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Environmental Justice:
Income, Race and Health

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An ECI Teaching Module on Social and Environmental Issues in Economics

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NOTE – terms denoted in bold face are defined in the KEY TERMS AND CONCEPTS section at the end of the module.

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ENVIRONMENTAL JUSTICE: INCOME, RACE, AND HEALTH

1. INTRODUCTION

Some economists have framed environmental protection as a luxury -- something people care about only when they have plenty of leisure time and disposable income. In practice, low-income communities and historically marginalized ethnic and racial groups often bear the most severe consequences of environmental degradation and pollution. Disproportionately affected communities have also led the way in addressing some of the most pressing environmental problems.

In this module, we explore questions related to the distribution of pollution and other forms of environmental degradation. Our discussion is centered on **environmental justice**: the recognition that certain communities bear a disproportionate share of environmental costs; the understanding that this is unjust; and the understanding that change must be led by the most affected communities. Environmental justice is related to broader questions of human rights and fundamental justice.

As stated by the California Environmental Protection Agency, "The principles of environmental justice call for fairness, regardless of race, color, national origin or income, and the meaningful involvement of community in the development of laws and regulations that affect every community's natural surroundings, and the places people live, work, play and learn."

Environmental injustices occur within the US and internationally. Toxic waste sites and polluting industrial facilities are often placed in lower-income communities, and toxic wastes are often shipped from higher-income to lower-income nations. Atmospheric and oceanic currents also transport toxic chemicals long distances through the environment, affecting communities far from their origin.

What are the issues involved in formulating policies for environmental justice? How are the health consequences of environmental degradation distributed among communities and ethnic groups? How do property values reflect the economic value we place on environmental goods?

We explore these and other questions in the sections below. We also look at some of the solutions that communities have developed as they work toward greater justice in environmental quality and public health.

This module is part of the Economics in Context series. It was originally published in 2004 and has been partially updated with newer information in 2024. A version with additional updates is planned for 2025. For more information, including a selection of resources from leaders in the environmental justice field, please see the Web Links section at the end of this document.

BOX 1: THE FLINT WATER CRISIS

The water quality crisis in Flint, Michigan is a prominent example of environmental injustice in 21st century America.[1] Like many urban water bodies, the Flint River historically served as a conduit for sewage, agricultural and city runoff, and toxic chemicals from landfills. Industrial facilities -- from car factories to paper mills -- also discharged toxic waste into the river. General Motors, a leader of the American automobile industry, was founded in Flint, leading to exceptional economic growth and prosperity throughout the 20th century but then to an abrupt unraveling by the 1980s. The rapid industrial decline left Flint impoverished, with nearly half the population living below the poverty line.[2]

On April 25, 2014, the municipality of Flint shifted its water source from Lake Huron water supplied through the city of Detroit to water from the Flint River. The river water was more corrosive than the previous supply, yet authorities failed to perform comprehensive tests, allowing lead and other heavy metal contaminants to leach into the municipal water supply through aging water distribution pipes. Lead is an extremely dangerous neurotoxicant that causes permanent damage to children's developing brains, with no safe level of exposure.[3]

In June 2015, researchers from Virginia Tech found that of 252 home water samples, over 40% registered above 5 parts per billion of lead. While residents had been sounding the alarm about declining water quality since January, it was not until October of 2015 that Flint was reconnected to Detroit's water system. By then, severe damage had occurred. In September 2015, a Flint pediatrician found that some 9,000 children in the community had been exposed to dangerously high levels of lead over an eighteen-month period. In 51% of households, at least one family member reported diminished physical health due to the crisis.[4]

A coalition of Flint residents sued both the municipal and state governments. The lawsuit eventually ended in a settlement that required proper quality testing and mandated the state to fund the replacement of many corroded lead pipes. The settlement also included a faucet filter education and installation program, free bottled water, and support for health programs to treat the effects of contamination. While the local government has since deemed water in Flint to be safe, the continued use and existence of corroded pipes remains a serious concern for residents.

Beyond Flint, drinking water contaminants are a problem in thousands of communities across the United States. In October 2024, the US EPA issued a final rule requiring "drinking water systems nationwide to replace lead service lines within 10 years" and providing funding to support replacement of lead drinking water service lines.[5]

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[1] Research for this Box prepared by Uma P. Edulbehram.
[2] Melissa Denchak. 2024. "Flint Water Crisis: Everything You Need to Know." Natural Resources Defense Council. https://www.nrdc.org/stories/flint-water-crisis-everything-you-need-know
[3] Mayo Clinic. "Lead Poisoning." https://www.mayoclinic.org/diseases-conditions/lead-poisoning/symptoms-causes/syc-20354717
[4] Denchak, 2024.
[5] The White House. 2024. "Biden-Harris Administration Issues Final Rule to Replace Lead Pipes Within a Decade, Announces New Funding to Deliver Clean Drinking Water." October 8, 2024.

2. POLLUTION, TOXICS IN CONSUMER PRODUCTS, AND HEALTH

A large body of scientific literature links toxic chemicals and other environmental hazards to a range of disabilities and chronic illnesses. Many studies have documented increased cancer rates associated with exposure to industrial chemicals in the environment.[6] Asthma is also linked to a variety of environmental factors, ranging from car and bus exhaust to certain pesticides. Industrial chemicals can contribute to neurobehavioral disorders and learning disabilities.[7] Many also act as **endocrine disrupters,** interfering with the normal functioning of hormones in the human body.[8]

Disparities in exposure to airborne carcinogens. A 2024 study examined the distribution of estimated cancer risk from toxic air pollutants in the US, considering data on air toxics alongside census data. The study found that "urban tracts that suffer from the highest estimated cancer risks were concentrated among the communities with a population of higher proportion of minorities." The authors find that "Black, Asian, and Hispanic individuals may be at significantly greater risk of cancer from air pollution."[9]

Childhood cancer trends. In the later part of the 20th century, rates of certain illnesses and disorders, including cancers such as breast cancer, childhood leukemia, and cancers of the brain and nervous system in children, rose steadily. Childhood cancer rates increased over the last quarter of the 20th century, with a nationwide increase of 31.7% in children under 15 from 1975 to 2000, and 29.6% in those under 20.[10]

This upward trend in child cancer rates continued after 2000. Recent data from 2015 to 2021 indicates a stabilization in the annual rates of new cancer cases among children overall.[11] (See Figures 1 and 2.) At the same time, within certain populations, there are continued increases for specific types of cancers.

Childhood leukemia rates in children classified as Hispanic increased from 1999 to 2020, with incidence rates for Hispanic and Native children double those observed in Black and White children.[12] Additionally, slight elevations were noted in central nervous system cancer incidence rates among Black children and teens under 20. [13] Rates of cancer in teenagers have also increased, with adolescents suffering increasingly from diseases including non-Hodgkin lymphoma, thyroid cancer, acute myeloid leukemia, and testicular cancer.

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[6] Shankar et al, 2019.
[7] Iqubal et al, 2020.
[8] National Institute of Environmental Health Sciences, July 22, 2024, https://www.niehs.nih.gov/health/topics/agents/endocrine.
[9] Hurbain, P. et al. 2024. Environmental Inequality in Estimated Cancer Risk from Airborne Toxic Exposure across United States Communities from 2011 to 2019. Environmental Science & Technology https://doi.org/10.1021/acs.est.4c02526. (Preprint, October 2024)
[10] SEER Cancer Statistics Review 1975-2000, Section XXVII: Childhood Cancer by Site: Incidence, Survival, and Mortality. http://www.seer.cancer.gov/csr/1975_2000/results_merged/sect_27_childhood_cancer.pdf
[11] SEER*Explorer, National Cancer Institute, 2024. SEER*Explorer Application (cancer.gov)
[12] "Cancer in Children and Adolescents", National Cancer Institute, 2023.
[13] SEER*Explorer, National Cancer Institute, 2024.

The trend was summarized by Burkhamer et al., "Despite improvements in survival, rising incidence trends mean growing numbers of young adults are undergoing painful and costly cancer treatments." A serious illness of this kind during adolescence, and the associated medical treatments, can create lifelong health consequences for health.[14]

