world>

²² Prata, J.C., Silva, A.L.P., Walker, T.R., Duarte, A.C. & Rocha-Santos, T. (2020) COVID-19 pandemic repercussions on the use and management of plastics. *Environ. Sci. Technol.*, 54, 7760-7765.

²³ Dharmaraj, S. et al. 2021 The COVID-19 pandemic face mask waste: A blooming threat to the marine environment. *Chemosphere*, Volume 272.

²⁴ Chowdhury, H., Chowdhury, T., Sait, S.M. 2021. Estimating marine plastic pollution from COVID-19 face masks in coastal regions. *Marine Pollution Bulletin*, Volume 168.

gloves, and birds using discarded masks as nesting materials. In other instances, animals have ingested masks or gloves²⁵. In order to curb this rapid pollution, efforts to organize disposal services and inform citizens about proper disposal of PPE are required. In the long term, this issue could serve as a catalyst for the development and implementation of low-waste and reusable PPE products, as there will likely be another public health crisis that calls for widespread mask-wearing again.

Along with the acute ecosystem effects, PPE disposal (and other plastic waste as well) is an environmental justice issue. Plastic waste heavily affects certain communities, such as those who rely on fishing to feed their families and provide income, as well as communities near dumping sites and landfills who experience toxic chemicals leaching into soil and water as well as a host of other adverse effects²⁶. These burdens are not evenly shared, and often those who produce the most plastic waste (generally wealthier people) don't have to deal with the consequences of pollution. Due to deeply ingrained systemic racism, landfills and dumping grounds tend to be placed overwhelmingly in majority non-white neighborhoods²⁷ and a large amount of trash is also shipped to less wealthy countries without adequate infrastructure to manage so much additional waste. These disparities place the burden of pollution disproportionately on people of color and on economies in the global South.

Additionally, waste workers are at risk due to the COVID-19 pandemic and the increase in PPE waste. According to the International Labor Organization (ILO), only around 20% of waste and recycling workers worldwide are formally employed, meaning that many have little to no job security or access to protection against potentially virus-contaminated waste such as masks and gloves. Oil prices also dropped during the pandemic, making new plastic much cheaper to produce than recycling and taking away recycling work (which was compounded by a reduction in funding for recycling programs). As a result, waste workers faced a dual threat: both to their jobs and to their health²⁸.

To address the social and environmental issues just discussed, a resilient and more sustainable waste system with protections for environmental and human rights is needed to

²⁵ Hiemstra, A., Rambonnet, L., Gravendeel, B., & Schilthuizen, M. (2021). The effects of COVID-19 litter on animal life, *Animal Biology*, 71(2), 215-231.

²⁶ UNEP. (2021). *Plastic pollution is an environmental injustice to vulnerable communities*. United Nations Environment Programme. <https://www.unep.org/news-and-stories/press-release/plastic-pollution-environmental-injustice-vulnerable-communities-new>

²⁷ *Targeting minority, low-income neighborhoods for hazardous waste sites*. (2016, January 19). University of Michigan News. <https://news.umich.edu/targeting-minority-low-income-neighborhoods-for-hazardous-waste-sites/>

²⁸ Kaza, S. (2020). *Waste workers are protecting our communities during COVID-19*. World Bank Blogs. <https://blogs.worldbank.org/sustainablecities/waste-workers-are-protecting-our-communities-during-covid-19>

lighten the burden of plastic waste on people and ecosystems²⁹. For example, this should include providing a living wage and robust personal protections to waste workers, which would ensure job security and a workforce to manage what will inevitably be increasing quantities of plastic waste. Better education, both in schools and in workplaces, should be implemented to help prevent improper disposal of waste. Increased funding for recycling programs is also needed.

However, the most important aspect of waste in the US is the mindset; as long as we continue to see trash as something that ceases to exist as soon as it leaves our homes or workplaces, we will only contribute to a growing crisis of pollution, inequality, and containment issues. Combating this mindset is no small task, but innovating low waste products and making them much more widely accessible, as well as teaching a much less wasteful and more intersectionally aware lifestyle in schools can help to shift the public view. In essence, there is no easy way out of this growing waste problem and our increasing vulnerability to crises like COVID-19, but the magnitude of the current and future trash problems faced by the world far overshadows concerns about the economic difficulties of reshaping waste systems.