Figure 1. *Age-Adjusted Cancer Incidence Rates, Ages 0-14 (1975-2000)*

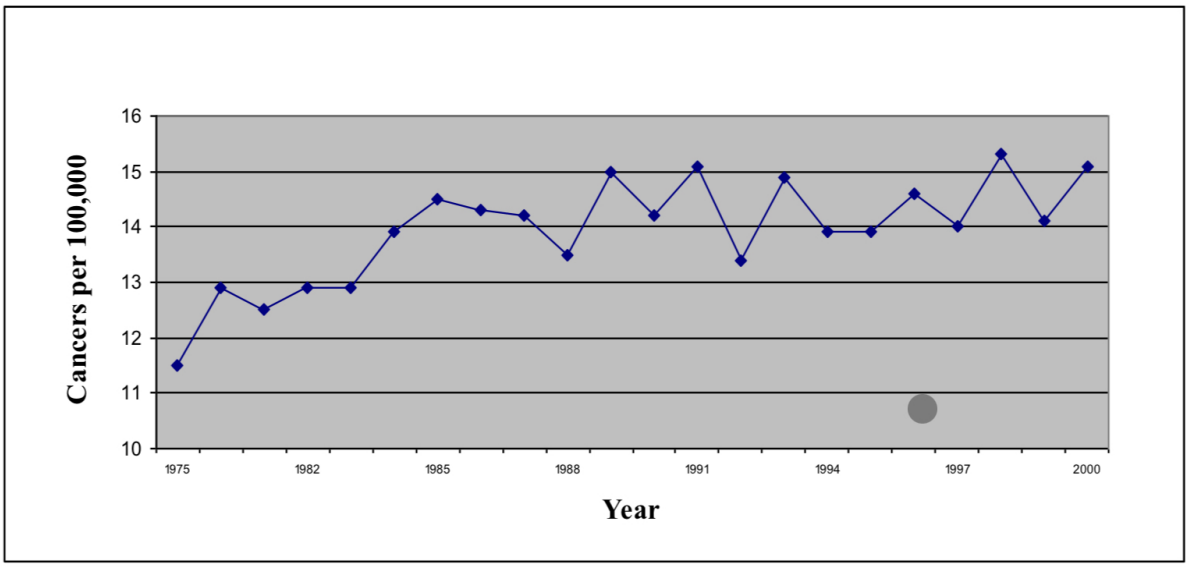
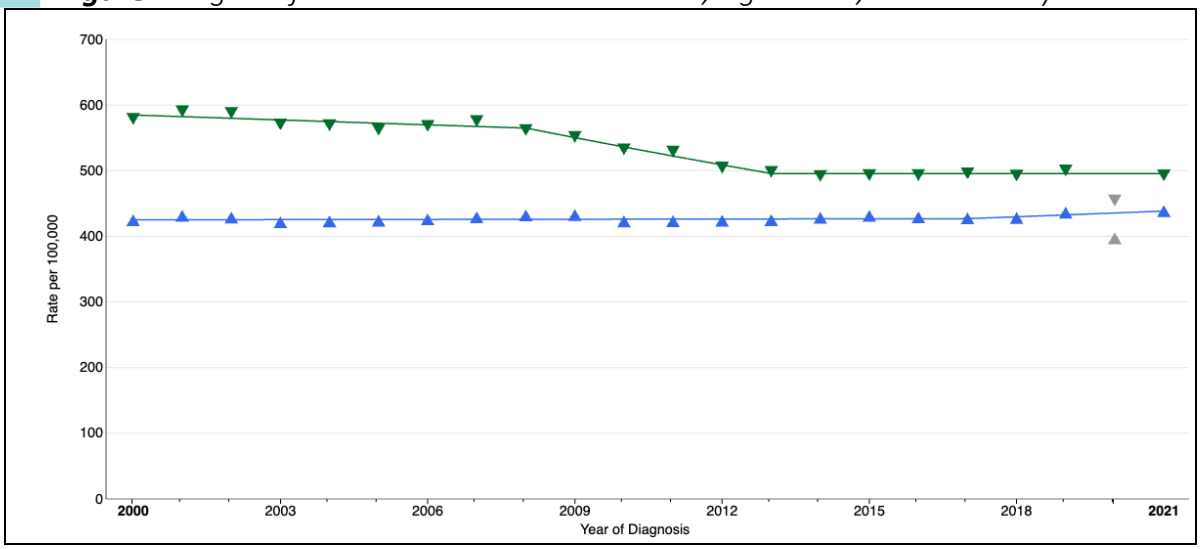


Figure 2. *Age-Adjusted Cancer Incidence Rates, Ages 0-20, 2000-20021)* [15]



Note: Green triangles are male, blue triangles female. Gray data points for 2020 were not included in trend line fitting (2020 was an unusual year due to the Covid pandemic).

[14] Burkhamer J, Kriebel D, Clapp R (2017) The increasing toll of adolescent cancer incidence in the US. PLoS ONE 12(2): e0172986. https://doi.org/10.1371/journal.pone.0172986.

[15] Source for Figures 1 and 2: National Cancer Institute, Surveillance, Epidemiology and End Results Program, https://seer.cancer.gov/statistics-network/

Disproportionate exposure to neurotoxicants. A 2023 study reviewed the literature on chemical exposures and neurodevelopmental outcomes for children from "population groups who have been historically economically/socially marginalized." The study considered exposure to seven pollutants: combustion-related air pollution, lead), mercury, organophosphate pesticides, phthalates, polybrominated diphenyl ethers, and polychlorinated biphenyls. The authors explain their research and its policy implication:

> As a whole, the studies we reviewed indicated a complex story about how racial and ethnic minority and low-income children may be disproportionately harmed by exposures to neurotoxicants, and this has implications for targeting interventions, policy change, and other necessary investments to eliminate these health disparities. How we frame the question of who is more harmed by neurotoxic chemical exposures is critical for informing the design of policy interventions.

They conclude there is an urgent need for action:

> Policymakers should not wait for further evidence to act, because this perpetuates harm. Overall, the studies in this review reported that children of color and those living in poverty were more highly exposed to seven exemplar neurotoxicants and thus at greater risk of cognitive and behavior disorders. Decisive action grounded in authentic stakeholder engagement to reduce exposures and health inequities is needed now to protect disproportionately exposed children and communities. [16]

Exposure through consumer products. Disproportionate exposures to toxic chemicals do not only occur because of geographic factors such as the siting of hazardous waste sites. Product marketing can also play an important role.

For example, many personal care products marketed to Black women contain chemicals of concern. As noted in a study of personal care product use among women in California:

> Women of color, particularly Black women, have higher exposures to personal care product chemicals, many of which are hormonally active. Exposure to these chemicals is associated with hormone-mediated health conditions such as uterine fibroids, preterm birth, and breast cancer – all of which disproportionately impact Black women.[17]

[16] Payne-Sturges, DC et al. 2023. Disparities in Toxic Chemical Exposures and Associated Neurodevelopmental Outcomes: A Scoping Review and Systematic Evidence Map of the Epidemiological Literature. Environmental Health Perspectives 131:9, https://ehp.niehs.nih.gov/doi/10.1289/EHP11750

[17] Dodson RE et al. 2021. "Personal care product use among diverse women in California: Taking Stock Study." *Journal of Exposure Science & Environmental Epidemiology* 31: 487-502.

BOX 2: TOXICS IN TENNESSEE AND LOUISIANA

Memphis, Tennessee is home to a 642-acre Defense Depot that was operated by the U.S. Army and Department of Defense from 1942 to 1997. It is bordered on three sides by largely residential areas; twelve schools are within a mile of the Depot's boundaries, and some homes are within 100 yards. The surrounding community is low income and predominantly Black.[18]

Toxic chemicals from the Depot, including lead, chromium, arsenic, mercury, and polychlorinated biphenyls (PCBs), have contaminated the soil, water, and air in surrounding communities. Toxic runoff drains into local streams, one of which flows through a local high school. Community members suffer severe health problems, including high rates of cancer and reproductive disorders.

The Depot was placed on the Superfund National Priority List in 1992. As documented in a 2003 report, some efforts have been made to clean up the site, including removing chemical weapons buried at the depot – but residents continued to suffer from adverse health effects.

The area referred to as Cancer Alley, an approximately 85-mile stretch of communities along the banks of the Mississippi River between New Orleans and Baton Rouge, is home to some 200 fossil fuel and petrochemical operations — the largest concentration of such plants in the Western Hemisphere. According to the Environmental Protection Agency, cancer risks in the corridor exceed 50 times the national average.[19]

Recent grassroots activism in Louisiana has led to cancellation of several major projects including a $1.25 billion plastics plant and a $800 million grain elevator. These victories demonstrate the growing power of Louisiana's environmental justice movement, with leadership especially by Black women.[20]

Neurobehavioral and neurodevelopmental disorders. Rates of certain neurobehavioral disorders and learning disabilities have also increased dramatically; for example, incidence of autism spectrum disorders has increased substantially in recent decades.[21] Some of these disorders have a genetic component, but genetic patterns in human populations cannot change over one or two generations. Thus, when rates of a disease or disability increase dramatically over a couple of generations, it is necessary to consider non-genetic factors in the explanation.

[18] Zoll and Boyce, 2003.
[19] "Louisiana's 'Cancer Alley," *Human Rights Watch*, January 25, 2024. https://www.hrw.org/news/2024/01/25/us-louisianas-cancer-alley; Oliver Laughland, "EPA opens civil rights investigations over pollution in Cancer Alley," *The Guardian*, April 14, 2022. EPA opens civil rights investigations over pollution in Cancer Alley | Louisiana | The Guardian
[20] Terry L. Jones, "Black Women are Leading the Fight against Polluters in Louisiana—and they're Winning."https://floodlightnews.org/black-women-are-leading-the-fight-against-polluters-in-louisiana/
[21] CDC Newsroom. 2023. "Autism prevalence higher, according to data from 11 ADDM communities." Press release, March 23, 2023. Accessed at https://www.cdc.gov/media/releases/2023/p0323-autism.html

A systematic review of a handful of developmental neurotoxicants (chemicals that damage the developing brain or nervous system) raised significant concerns about the role of these chemicals in patterns of disease and disability.[22] The authors explain:

> "Neurodevelopmental disabilities, including autism, attention-deficit hyperactivity disorder, dyslexia, and other cognitive impairments, affect millions of children worldwide, and some diagnoses seem to be increasing in frequency. Industrial chemicals that injure the developing brain are among the known causes for this rise in prevalence …Strong evidence exists that industrial chemicals widely disseminated in the environment are important contributors to what we have called the global, silent pandemic of neurodevelopmental toxicity. The developing human brain is uniquely vulnerable to toxic chemical exposures, and major windows of developmental vulnerability occur in utero and during infancy and early childhood."

Chemicals that have been linked to impaired neurodevelopment include lead, mercury, manganese and polychlorinated biphenyls (PCBs).[23] Such chemicals can often travel long distances from their point of origin (See Box 3).