Food Systems

Finally (and heavily connected to the waste issue), COVID-19 has had a series of impacts on food systems. Changes took place on both the consumer and producer sides of the food system, including markets, awareness, and preferences. For example, there were two main consumer behavior stages during 2020: panic buying and living in quarantine³⁰. Panic buying was marked by a sharp increase in consumption of canned, frozen, and packaged shelf-stable goods, which occurred during the most alarming beginning stages of the pandemic. Next came living in quarantine, which consisted of an increase in home-cooked meals requiring staples like pasta, flour, eggs, and milk, as well as online grocery shopping and food delivery which grew by 30% in the United States. Along with this uptick in online food shopping and delivery came an increase in plastic packaging waste, which contributes along with PPE to the plastic garbage crisis. Similarly, restaurants were forced to pivot to takeout and single-use

²⁹*What a Waste: An Updated Look into the Future of Solid Waste Management*. (2018). The World Bank. <https://www.worldbank.org/en/news/immersive-story/2018/09/20/what-a-waste-an-updated-look-into-the-future-of-solid-waste-management>

³⁰ Filho, W.L. et al. 2021. "COVID-19 and waste production in households: A trend analysis." *The Science of the total environment* vol. 777.

packaging in order to stay in business, and without robust municipal composting systems³¹, using compostable dishware was rarely a feasible option.

There was also a dramatic increase in on-farm food waste during lockdowns. As markets shifted and demand from places like schools, universities, and restaurants disappeared, access to processing facilities was also disrupted (especially in the meat industry). Farmers without markets and people without access to food all suffered the consequences of the shock to the food supply chain, as did the environment (mass food waste goes to landfills or incinerators and emits methane during the process of decomposition).

As the food system was changing and adapting to such unprecedented challenges, so was the media's portrayal of it. Images of horrifying working conditions, crops being plowed under, and tankers of milk being dumped flooded the news. Some level of transparency on food system issues was readily available on the internet, and it shocked and appalled many consumers to see so much good food going to waste purely because it couldn't make its way to the people who needed it. According to several 2020 studies,^{32,33} food waste in homes was actually reduced during the pandemic, and it's hypothesized that this may have something to do with increased awareness of food waste due to media coverage. Farm-shares and CSAs³⁴ also experienced a resurgence as those with the monetary resources to buy fresh produce turned increasingly to small, local producers for their needs. For example the Good Acre's farm-share program (see the following case study) sold out in record time during the 2020 season, and again quicker than usual during the 2021 season.

³¹ As of 2017, only around 4% of wasted food in the US was composted, and only around 6 million of the 120 million households in the US had access to curbside compost pickup services. Read more at <https://www.epa.gov/sustainable-management-food/reducing-impact-wasted-food-feeding-soil-and-composting>

³² Pappalardo, G., Cerroni, S., Nafta, R.M. and Wei, Y. (2020), The Impact of COVID-19 on Household Food Waste: The Case of Italy. *Frontiers in Nutrition*, 7: 291.

³³ Roe, B.E., Bender, K. and Qi, D. (2021), The Impact of COVID-19 on Consumer Food Waste. *Appl Econ Perspect Policy*, 43: 401-411.

³⁴ Community-Supported Agriculture, a system where consumers can buy into a local farm in exchange for fresh produce during the growing season.

Case Study: The Good Acre

One way to counter the food waste issue (and address future supply and demand disparities) is to implement programs like the Local Emergency Assistance Farmer Fund (LEAFF), which is led by Minneapolis food hub The Good Acre³⁵. In an interview and virtual facilities tour with Nikki Warner, the communications director, the benefits of the program were explained.³⁶

Essentially, local Black, Indigenous, and People of Color (BIPOC)³⁷ farmers can apply for a guarantee that the Good Acre will buy between \$2,500 and \$7,500 of produce from them during the growing season and provide packaging. The Good Acre then passes the



produce on to local hunger relief organizations who are able to connect people in need with local, fresh, culturally relevant foods. In a year like 2020, when racial injustices such as police violence shook Minneapolis along with COVID-19, hunger relief was more needed than ever to mitigate the disproportionate effects of both problems on people of color. This process has a multitude of benefits: it supports small local farms, it combats systemic racism in the food system and beyond, it returns a sense of dignity to those experiencing hunger, and it reduces food waste and increases efficiency overall. The organization also provides communal kitchens and warehouse facilities for local food entrepreneurs who may not have the resources to own their processing equipment. Ms. Warner explained that having a local food hub like the Good Acre to centralize small operations and provide resources and community for small farmers is essential -- it's a cornerstone of a healthy local food system that can stand up to crises like COVID-19.

A resilient food system would be focused on producer and consumer needs, providing support on both ends in order to facilitate a smooth transfer of food from farmers to households. Policy and subsidies would follow consumer needs and preferences, instead of

³⁵ Image sourced from

<https://www.mprnews.org/story/2019/07/29/a-beautiful-world-food-hubs-provide-a-critical-link-for-small-farmers>

³⁶ Warner, Nikki. Personal interview. By Vivian Powell. June 28, 2021.

³⁷ This program was limited to BIPOC farmers in order to address racism in farming and the disproportionate effects of the pandemic on people of color. Similar programs could be designed for women or LGBTQ+ producers or any producer who needs financial assistance.

the other way around, and programs would exist to support farmers experiencing racism or language barriers. Supply chains would be shorter, and local farmers would rise to meet the needs of their communities with the help of government and NGO assistance like LEAFF. Food deserts would be addressed with the needs of communities in mind. A more sustainable and equitable food system would not only be more efficient and stand up better to future shocks, but it would lead to healthier citizens who would be less susceptible to COVID-19 and its comorbidities (such as obesity and diabetes). While this model may not be consistently or widely included in current policy, COVID-19 has laid bare the massive issues within the food system and could spark a consumer movement to address them.

For example, programs like LEAFF have shown their effectiveness and can serve as a model for wider implementation of similar programs in the future. The USDA created several national programs to assist the food system during the pandemic³⁸, but few are sustainable or sufficiently address issues of hunger and access. For example, the Pandemic Livestock Indemnity Program (PLIP) incentivizes farmers to “depopulate”, or euthanize and dispose of their surplus livestock for a per-head grant. While this program helps deal with the producer side of COVID-related food waste, it eliminates millions of pounds of meat from the food system and fails to address consumer needs. Multifaceted and holistic programs (which are admittedly more feasible at a local level than a national level) are much more effective at streamlining the food system than programs like PLIP, which operate on too large a scale to scratch the surface of underlying issues. This is why local NGOs and nonprofits which know the unique needs of their own communities are better equipped to act sustainably and equitably.

Conclusions and Future Considerations

This research is by no means an exhaustive review of the environmental and social justice effects of the COVID-19 pandemic. However, the findings I have outlined in the areas of Transportation, Energy, Waste, and Food Systems do form patterns that can encourage an understanding of the importance of sustainability in times of crisis as well as the persistent environmental inequalities exposed by the pandemic.

One similarity among sectors is the importance of community organizing, local programs, and local sovereignty. As discussed in the Transportation section, the effects of limiting public transit options were felt differently in different neighborhoods and cities depending

³⁸ United States Department of Agriculture. (2021). *USDA Pandemic Assistance for Producers*. Farmers.Gov. <https://www.farmers.gov/pandemic-assistance>

on local reliance on public transportation, which itself is correlated with income and race. Energy faces similar issues; large-scale energy companies fail to address energy needs on the community level. Toxic waste facilities are placed in disproportionately BIPOC areas, leaving people who are often experiencing racism and poverty to simultaneously deal with the burden of pollution. Finally, local food hubs are far more efficient at stimulating and streamlining local food systems than one-size-fits-all government initiatives. In a country that is so divided, segregated, and characterized by the concept of race, environmental and COVID-19 policies that fit one community are not guaranteed to fit the next. In the pursuit of equity, resilience against crisis, and sustainability, communities should have access to the resources and support they require to meet their own basic needs. Environmental sustainability can be thought about as an essential companion of human sustainability and social justice.

Secondly, not only does COVID-19 have an impact on these four sectors of sustainability, but each of them has a reciprocal impact on the pandemic and its dangers to humans. For example, a long history of segregation, redlining, and highway building in BIPOC communities places people of color at a higher risk of dying of the coronavirus⁵. Similarly, the placement of energy plants, waste facilities, and food deserts as well as the exploitation of waste and food workers endanger human health in certain communities, making people less able to survive COVID-19. While these issues have long been widespread in the United States, the pandemic has exacerbated them by taking advantage of systemic inequalities in environmental health and well-being.

The COVID-19 pandemic leaves humanity with a final question: will we take this opportunity to change by accommodating the needs of communities, easing the environmental injustices that the coronavirus has shown, and working to make our essential services more accessible, sustainable, efficient, and resilient?