Per- and polyfluoroalkyl substances. Per- and poly-fluoroalkyl substances (PFAS) are a large family of synthetic chemicals that are used in a variety of industrial processes and consumer products. Thousands of different PFAS compounds exist. PFAS are highly persistent in the environment. For this reason, they are sometimes referred to as "forever chemicals."

PFAS are used in a wide variety of products, and have been detected as contaminants in many drinking water systems. Certain professions, such as firefighters, can have greater exposure to PFAS, increasing their risk of adverse health effects. Farm families can be at risk due to the use of PFAS-contaminated sewage sludge as fertilizer, while meat and produce from affected farms pose a risk to consumers.[24]

According to the US Centers for Disease Control and Prevention (CDC), most people have been exposed to PFAS at some point. Research is ongoing to understand the long-term effects of low-level exposure and exposure during childhood. Peer-reviewed studies have linked PFAS exposure to decreased fertility, high blood pressure in pregnant women, developmental delays, increased risk of certain cancers, reduced immune response, hormone disruption, and elevated cholesterol levels.[25] A study of PFAS contamination in drinking water in New Jersey found that drinking water systems serving lower-income communities and communities of color were more likely to be contaminated with PFAS.[26]

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[22] Grandjean and Landrigan, 2014.

[23] Ibid. PCBs are industrial chemicals used in electrical equipment, in paints, and as lubricants in industrial processes. Their use was banned in the U.S. in 1977, but PCBs persist in the environment and continue to affect people's health.

[24] Did PFAS From Sewage Sludge Poison a Family Farm? - The New York Times (nytimes.com)

[25] https://www.epa.gov/pfas/our-current-understanding-human-health-and-environmental-risks-pfas

[26] Mueller R et al. 2024. "Quantifying Disparities in Per- and Polyfluoroalkyl Substances (PFAS) Levels in Drinking Water from Overburdened Communities in New Jersey, 2019–2021." *Environmental Health Perspectives* 132:4.

BOX 3: POLLUTION IN THE ARCTIC

In the Arctic Circle, Inuit communities maintain a traditional way of life, relying on subsistence hunting and fishing. Their traditional diet consists largely of fish and seal meat. Core values such as sustainability, respect for nature, and sharing guide Inuit hunting practices. Hunting and fishing are a practical and cultural necessity, especially in regions like Nunatsiavut, Canada, where food cannot be shipped for several months due to sea ice, resulting in high costs for imported food.[27] As described in a recent report by Alaska Community Action on Toxics and the International Pollution Elimination Network "The harvest and consumption of traditional foods is central to the nutritional, cultural, and economic health of Arctic Indigenous Peoples." [28]

Imported food is also less nutritious than the traditional diet. As described in the report, "Concerns surrounding the consumption of potentially contaminated traditional foods could shift Arctic communities away from these highly nourishing foods, replacing them with processed foods which carry an entirely new set of health risks, including high concentrations of sodium, sugar, and contaminants in food packaging. In many Arctic communities, store-bought foods are not only generally less nutritious than traditional foods but are also expensive due to shipping costs."

Inuit communities face unprecedented challenges, often exacerbated by climate change. Many regions have seen a significant reduction in annual snow cover due to shifting weather patterns. The Arctic is warming at a rate nearly four times that of other parts of the world. Moreover, industrial pollutants have become a critical concern. These pollutants, transported northward by ocean currents, accumulate in Arctic wildlife, including fish and seals. Toxic chemicals known as Persistent Organic Pollutants (POPs) produced throughout the world are found in extremely high levels in Inuit people's bodies and in Inuit women's breast milk. Inuit babies and children begin life exposed to an enormous burden of toxic chemicals, placing them at increased risk of a range of developmental disorders.[29]

The disproportionate impacts of climate change and of industrial pollutants are interconnected and reinforce one another. "Climate warming exacerbates the mobilization of chemicals and plastics that are sequestered in sea ice, permafrost, and glaciers. Climate warming also accelerates the rate of global distillation (i.e., a transport mechanism for persistent organic pollutants) and deposition of chemicals and plastics transported from lower latitudes into the Arctic." [30]

[27] Ossie Michelin, "A New Dawn Rises in the Arctic: The Inuit Plan to Reclaim Their Sea", *The Guardian,* August 27, 2023. A new dawn rises in the Arctic: the Inuit plan to reclaim their sea | Environment | The Guardian
[28] Miller P, Karlsson T, Seguinot Medina S, Waghiyi V. 2024. 2024. The Arctic's Plastics Crisis: Toxic Threats to Health, Human Rights, and Indigenous Lands from the Petrochemical Industry. Alaska Community Action on Toxics and International Pollution Elimination Network. Accessed at https://www.akaction.org/wp-content/uploads/ipen-alaska_report-2024-final-compressed.pdf.
[29] Véronique Morin, "The Rise of Inuit Activism in a Changing Arctic," The *New Humanitarian*, June 16, 2016. https://deeply.thenewhumanitarian.org/arctic/articles/2016/06/16/the-rise-of-inuit-activism-in-a-changing-arctic#
[30] Miller et al., 2024, op. cit.

Inuit activism has played an integral role in environmental and conservation efforts. Some POPs, including DDT and PCBs have been banned, partly in response to advocacy from Indigenous communities.[31] Collaborating with Canada, Inuit communities established the world's first Inuit Protected Area, safeguarding their land and waters from industrial encroachment.[32] Sheila Watt-Cloutier, a prominent Inuk activist, has been instrumental in advocating for environmental and human rights through legal frameworks. Her work has significantly influenced international discussions linking climate change to the livelihoods of Indigenous peoples.[33]

(For more information about environmental justice in the Arctic, see the website of Alaska Community Action on Toxics: https://www.akaction.org/.)

3. POLLUTION, POVERTY AND RACE

Some diseases and disabilities that have an environmental component are unequally distributed across race and income levels. For example, asthma prevalence in the U.S. is significantly higher in minority and low-income populations than in the general population (see Box 3). Unequal exposure to environmental factors that cause or exacerbate asthma may play a role. Compounding this problem, members of minority populations often receive lower quality health care and may be forced to rely more on emergency room visits, rather than routine doctor visits.

Across the United States, low-income and minority neighborhoods bear an unequal burden from hazardous facilities and waste sites. This pattern is evident nationally as well as on the state and local level. Pollution is unequally distributed across the country; it is also distributed unequally within individual states, counties, and cities. Hazardous waste sites, municipal landfills, incinerators, and other hazardous facilities are disproportionately and deliberately located in low-income and minority neighborhoods.[34] Communities that have less political influence and are under-resourced have greater difficulty resisting the placement of hazardous sites in their neighborhoods, despite strong mobilization efforts.[35]

This pattern of injustice was exemplified by the struggle in the 1980s over landfill location in Warren County, North Carolina, a landmark event in the environmental justice movement.[36] Warren County was one of the poorest counties in the state and had the highest percentage of Black residents; Afton, the community chosen for the landfill, was over 84 percent Black. Despite low incomes, an exceptionally large percentage of residents in this area owned their own homes.

The landfill in Warren County was created to hold tens of thousands of cubic yards of soil contaminated by polychlorinated biphenyls (PCBs). Experts argued that the siting of the landfill in Warren County made no scientific sense; the water table was only five to ten feet below the

[31] Persistent Organic Pollutants (POPs) | Inuit Circumpolar Council Canada
[32] Michelin, op. cit.
[33] Morin, op. cit.
[34] Bullard et al, 2007.
[35] Mohai and Saha, 2015.
[36] Bullard, 2018.

surface, and area residents relied on local wells for their drinking water. National civil rights leaders and others joined with local residents in opposing the landfill. Hundreds of protesters were arrested. Despite the protests, the PCB-laden soil was placed in the landfill as planned.

In the aftermath of the fight over the Warren County landfill, the U.S. General Accounting Office (GAO) conducted a survey of siting decisions for hazardous-waste landfills. GAO found that hazardous waste landfills were disproportionately located in minority and low-income communities.[37] Recent studies at the University of Michigan and the University of Montana have since confirmed these findings by analyzing 30 years of demographic data.[38]

3.1 Location of Hazardous Waste Sites

A 1987 study of toxic waste and race, conducted by the New York-based Commission for Racial Justice, also found a strong link between race and location of hazardous waste facilities. This study found that of 27 hazardous-waste landfills nationwide, a third -- representing almost 60 percent of total hazardous waste landfill capacity -- were located in five southern states: Alabama, Louisiana, Oklahoma, South Carolina, and Texas.[39] Of these, three of the largest sites were located in primarily Black zip codes, and these three "accounted for about 40 percent of the total estimated hazardous-waste landfill capacity in the entire United States."[40]

Race was by far the most prominent factor in the location of commercial hazardous-waste landfills, more prominent than household income and home values. Nearly 40 years later, race remains the primary predictor of the location of hazardous polluting facilities, with environmental degradation continuing to burden Black and Brown communities disproportionately.[41] A 2004 study in Alabama found that garbage dumps are disproportionately sited in low-income and African American communities. Of twenty-nine dumps considered by the study, twenty were in areas that are primarily African American, low-income, or both.[42]

Local and regional research is expanding to uncover area-specific environmental injustices, helping to identify where communities are being placed at greater health risk. A study in 2002 drew attention to environmental injustices in the state of Massachusetts, finding that "high-minority communities face a cumulative exposure rate to environmentally hazardous facilities and sites that is nearly nine times greater than that for low-minority communities."[43]

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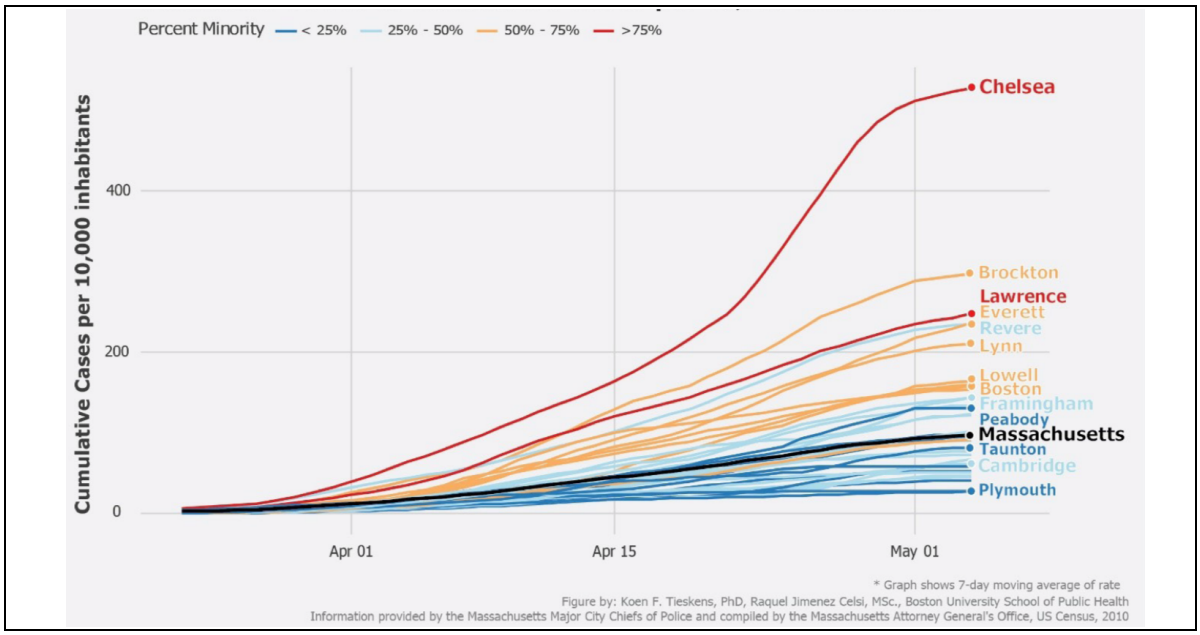
[37] U.S. General Accounting Office, Siting of Hazardous Waste Landfills and Their Correlation with Racial and Economic Status of Surrounding Communities Report, 1983. GAO Report Number: GAO/RCED-83- 168.
[38] Targeting minority, low-income neighborhoods for hazardous waste sites | University of Michigan News (umich.edu)
[39] Bullard, 1990.
[40] Ibid.
[41] The origins of environmental justice—and why it's finally getting the attention it deserves (nationalgeographic.com)
[42] John Davis, "Most Alabama Dumps Sit in Poor or Black Areas," *Montgomery Advertiser,* Sept 8, 2004.
[43] Faber and Krieg, 2002.

Communities of color in Massachusetts have also been disproportionately exposed to high levels of air pollution, including fine particulate matter (PM2.5) and nitrogen oxide (NO2), due to their proximity to industrial facilities and highways.[44] Such pollution has been linked to higher COVID-19 death rates, as demonstrated by a Harvard T.H. Chan School of Public Health study, which found that long-term exposure to PM2.5 increases vulnerability to the virus.[45] More recently, data has shown that the communities hit hardest by the COVID-19 pandemic were predominantly Black and Latinx.[46]

In addition to air pollution, other systemic inequities, such as living in low-income areas and reliance on public transportation, further heightened COVID-19 risks for these communities.[47] Many residents work in essential jobs—healthcare, transportation, and food services—putting them at greater risk of exposure. Combined with higher rates of chronic conditions like asthma, these factors compound the health disparities that made minority communities disproportionately vulnerable to the pandemic's impacts.[48]

Figure 3 shows that low-income, higher-minority communities in Massachusetts such as Chelsea, Brockton, Lawrence, Everett, Revere, and Lynn experienced higher average rates of COVID-19 as the COVID pandemic spread rapidly in 2020.

Figure 3. *Confirmed COVID-19 Cumulative Cases per 10,000 Inhabitants, 2020*[48]



[44] Rosofsky et al, 2018.
[45] Wu et al, 2020.
[46] Coronavirus In The U.S.: Latest Map And Case Count - The New York Times (nytimes.com)
[47] COVID-19's Unequal Effects in Massachusetts - Office of the Attorney General (mass.gov)
[48] https://www.mass.gov/doc/covid-19s-unequal-effects-in-massachusetts/download

Historically, there has been a strong link between race or ethnicity and exposure to toxic air pollutants in California. Almost 1/3 of the minority population of southern California is located in the areas with the highest cancer risk, whereas 15% of the white population lives in such areas. A 2005 study found "large racial disparities" in environmental risk throughout California. [49]

More recent studies confirm that communities of color are still disproportionately burdened by environmental health hazards, including higher cancer risk from toxic air contaminants and higher levels of nitrate contamination in drinking water.[50]

In 2001, a study looked at distribution of toxic air pollutants in southern California. The researchers found strong links between race or ethnicity and exposure to toxic air pollutants. Everyone was found to face an elevated cancer risk due to toxic air pollutants, but almost 1/3 of the minority population of southern California was located in the areas with the highest cancer risk, whereas 15% of the white population lived in such areas. The researchers also looked at local environmental conditions in the vicinity of Los Angeles public schools, and found significant disparities in children's exposure to air pollution at school. They found that:

> "Estimating cancer and respiratory risks associated with pollution exposures from large and small manufacturers and traffic near each school revealed striking distribution patterns. The fifth of the schools with the cleanest air were nearly 30 percent Anglo (in a school district that is less than 15 percent white), while the fifth of the schools with the most polluted air were 92 percent minority."

Even when they controlled for the range of predictors usually associated with school achievement, such as income level and parents' academic background, the researchers found a link between higher air pollution and lower achievement in school. [51]

Higher levels of air pollution are also linked to greater incidence of asthma among children (See Box 4). In 2022, the Los Angeles Unified School District installed an air quality monitoring network, with over 200 schools included, taking one step to address this disproportionate burden of air pollution.[52]

[49] Morello-Frosch, Rachel, Manuel Pastor, Carlos Porras, and James Sadd, 2002; Pastor, Manuel, Rachel Morello-Frosch, and James L. Sadd, 2005.
[50] Bliss, Laura. 2015. "In California, People of Color Are Hit Hardest By Environmental Hazards." *The Atlantic* September 29, 2015.
[51] Morello-Frosch, Rachel, and Manuel Pastor, 2001.
[52] LAUSD Unveils Air Quality Monitoring Network Using Sensors at 200 School Locations - KCAL News (cbs.com)

BOX 4: UNEQUAL DISTRIBUTION OF ASTHMA

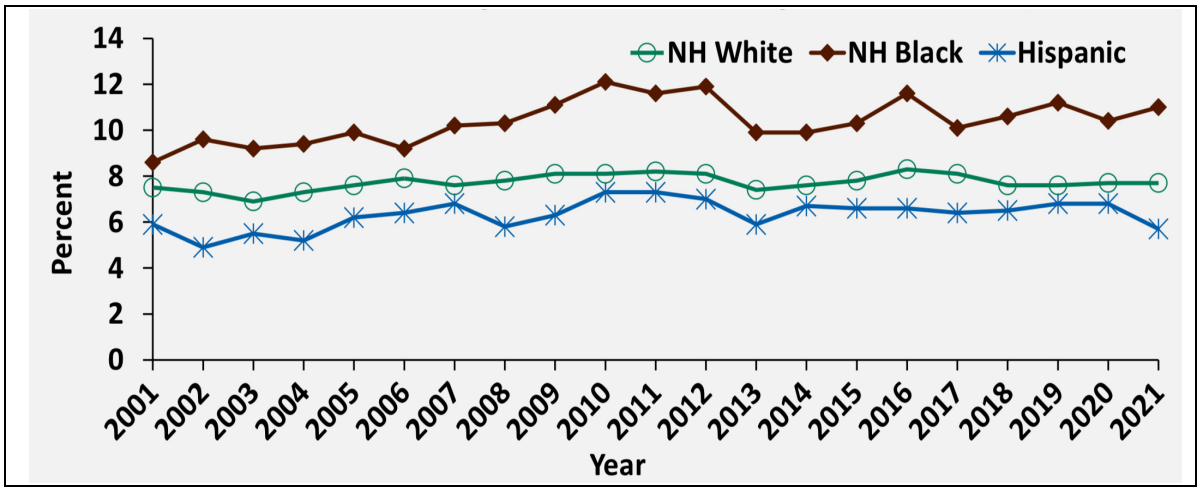
Asthma is a chronic illness in which the lungs can become constricted, making breathing difficult. Severe asthma attacks can require hospitalization and may be fatal. Childhood asthma causes more missed school days than any other childhood illness. Children in all socioeconomic brackets are affected by asthma, but the highest rates of the illness -- as well as the largest numbers of deaths -- are in low-income and minority communities. A number of industrial chemicals are linked to new-onset asthma or asthma exacerbation.[53]

Data collected in Washington state show that in families with incomes below $15,000 per year, asthma prevalence is about twice that of families with incomes of $75,000 and above.[54] In Massachusetts, Black children experience asthma at a rate of 15.1%, while Hispanic children have a rate of 12.6%. These rates are significantly higher than the 9.7% prevalence among white children.[55] (See Figure 4.)