Bibliography

- Bagley, K. (2020). *Connecting the Dots Between Environmental Injustice and the Coronavirus*. Yale E360.
<https://e360.yale.edu/features/connecting-the-dots-between-environmental-injustice-and-the-coronavirus>
- Brosemer, Kathleen et al. (2020). The energy crises revealed by COVID: Intersections of Indigeneity, inequity, and health. *Energy Research & Social Science*, Volume 68.
- Cheval, Sorin et al. 2020. Observed and Potential Impacts of the COVID-19 Pandemic on the Environment. *International Journal of Environmental Research and Public Health* 17.11: 4140
- Chowdhury, H., Chowdhury, T., Sait, S.M. (2021). Estimating marine plastic pollution from COVID-19 face masks in coastal regions. *Marine Pollution Bulletin*, Volume 168.
- Covid-19 impact on electricity – Analysis*. (2021, January). IEA.
<https://www.iea.org/reports/covid-19-impact-on-electricity>.
- Dharmaraj, S. et al. 2021 The COVID-19 pandemic face mask waste: A blooming threat to the marine environment. *Chemosphere*, Volume 272.
- Digital Commerce 360. (2021). *COVID's impact on online shopping*.
<https://www.digitalcommerce360.com/article/coronavirus-impact-online-retail/>
- EBP US, Inc. (2021). The Impact of the COVID-19 Pandemic on Public Transit Funding Needs in the U.S. *APTA*.
- Energy Information Administration. (2021). *U.S. energy consumption fell by a record 7% in 2020*. Today in Energy. <https://www.eia.gov/todayinenergy/detail.php?id=47397>
- Filho, W.L. et al. 2021. “COVID-19 and waste production in households: A trend analysis.” *The Science of the total environment* vol. 777.
- Hiemstra, A., Rambonnet, L., Gravendeel, B., & Schilthuizen, M. (2021). The effects of COVID-19 litter on animal life, *Animal Biology*, 71(2), 215-231.
- IEA (2020), *Renewables 2020*, IEA, Paris <https://www.iea.org/reports/renewables-2020>
- Jiang, P., Van Fan, Y., Jaromír Klemeš, J. 2021. Impacts of COVID-19 on energy demand and consumption: Challenges, lessons and emerging opportunities. *Applied Energy* Volume 285.
- Kaza, S. (2020). *Waste workers are protecting our communities during COVID-19*. World Bank Blogs.
<https://blogs.worldbank.org/sustainablecities/waste-workers-are-protecting-our-communities-during-covid-19>
- Kim, K. (2021). Impacts of COVID-19 on transportation: Summary and synthesis of interdisciplinary research. *Transportation Research Interdisciplinary Perspectives*, Volume 9.
- Liu L, Miller H.J., Scheff J (2020) The impacts of COVID-19 pandemic on public transit demand in the United States. *PLoS ONE* 15(11): e0242476.

- <https://doi.org/10.1371/journal.pone.0242476>
- March, D., Metcalfe, K., Tintoré, J. *et al.* (2021). Tracking the global reduction of marine traffic during the COVID-19 pandemic. *Nat Commun* 12, 2415.
- Maritime human rights risks and the COVID-19 crew change crisis: a tool to support human rights due diligence.* 2021. United Nations Global Compact.
- National Academies of Science, Engineering, and Medicine. (2021). *COVID-19 trends impacting the future of transportation planning and research.*
<https://www.nationalacademies.org/trb/blog/covid-19-trends-impacting-the-future-of-transportation-planning-and-research>
- Pappalardo, G., Cerroni, S., Nafta, R.M. and Wei, Y. (2020), The Impact of COVID-19 on Household Food Waste: The Case of Italy. *Frontiers in Nutrition*, 7: 291.
- Prata, J.C., Silva, A.L.P., Walker, T.R., Duarte, A.C. & Rocha-Santos, T. (2020) COVID-19 pandemic repercussions on the use and management of plastics. *Environ. Sci. Technol.*, 54, 7760-7765.
- Targeting minority, low-income neighborhoods for hazardous waste sites.* (2016). University of Michigan News.
<https://news.umich.edu/targeting-minority-low-income-neighborhoods-for-hazardous-waste-sites/>
- Turrentine, J. (2019). *The United States Is the Most Wasteful Country In the World.* NRDC.
<https://www.nrdc.org/onearth/united-states-most-wasteful-country-world>
- Roe, B.E., Bender, K. and Qi, D. (2021), The Impact of COVID-19 on Consumer Food Waste. *Appl Econ Perspect Policy*, 43: 401-411.
- Rume, T. and Didar-UI Islam, S.M. (2020). Environmental effects of COVID-19 pandemic and potential strategies of sustainability.” *Heliyon* Volume 6, Issue 9.
- UNEP. (2021). *Plastic pollution is an environmental injustice to vulnerable communities.* United Nations Environment Programme.
<https://www.unep.org/news-and-stories/press-release/plastic-pollution-environmental-injustice-vulnerable-communities-new>
- United States Department of Agriculture. (2021). *USDA Pandemic Assistance for Producers.* Farmers.Gov. <https://www.farmers.gov/pandemic-assistance>
- Warner, Nikki. Personal interview. By Vivian Powell. June 28, 2021.
- What a Waste: An Updated Look into the Future of Solid Waste Management.* (2018). The World Bank.
<https://www.worldbank.org/en/news/immersive-story/2018/09/20/what-a-waste-an-updated-look-into-the-future-of-solid-waste-management>
- Wu, X., Nethery, R. C., Sabath, M. B., Braun, D. and Dominici, F. (2020). Air pollution and COVID-19 mortality in the United States: Strengths and limitations of an ecological regression analysis. *Science advances*, 6(45).