Factors implicated in the onset of asthma include maternal smoking during pregnancy, exposure to cockroaches, and exposure to pesticides during the first year of life. A recent study found that "structurally deficient housing stock cultivates home environments rife with indoor asthma triggers."[56] High rates of asthma among children of color can be compounded by inadequate access to health care. Inadequate access to preventive care increases the risk of serious asthma attacks requiring emergency room treatment. According to the United States Department of Health and Human Services, in 2019, "non-Hispanic Black children were 4.5 times more likely to be admitted to the hospital for asthma, as compared to non-Hispanic white children," and "in 2020, non-Hispanic black children had a death rate 7.6 times that of non-Hispanic white children." [57]

[53] Massachusetts Toxics Use Reduction Institute. 2012. TUR and Disease Prevention Fact Sheet: Asthma. https://www.turi.org/publications/massachusetts-toxics-use-reduction-institute-tur-and-disease-prevention-fact-sheet/
[54] Asthma and Socioeconomic Status in Washington State – Washington State Department of Health (doh.wa.gov)
[55] Asthma Among Children in Massachusetts- asthma-data-bulletin.pdf (mass.gov)
[56] Housing and asthma disparities - Journal of Allergy and Clinical Immunology (jacionline.org)
[57] US Department of Health and Human Services Office of Minority Health. "Asthma and African Americans." Accessed at https://minorityhealth.hhs.gov/asthma-and-african-americans.

Figure 4. *Asthma Prevalence by Race and Ethnicity: United States, 2001-2021*[57]



Many of the observed inequities in the impact of pollution on low-income and minority communities are exacerbated by climate change. In Section 5 of this module we discuss the international impacts of climate change, but it is also true that "within the United States, climate change and fossil fuel–generated air pollution have disproportionately harmed people of color and low-income communities.. . . climate change will amplify existing health, social, and economic inequalities while creating new ones."[58] "Heat islands", where temperatures rise excessively due to urban density and lack of vegetation, are common in low-income areas.[59]

A recent study in the New England Journal of Medicine documented the unequal impact of climate change:

> Many components of the fossil-fuel supply chain and infrastructure in the United States are disproportionately located in communities of color and low-income neighborhoods, thereby creating inequitable landscapes of environmental health risk. . . . The flooding associated with Hurricanes Katrina, Harvey, Sandy, and Maria disproportionately affected people of color and low-income people who were more likely to live in flood-prone zones. . .
>
> Sea-level rise is imposing displacement pressures on communities of color, including tribal populations that are being forced to relocate inland, away from low-lying areas, in places such as Alaska, Washington, and regions along the Gulf Coast.[60]

[58] Morello-Frosch, Rachel, and Osagie K. Obasogie, 2023.
[59] Disturbing data reveals heat island effect: 'Your experience with that heat is very unequal' (thecooldown.com)
[60] Morello-Frosch and Obasogie, 2023.

4. THE ECONOMICS OF POLLUTION AND HEALTH

4.1 The Theory of Externalities

What does economic analysis have to tell us about the problem of environmental injustice? Standard environmental economic theory recognizes a concept – **externalities** – that is useful in understanding some of the important issues in this area. Externalities arise when a market transaction affects individuals or firms other than those involved in the transaction. A negative externality arises when a market transaction imposes *costs* on individuals or firms not involved in the transaction; a positive externality arises when those individuals or firms enjoy a *benefit* from the transaction.

From an environmental justice perspective, we can see an additional dimension to the problem of externalities: in many cases, the principal bearers of negative externalities are the poor and underprivileged. For example, distant stockholders may profit from the operation of a polluting factory, while people living next to the factory become ill or die from the effects of the pollution.

4.2 Efficiency and Equity

Economists define **efficiency** in terms of total welfare gains and losses. An efficient policy is one that maximizes total net welfare gains for society as a whole. **Equity**, in contrast, is defined on the basis of *who* gains or loses. A policy that is efficient is not necessarily equitable, and may in fact be rejected on an equity basis. For example, a policy that makes a rich person $1,000 richer while a poor person grows $800 poorer meets the definition of "economic efficiency," because it offers a net social gain of $200. Such a policy is not equitable, however, because it benefits the wealthy at the expense of the poor.

As we have seen in the discussion above, distribution of environmental harm is often not equitable. The pursuit of economic efficiency may lead to greater overall wealth, while the negative environmental externalities accompanying economic growth fall mainly on lower-income people.

4.3 Hedonic Pricing

Economists sometimes examine the relationship between pollution and location through the study of **hedonic pricing**. Hedonic pricing attempts to calculate the dollar value of environmental factors by looking at variations in the value of marketed goods, such as houses or land. For example, economists may compare property values between two neighborhoods that are largely similar in terms of home size, access to schools, and other factors. If one neighborhood contains a toxic waste site and the other is relatively unpolluted, the more polluted neighborhood is likely to have lower property values.

By isolating the effect of the toxic waste site on property values, economists estimate the implicit dollar value people place on being protected from pollution. Many studies have found that as pollution increases, property values go down. Of course, this principle implies that those who can best afford to pay to avoid pollution will be able to escape negative impacts of toxic wastes

and other environmental harm, while those who have lower incomes will be forced to accept higher levels of pollution. Sometimes those who are forced to live near toxic waste sites or dangerous industrial facilities may lose their homes completely (see Box 5).

4.4 Valuing Human Life and Health

When an economic activity poses threats to human health or human lives, economists may undertake to discuss the "value of a human life." While one might reasonably feel that this value is inestimable, when policy decisions regarding pollution prevention are involved, the question often arises of how much it is worth spending per estimated life saved. One approach is to calculate the **value of a statistical life**. Methodologies for calculating the value of a "statistical life" include so-called wage-risk analyses and analyses of foregone future income.

In wage-risk analyses, economists collect data and perform calculations to find out how much money people are generally willing to spend in order to avoid a small risk of death. For example, they may look at the wage premium associated with working in a dangerous job and extrapolate to estimate the value of a person's life. Analyses of foregone future income attempt to estimate the value of life as the amount a person would have earned over the remainder of his or her lifetime, if he or she had survived. This approach puts a higher value on people who were likely to become rich than on people who were expected to pursue a middle- or low-income career path.

Clearly these methods of analysis are biased by social inequity, implying that the lives of lower-income people are worth less than those of higher-income people. The issue of valuation of human life will remain highly controversial, no matter what methodology is adopted.

BOX 5: COMPENSATION AND RELOCATION

One approach to dealing with equity in economic analysis is the principle of **compensation**. If one group of people suffers from a particular economic activity or policy, they can – in theory – be compensated for their loss. In practice, however, those who suffer from environmental pollution rarely receive adequate compensation. Indeed, it is not clear that any level of compensation is adequate when health damages are very severe.

In 1980, families in Love Canal, a community near Niagara Falls in New York State, succeeded in pressuring the federal government to relocate them off the contaminated land where they had purchased homes and were raising children. The families had not been informed when they purchased their homes that Hooker Chemical, a local company, had buried tons of hazardous waste in the neighborhood before the homes were built. Highly toxic wastes were seeping into these families' homes and the school playground, causing severe illnesses in local children.

After years of struggle, these families won an agreement with the federal government in which they were given the resources to move to safer neighborhoods. Decades later, however, many other communities across the U.S. face similar situations. In many of these cases, the communities that

are now fighting for relocation were there long before the industrial facilities that are driving them away.

For example, the Diamond community of Norco, Louisiana fought for relocation for decades. Diamond is a primarily Black community; many residents own their homes, and many families have lived on the same land for generations. In the 1950s, Shell Corporation built a chemical facility directly adjacent to the community; the plant's fence line is 25 feet from people's homes. The community is flanked on the other side by a refinery.

Residents of Diamond suffered regularly from a high level of respiratory problems, headaches, and a variety of other symptoms. Air samples collected by a community group found extremely high levels of cancer-causing chemicals in the air. In June 2002, after years of negotiation, the community reached a relocation agreement with Shell.

Shell offered to buy out 350-400 residents, including 160 houses and mobile homes and 30 vacant lots. "The company planned to relocate all four streets of the Diamond community and pay residents a minimum of $80,000 for their homes; Shell offered trailer owners a minimum of $50,000. For residents who did not want to relocate, the company offered home-improvement loans. Overall, Royal/Dutch Shell spent $30 million on the Diamond buyout."[61]

4.5 The Precautionary Principle and Social Equity

An alternative perspective to standard economic analysis of environmental justice issues emphasizes the **precautionary principle** and **social equity.** The precautionary principle represents the view that policies should be aimed at protecting social welfare by avoiding the possibility of serious health damages or other catastrophic events. The principle of social equity implies that specific attention is needed to defend the interests of lower-income families and individuals and marginalized groups within a society. These approaches have been emphasized by those who feel that standard economic analysis neglects or undervalues environmental harms and social injustices.

The application of these principles implies that methods of economic analysis such as those we have reviewed should be balanced with other perspectives. For example, if a new production facility would add to overall GDP and, in standard economic terms, increase social welfare, but would at the same time pollute the water supply for a low-income community, we should not necessarily use an economic analysis to balance the monetary gains with a monetary estimate of health losses. The community's right to a healthy environment also needs to be taken into account. To judge such issues, we need to apply ethical principles as well as economic analysis.

[61] Black residents of Diamond win fight with Shell Chemical for relocation 1989-2002 | Global Nonviolent Action Database (swarthmore.edu)

5. INTERNATIONAL DIMENSIONS OF ENVIRONMENTAL JUSTICE

Just as low-income communities often bear a disproportionate burden of pollution and environmental degradation compared with wealthier communities within the same country, poorer nations may bear a disproportionate burden of environmental impacts. For example, low-income developing nations may have to deal with toxic wastes that are exported from wealthier nations They may also suffer from pollution produced by "dirty" industries located in their countries but producing goods destined for consumption in richer countries. Poorer nations may also bear a disproportionate burden from **global climate change** and other human-induced changes that affect the entire planet.

Global climate change is an example of problems both of environmental externalities and of equity issues on a planetary scale. The "greenhouse effect" is a process in which gases such as carbon dioxide build up in the earth's atmosphere and trap energy from the sun. Factories, cars, planes, and other mainstays of industrialized living all increase the levels of carbon dioxide and other greenhouse gases in the atmosphere. Through the greenhouse effect, these gases contribute to global warming, which leads to multiple disruptive effects on climate patterns.

The Intergovernmental Panel on Climate Change (IPCC), an international body of scientists, has developed a series of scenarios from which predictions can be made about likely changes associated with global warming.

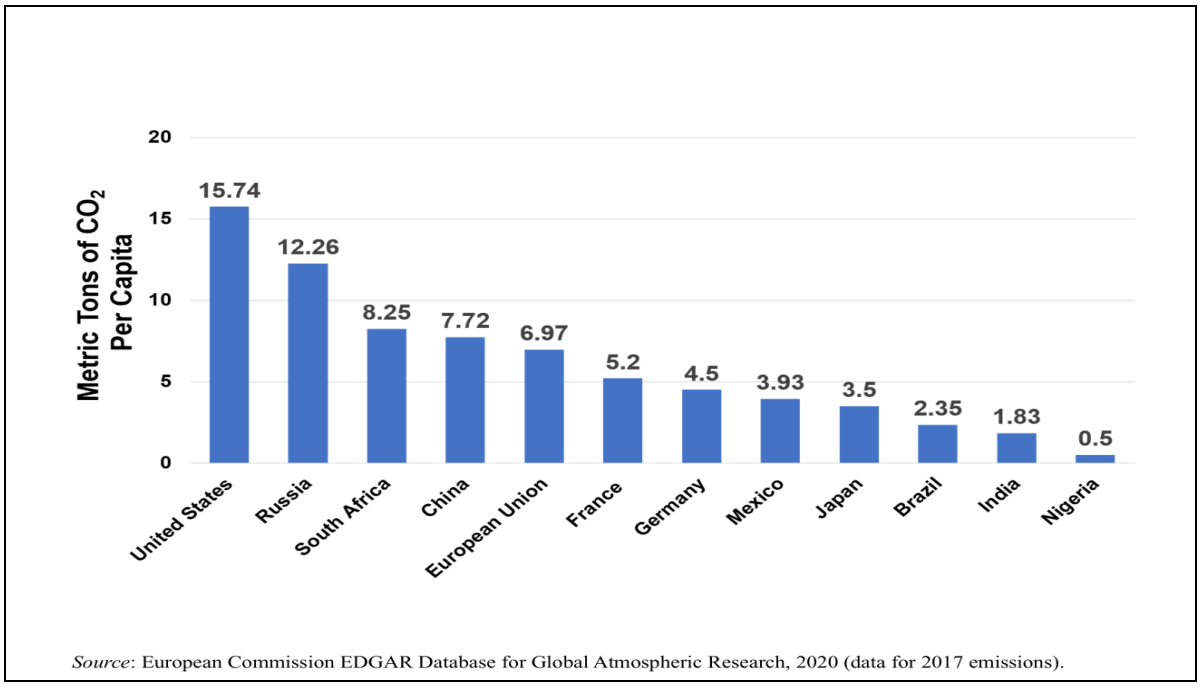
According to the IPCC's 2023 report, "human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production. Expected changes include higher temperatures in many parts of the world, greater likelihood of droughts and flooding, increased frequency and severity of storms, and rising sea level."[62]

Wealthier countries have enjoyed most of the gains from rapid industrial expansion and widespread use of automobiles and other fuel-intensive forms of transportation. Lower income countries, on the other hand, are predicted to bear the most serious consequences from global warming. The IPCC finds that "vulnerability of ecosystems and people to climate change differs substantially among and within regions, driven by patterns of socioeconomic development, unsustainable ocean and land use, inequity, marginalization, historical and ongoing patterns of inequity such as colonialism, and governance. Approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change."[63]

Although overall carbon emissions from developed countries have now started to decline, per capita emissions are still significantly higher in richer countries (see Figure 5).

[62] IPCC, 2023. AR6 Synthesis Report: Climate Change 2023 — IPCC
[63] IPCC, 2022. AR6 Climate Change 2022: Impacts, Adaptation and Vulnerability — IPCC

Figure 5. *Per Capita Carbon Emissions by Country*



Source: European Commission EDGAR Database for Global Atmospheric Research, 2020 (data for 2017 emissions).

Lower income nations, while contributing the least to the global problem, tend to suffer the worst consequences. "Global hotspots of high human vulnerability are found particularly in West-, Central- and East Africa, South Asia, Central and South America, Small Island Developing States and the Arctic. Vulnerability is higher in locations with poverty, governance challenges and limited access to basic services and resources, violent conflict and high levels of climate-sensitive livelihoods (e.g., smallholder farmers, pastoralists, fishing communities)."[64] These consequences include severe flooding, storm damage, heat waves, and loss of agricultural production due to extreme weather (see Box 6).

BOX 6. UNEQUAL BURDEN FROM GLOBAL CLIMATE DISRUPTION

Bangladesh is a densely populated country of some 115 million people, living in an area of about 144,000 square kilometers. Bangladesh is located at the delta of three major rivers and is subject to severe flooding. This could be made much worse by climate change.

According to one study, if sea level rises by a meter, over 11% of the population of Bangladesh (over 13 million people) will be displaced; nearly a fifth of the total land area of the country will be completely flooded and unique mangrove forests will be lost. In addition, more than a fifth of the country's monsoon rice land will be covered with water; and coastal shrimp production will become impossible.

[64] IPCC, 2022. AR6 Climate Change 2022: Impacts, Adaptation and Vulnerability — IPCC

One possible option for combating the effects of a sea-level rise of this magnitude may be to build barriers, or dikes, to protect land areas in Bangladesh. This measure would only address the specific problem of sea level rise and would not deal with the additional problem that global warming is likely to increase the frequency and severity of cyclones and other destructive weather events.[65]

The likely effects of global warming in Bangladesh exemplify the unequal burden of environmental problems that result from some economic activities. The contribution of Bangladesh itself to global warming is minimal; yet Bangladesh will bear some of the greatest costs of rising temperatures on earth.

In neighboring Pakistan, record-breaking floods caused "a catastrophe that left more than 1,700 people dead and affected 30 million in 2022, and severe flooding returned in 2024. "Pakistan has been afflicted both by heavy rains and unusually high temperatures that have accelerated snowmelt in its mountainous northern regions. The runoff has turned into roaring rivers, drenching the south." While no individual incident of flooding can be definitively linked to climate change, "the science linking climate change and more intense monsoons is quite simple. Global warming is making air and sea temperatures rise, leading to more evaporation. Warmer air can hold more moisture, making monsoon rainfall more intense.[66]

Global negotiations under the auspices of the United Nations have created a system of Nationally Determined Contributions (NDCs) according to which each country pledges to reduce their greenhouse gas emissions, with larger contributions from those who have greater responsibility and capability. Despite weaknesses and disputes, this system has made some progress – but not enough to stop or reverse global warming, or to limit it to the IPCC's goal of no more than a 1.5° Celsius increase over pre-industrial temperatures. [67]

Along with other commitments, developed nations have pledged to contribute to a Loss and Damage Fund, which will direct funding toward countries most vulnerable to the effects of extreme weather events, including droughts, flooding, and rising seas. But funding of about $720 million pledged as of 2024 pales in comparison with estimates of annual damages from climate disasters in vulnerable countries, which are estimated to be in the range of $400 billion annually.[68]

5.1 International Trade in Toxics

Nobody wants hazardous waste, but hazardous waste is traded internationally just like desirable goods, such as food and clothing. Many people believe that international trade in hazardous waste places an unfair burden on the countries that receive it. The option to send

[65] Huq, 1999.
[66] Two Years After Deadly Floods Hit Pakistan, It's Happening Again - The New York Times (nytimes.com); How Pakistan floods are linked to climate change (bbc.com)
[67] Nationally Determined Contributions (NDCs) | UNFCCC
[68] The successes and failures of COP28 (brookings.edu); Climate Challenges after the Glasgow Conference: The Roles of Forests and Soils (tufts.edu); A Loss and Damage Fund Is Taking Shape at COP Climate Talks - The New York Times

hazardous waste abroad also makes it easier for firms in wealthy countries to keep producing the waste, because they do not have to find room for it within their own communities.

An international treaty, the **Basel Convention,** was created in 1989 to place limits on international trade in toxic wastes, and to promote environmentally sound management. The Basel Convention provides for some restrictions and regulations on hazardous waste trade, but an effort to agree on a total ban on exports of hazardous wastes from wealthier to lower-income countries has not succeeded. But there are many loopholes associated with the definition of hazardous waste; for example, wastes that are designated for "recycling" may escape restrictions (see Box 7).

5.2 The Problem of Electronic Waste

Computers and other electronic equipment contain large amounts of heavy metals and other toxic substances. Millions of pounds of toxic electronic waste, or "E-waste," are generated each year within the U.S. alone, as households and businesses discard computers, cell phones, and other equipment that has been designed to have a useful life of just a few years.[69]

When toxic electronic waste is diverted from landfills in the U.S., it is often exported overseas. An estimated 50% to 80% of the televisions and computer monitors that U.S. consumers bring to recycling centers are actually exported to low-income communities in Asia.[70]

Once in Asia, this electronic equipment is not recycled in the way we might imagine. Some of the materials are recovered for further use, but the way the materials are extracted poses tragically severe health consequences for the people doing the work and for their families and neighbors. In China, India, and Pakistan, electronics "recycling" is associated with hazardous activities including open burning of plastics, which can produce highly toxic byproducts; exposure to toxic solders; and dumping of acids in rivers. Many of the workers who are exposed to these hazardous byproducts are children.

E-waste has also become a severe health and environmental problem in some African countries. Much of the waste is not recyclable and contributes to local pollution and health problems in countries such as Ghana. "Formally, Ghana prohibits the import of many forms of hazardous e-waste material. But the team found that a well-placed bribe can get port officials to look the other way. As a result, informal e-waste sites are growing across Ghana's coast. E-waste gets dumped into vast piles that are encroaching on residential areas."[71]

In 2021, the World Health Organization (WHO) published its first comprehensive report on E-waste and children's health. The report notes that "In 2019, some 53.6 million tonnes of electronic and electrical waste (e-waste) were generated worldwide, a 21% increase over the past five years. Global e-waste generation is projected to grow to 74.7 million tonnes by 2030." [72]

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[69] Puckett et al. (2002).
[70] Closing the Loop on the World's Fastest-growing Waste Stream: Electronics | Baker Institute
[71] Lambert, Jonathan. 2024. Stunning photos of a vast e-waste dumping ground — and those who make a living off it. National Public Radio. https://www.npr.org/sections/goats-and-soda/2024/10/05/g-s1-6411/electronics-public-health-waste-ghana-phones-computers
[72] World Health Organization. 2021. *Children and Digital Dumpsites: E-waste exposure and child health."* Accessed at https://iris.who.int/bitstream/handle/10665/341718/9789240023901-eng.pdf

BOX 7: EXPORTED TOXIC WASTE: E-WASTE IN ASIA

An investigation published in 2002 by the Basel Action Network, a non-governmental organization, documented highly hazardous practices in a rural area of China where electronic equipment is dismantled to recover valuable components. Around 100,000 people worked in the electronics "recycling" operations of Guiyu, many of them women and children.

The report documented how electronic equipment was dismantled by hand, with minimal or no precautions to protect workers from the toxic substances contained in the equipment. For example, workers dismantling used toner cartridges used paintbrushes and their bare hands to remove remaining toner; they breathed the toner dust and it covered their clothing. Other workers burned plastic-coated wires to recover the valuable copper within them. The polyvinyl chloride (PVC) coating of the wires, as well as brominated flame retardants in the wire insulation, are likely to produce the highly toxic chemicals known as dioxins and furans when they burn. Small children played in the toxic ashes. Local drinking water sources were highly contaminated.[73]

In 2015, the Guiyu e-waste site was finally closed, leaving a devastating legacy of contamination and harm to human health.[74] Guiyu has been subject to a cleanup effort, but environmental activists fear that it will take "centuries" to undo all the damage, There is little or no accounting of health damages sustained by workers.[75] In 2018, the Chinese government, responding to extensive pressure and exposés of the damage caused by hazardous wastes, introduced a ban on many imported wastes, which was strengthened in 2021.[76]

With China's new restrictions on hazardous waste imports, the problem has shifted to other Asian countries. According to the United Nations Environment Programme (UNEP), "up to 90 per cent of the world's electronic waste, worth nearly US $19 billion, is illegally traded or dumped each year."[77] As described in a recent article, "According to recent data, the e-waste conundrum in Southeast Asia has taken on a gargantuan scale. With an astounding 12.4 million metric tons of E-waste being generated in 2021, the region's environmental situation has escalated from a concern to an urgent crisis. . . countries like Thailand, Vietnam, and the Philippines have been turned into significant hubs."[78]

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[73] Puckett, J et al. 2002. *Exporting Harm: The High-Tech Trashing of Asia.* Report by Basel Action Network and Silicon Valley Toxics Coalition. Accessed at https://static1.squarespace.com/static/558f1c27e4b0927589e0edad/t/55d79060e4b0ff44487f306a/1440190560888/BANsExportingHarm-2002.pdf.

[74] Basel Action Network. 2015. "In Pictures: Infamous Chinese E-waste Town Finally Closes Doors to Imports." Accessed at https://www.ban.org/news-new/2015/12/16/infamous-chinese-e-waste-town-finally-closes-doors-to-imports

[75] Looks are deceiving in Chinese town that was US e-waste dumping site - Reveal (revealnews.org); Electronic Waste in Guiyu: A City under Change? | Environment & Society Portal (environmentandsociety.org)

[76] China Doesn't Want The World's Trash Anymore. Including 'Recyclable' Goods. (forbes.com)

[77] Illegally Traded and Dumped E-Waste Worth up to $19 Billion Annually Poses Risks to Health, Deprives Countries of Resources, Says UNEP report

[78] E-Waste: Southeast Asia's Growing Environmental Concern | KrASIA (kr-asia.com); Trash Trade Wars: Southeast Asia's Problem With the World's Waste | Council on Foreign Relations (cfr.org)

The solution to the problem of hazardous e-waste lies at least partly in pursuing clean production. For the most part, electronics are not designed to facilitate recycling. If electronic equipment were designed to be easily and efficiently recycled, resources could be saved while protecting workers' health. Legislation on electronics in the European Union makes manufacturers responsible for eliminating some of the most toxic components of electronic equipment, and creates incentives or requirements for manufacturers to create easily recycled products.[79] But with electronics production burgeoning worldwide, the problem is growing, with ever-increasing impacts on low-income workers.

5.3 New Issues with Plastic Waste

Increasing attention has focused on the global problem of plastic waste. “Plastic pollution has become one of the most pressing environmental issues, as rapidly increasing production of disposable plastic products overwhelms the world’s ability to deal with them. Plastic pollution is most visible in less-wealthy Asian and African nations, where garbage collection systems are often inefficient or nonexistent. But wealthy nations, especially those with low recycling rates, also have trouble properly collecting discarded plastics. Plastic trash has become so ubiquitous it has prompted efforts to write a global treaty negotiated by the United Nations.”[80]

Like other wastes, plastic waste is often shipped from developed to developing nations, and some developing nations have viewed it as an important source of income. But the quantities have now become so large as to be out of control.

“The growing momentum to address plastic pollution through global governance has seen the emergence of new international regulations on the management of plastic waste under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. While these new Basel Convention controls are vital, they only partially address the continued threat the trade and management of plastic waste poses to workers, communities, ecosystems and planetary boundaries.” [81]

These problems have led some countries, such as Malaysia and the Philippines, to start shipping plastic waste back to its point of origin. According to Yeo Bee Yin, Environment Minister for Malaysia, “Malaysia will not be a dumping ground to the world . . . we will fight back. Even though we are a small country, we cannot be bullied by large countries,”[82] As with other environmental justice issues, resistance from those who suffer the worst effects may in time force improvements in overall environmental management.

[79] RoHS Directive - European Commission (europa.eu)
[80] The World's Plastic Pollution Crisis Explained (nationalgeographic.org)
[81] https://eia-international.org/wp-content/uploads/2023-EIA-UK-Bridging-the-Basel-Convention-Gaps-with-the-Future-Plastics-Treaty.pdf
[82] This is what the world’s waste does to people in poorer countries | World Economic Forum (weforum.org); Why some countries are shipping back plastic waste (bbc.com)

6. EQUALIZE THE BURDEN OR ELIMINATE POLLUTION?

There are two possible solutions to environmental justice problems: spread out pollution more equitably, or reduce the total burden of pollution. In general, community groups working for environmental justice stress that their goal is the latter. In many instances, in fact, groups working for environmental justice have achieved broader goals.

For example, an environmental justice effort in San Diego, California led to broader changes in management of toxic pesticides. The pesticide methyl bromide had been widely used to fumigate incoming produce in San Diego's port district. Methyl bromide is a reproductive toxicant and an ozone depleting chemical, so it is significant both for local environmental health and for the global environment. In the low-income neighborhoods near the port, residents suffered health consequences -- including asthma, vision problems, and skin disorders -- from exposure to a range of pollutants including methyl bromide.

An Environmental Health Coalition campaign against the use of methyl bromide was successful and its use was discontinued; San Diego adopted the first policy in the world prohibiting use of methyl bromide as a port fumigant. This successful campaign has served as a model for environmental health campaigns in other port communities and has spurred the creation of other local projects for environmental protection and reclamation.[83]

As we saw in the discussion of electronic waste, unequal distribution of environmental harm can sometimes help to prolong serious problems at the nexus of economics and the environment, by hiding those problems from the people who have power to make changes. Solving environmental justice problems often implies solving underlying production problems.

In the case of e-waste, a production problem -- electronic equipment that is nearly impossible to recycle safely -- leads to an environmental justice problem when poverty-stricken workers destroy their health attempting to extract the valuable components of old computers. Solving this problem is not a simple matter of introducing new rules for safe handling of old electronic equipment. It requires changing the way electronic goods are manufactured, so as to promote genuine recycling without major environmental hazards. In this and many other cases, when people work to redress environmental injustices, they can help to repair other problems in the economy in the process.

[83] See Faber and McCarthy, 2003.

7. SUMMARY

Environmental justice is the recognition that minority and low-income communities often bear a disproportionate share of environmental costs – and that this is unjust. Environmental quality, income levels, and access to health care can all affect people's health. People with low incomes and inadequate access to health care are often disproportionately exposed to environmental contamination that threatens their health.

Environmental pollution is linked to a range of disabilities and chronic illnesses including cancer, asthma, and certain learning disabilities. Rising rates of these problems affect everyone, but in many cases, low-income and minority communities are disproportionately affected. Pollution is distributed unequally within individual states, within counties, and within cities. Hazardous waste sites, municipal landfills, incinerators, and other hazardous facilities are disproportionately located in low-income and minority neighborhoods.

A variety of economic concepts are relevant to the study of the interrelationship among income, pollution, and health. These include hedonic pricing, which attempts to calculate the dollar value of environmental factors by looking at variations in the value of marketed goods, such as houses or land. The difference between efficiency and equity is also important for an understanding of the economics of pollution and health. A policy that is efficient is not necessarily equitable, and may in fact be rejected on an equity basis. In many cases, distribution of environmental harms is not equitable, requiring an analysis that includes social equity as well as economic efficiency.

In some uses of economic analysis, income differences can be presented as a justification for unequal distribution of environmental harms. This approach can be particularly problematic when it relies on defining the monetary value of a human life. Methodologies for calculating the value of a "statistical life" include so-called wage-risk analyses and analyses of foregone future income. These methods, however, are inherently biased in that they tend to place less value on the lives of people with lower incomes.

Just as low-income communities often bear a disproportionate burden of pollution and environmental degradation compared with wealthier communities within the same country, poorer nations may bear a disproportionate burden from toxic wastes that are exported from wealthier nations. Low-income developing nations may also bear a disproportionate burden from global warming and other human-induced changes that affect the entire planet. Global climate change is caused by fossil fuel use, which historically has been concentrated in developed countries; yet the adverse effects of climate disruption may be concentrated disproportionately in certain developing countries.

KEY TERMS AND CONCEPTS

Basel Convention: An international convention created in 1989 to manage and regulate international trade in hazardous wastes.

Climate change: climate disruption resulting from the increase in average global temperature as a result of emissions from human activities.

Compensation: providing monetary payments or other resources to those who suffer an inequitable burden from economic activities, policies, or environmental externalities.

Disproportionate exposures: The concept that marginalized populations often experience disproportionately large exposures to certain toxic chemicals, air and water pollution, and other environmental hazards that affect human health.

Efficiency: The term "efficiency" in economics is defined in terms of total welfare gains and losses. An allocation is considered efficient if it maximizes cumulative welfare across society. This concept does not take account of equity concerns: a society can be highly inequitable, in the sense that wealth and income is concentrated in the hands of a few, and can still be considered efficient.

Environmental Justice: the recognition that minority and low-income communities often bear a disproportionate share of environmental costs and that this is unjust.

Endocrine disrupters: chemicals can interfere with the normal functioning of hormones in the human body.

Equity: Equity is a measure of *who* gains or loses from a situation or policy. An equitable result means that all parties are treated fairly, and that gains are not concentrated in the hands of a few.

Externality: an effect of a market transaction on individuals or firms other than those involved in the transaction. A negative externality arises when a market transaction imposes *costs* on individuals or firms not involved in the transaction; a positive externality arises when those individuals or firms enjoy a *benefit* from the transaction.

Foregone future income: the income an individual would have been expected to earn in the absence of an illness, disabling event, or death. Foregone future income is one measure used to place a monetary value on an illness, disability, or death.

Hedonic pricing: a method for estimating the dollar value of environmental factors by looking at variations in the value of marketed goods, such as houses or land. For example, economists may compare property values between two neighborhoods that are similar in most respects but that differ in level of pollution, and estimate the price differential related to the different levels of environmental quality.

Precautionary principle: the view that precautionary action should be taken to protect human health and the environment from serious hazards, without waiting for complete scientific certainty about those hazards.

Social equity: a principle of justice, implying that overall economic welfare does not guarantee fair or equitable outcomes, so that specific attention is needed to defend the interests of lower-income families and individuals and marginalized groups within a society.

Value of a statistical life: a monetary value placed on the possibility of loss of human life associated with a particular policy or course of action**.**

Wage-risk analyses: a methodology for estimating the monetary value individuals place on their physical safety, health, or life by measuring the wage increase associated with high-risk jobs.

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WEB LINKS

Alaska Community Action on Toxics https://www.akaction.org/
"Driven by a core belief in environmental justice, Alaska Community Action on Toxics (ACAT) empowers communities to eliminate exposure to toxics through collaborative research, shared science, education, organizing, and advocacy."

Basel Action Network http://www.ban.org/
The Basel Action Network is a non-governmental organization that investigates toxic waste trade issues, including programs on E-waste and plastic pollution.

Bullard Center For Environmental Justice https://www.bullardcenter.org
The Bullard Center for Environmental Justice at Texas Southern University "addresses longstanding issues of systemic inequality and structural racism". It features recent news stories on environmental justice struggles and policy issues.

Center for Health, Environment and Justice http://www.chej.org/
Center for Health, Environment, and Justice aims "to prevent harm to human health by providing technical and organizing support to individuals and communities facing toxic hazards."

Collaborative for Health and Environment https://www.healthandenvironment.org/
The Collaborative for Health and Environment (CHE) brings together scientists, policy makers, advocates and others to amplify the latest, peer-reviewed science and support policy changes to protect human health and the environment. CHE's website includes educational webinars, blog posts, and fact sheets on environmental health and environmental justice.

Coming Clean https://comingcleaninc.org/
Coming Clean is "a nonprofit environmental health collaborative working to transform the chemical industry so it is no longer a source of harm, and to secure systemic changes that allow a safe chemical and clean energy economy to flourish."

Environmental Justice | US EPA
The U.S. Environmental Protection Agency's Environmental Justice Program to protect people from "disproportionate and adverse human health and environmental effects and hazards".

Environmental justice - Search Videos (bing.com)
Videos of Environmental Justice community activism, law and policy.

The Father of Environmental Justice Exposes the Geography of Inequity by Yesenia Funes, Scientific American 2023.
Robert Bullard is considered "Father of Environmental Justice, based on his work as the first scientist to publish research on the links between race and exposure to pollution in the 1970s, and his role in initiating the now widespread movement for environmental justice. Bullard comments on the progress of the environmental justice movement over the decades.

Intergovernmental Panel on Climate Change https://www.ipcc.ch/
The Intergovernmental Panel on Climate Change (IPCC), the United Nations panel for assessing the science related to climate change, including assessment of disproportionate impacts of climate change throughout the world.

Louisiana Bucket Brigade http://www.labucketbrigade.org/
Louisiana Bucket Brigade "uses grassroots action to hold the petrochemical industry and government accountable for the true costs of pollution."

Massachusetts Office of Environmental Justice and Equity
https://www.mass.gov/orgs/office-of-environmental-justice-equity-oeje
This web page includes links to maps of environmental justice neighborhoods in Massachusetts, as well as the state's Environmental Justice Policy, adopted in 2002 and updated in 2021. Massachusetts also adopted an Environmental Justice Strategy in 2024, designed to "integrate environmental justice principles into policies, programs, and practices."

Taking Stock Study https://takingstockstudy.org/
"The Taking Stock study seeks to explore the impacts of beauty products on Black and Latina women in California." This "community-driven pilot study is guided by the overall hypothesis that consumer product use patterns contribute to exposure and health inequities observed in Black and Latina women in California."

What Environmental Justice Means—and Why it Matters - Goldman Environmental Prize (goldmanprize.org)
The Goldman Environmental Prize "recognizes individuals for sustained and significant efforts to protect and enhance the natural environment, often at great personal risk."

Yale Experts Explain Environmental Justice | Yale Sustainability
Environmental Justice experts discuss "the link between social justice and environmental health, and how we cannot move forward without addressing both."

Environmental Justice Health Alliance for Chemical Policy Reform https://ej4all.org/
"The Environmental Justice Health Alliance for Chemical Policy Reform is a national network of grassroots Environmental and Economic Justice organizations and advocates in communities that are disproportionately impacted by toxic chemicals from legacy contamination, ongoing exposure to polluting facilities and health-harming chemicals in household products. EJHA supports a just transition towards safer chemicals and a pollution-free economy that leaves no community or worker behind."

DISCUSSION QUESTIONS

1. Consider a company that is seeking to build a new industrial facility that will release toxic chemicals into air, water and soil. Three possible locations are under consideration: a middle-class suburban community, a rural high-income community, and an urban low-income community. What political, economic, and geographic factors might affect the company's decision about where to site the facility?

2. Consider a neighborhood where a typical home costs $250,000. Most residents own their homes and have lived in the neighborhood for more than ten years. Five years ago, an oil refinery was constructed within half a mile of the neighborhood. There have been several accidents at the refinery in which toxic gases were released into the air. What factors will affect residents' decisions about whether to remain in the neighborhood or sell their homes and move elsewhere?

3. Wage-risk analysis is one approach to estimating the monetary value of a human life. In a wage-risk analysis, economists look at the pay increase that is associated with taking a high-risk job. For example, a job that poses a 1 in 10,000 risk of death may command a higher hourly pay rate than a similar but safer job. Economists use this risk premium to estimate the value that people place on a 1 in 10,000 risk of death. Suggest one reason why the results of a wage-risk analysis may fail to give an accurate representation of people's values.

4. Using these web sites and others that you can find, explore the issues involved with E-waste disposal. To what extent is this an environmental justice issue? What policies are needed to reduce the many negative impacts of E-waste disposal and recycling?

   Here is everything you need to know about electronic waste | World Economic Forum (weforum.org)
   Waste from Electrical and Electronic Equipment (WEEE) - European Commission (europa.eu)
   How much e-waste does Europe generate, recycle and repair? | Euronews
   The Burning Truth Behind an E-Waste Dump in Africa | Smithsonian (smithsonianmag.com)