2023

Unequal Exposure: An Inclusive Approach to Teaching Environmental Justice

Keith Brouhle

Nirupama Devaraj

UNEQUAL EXPOSURE: AN INCLUSIVE APPROACH TO TEACHING ENVIRONMENTAL JUSTICE

Appendix

Keith Brouhle, Grinnell College

brouhlek@grinnell.edu

Nirupama Devaraj, Valparaiso University

Niru.Devaraj@valpo.edu

The following Appendices B, C, and D are part of the work titled, "Unequal Exposure: An Inclusive Approach to Teaching Environmental Justice", published in the Journal of Economic Education. Appendix A is included in the journal article itself. These remaining appendices are referenced therein and available on ValpoScholar, the central exchange for scholarship and creative work hosted by Valparaiso University.

Appendix B: Map Exercise and Discussion for Firm Siting Hypothesis

EPA Environmental Justice Screening Tool

Introduction

An unequal distribution of pollution in society is likely not surprising to you. Cities have zoning rules and regulations that tend to focus economic activity in certain areas. Firms may find it advantageous to locate near other firms for infrastructure reasons. Thus, the presence of pollution and discharges of waste that generate environmental hazards are spatially distributed.

At the same time, households are also distributed somewhat unequally across space. Whether as a result of historical discrimination or what might be described as taste-based preferences in living locations, the residential landscape of most American cities is segregated. Across many different characteristics such as race, education, income, etc., we find clusters of similar individuals/households living in proximity.

This exercise asks you to consider the extent to which the distribution of environmental hazards (pollution, waste, etc.) is correlated with the distribution of socio-demographic characteristics of neighborhoods (race, education, income, etc.).

Assignment

In preparation for class, I would like to ask you to prepare two maps. One map will illustrate what you perceive to be a significant relationship between an environmental hazard and a neighborhood characteristic (the two outcomes appear to be correlated). The second map will illustrate what you perceive to be a lack of a relationship between an environmental hazard and a neighborhood characteristic.

Your two maps should be in a format to easily share with your classmates and myself. I think it is probably easiest to take a screenshot of the maps that you create and then save the screenshot in a word file or pdf file. Also, be sure to include the relevant characteristics such that someone else can easily (and quickly) recreate the map using the mapping tool.

Environmental Justice Tool

To explore the relationship between environmental hazards and neighborhood characteristics, we will use a visualization mapping tool from the EPA. The tool is EJSCREEN: Environmental Justice Screening and Mapping Tool. Please go the following website to access the mapping tool: https://www.epa.gov/ejscreen. You may want to browse and explore the website if interested.

This tool will allow us to map (1) the location of an environmental hazard and (2) a characteristic of the surrounding neighborhood. There are a lot of options on the site, but broadly, we can identify location-based information on the following:

Environmental hazards include:

- Superfund
- Brownfield
- Air Pollution
- Hazardous Waste
- Toxic Release Inventory

Neighborhood characteristics include:

- Income/Poverty
- Education
- Employment
- Health

Instructions / Guidelines

There are many different maps you can create. Below, I provide some instructions or general guidelines, but feel free to explore on your own to create the most interesting and compelling map!

1. Go to the website: https://www.epa.gov/ejscreen. In the middle of the screen just above the large picture, you'll see the text "Launch the EJSCREEN Tool." Click this link.
2. A new window will open that displays a (partial) map of the US. In the top right-hand corner of the map, you'll find a text box where you can "find address or place." Choose a location in the US that you would like to explore by entering the city name or zip code into the text box. The map will recenter to display this geographic area.
   - Hint: You'll find data is sparse in some rural locations; environmental hazards are few and the gradations on neighborhood characteristics are limited. Hence, exploring the data in a more urban environment may be more illustrative.
3. The large display box on the lefthand side of the map allows the user to choose among several mapping features. Hover your mouse over the icons at the top of the display menu to locate the "Additional Demographics" icon. Click on this icon. A new set of options will appear in the display box.

   The drop-down menu displays different demographic variables that can be displayed on the map. You are free to explore and choose a demographic variable of interest.

   - I was interested in looking at income levels in my mapped area. To explore this variable, I chose the following options in the pop-up box:

     Category: Income/Poverty
     Variable: Pct HH below poverty level
     Block group Map

   - Hint: By clicking on the legend in the "Map Contents" box, you can identify the thresholds behind the color gradations and can adjust the degree of transparency to maximize the visual impact.
4. Next, go back to the display box on the lefthand side of the map. Hover your mouse over the icons on the top of the display menu to locate a teardrop icon named "Places." Choose this option.
5. From the drop-down menu that appears, click on the "EPA Regulated facilities" option. From the legend on the right, you may choose from several sources of environmental hazards: Superfund, Water Dischargers, Brownfields, and Toxic Release Inventory facilities.
   - Hint: There may not be any locations of a specific environmental hazard in your map area. You can choose different hazards and/or zoom in/out on the map to get a better sense of the locations of these environmental hazards. While you can explore different environmental hazards at this stage, in creating your map, pick just one.
6. Success! You have created a map that shows the levels of a demographic characteristic around the locations of an environmental hazard. Take a screenshot of the map and write down notes of the environmental hazard of interest, the demographic characteristics (and the chosen settings) in the given geographic area. We'll discuss these maps in class.

Appendix C: Discussion-based Article Analysis of Coasian Bargaining Hypothesis

Challenges to Coasian bargaining in a real-world setting

This exercise explores the theoretical predictions of the Coase Theorem in a real-world setting. This exercise unfolds in three parts: a reading, a class discussion, and a short, written assignment.

Part 1: Reading

Please read the chapter "Internal Colonialism" by Taylor (2014). The chapter appears in the book *Toxic Communities: Environmental Racism, Industrial Pollution, and Residential Mobility* (NYU Press). The chapter describes interactions between the federal government and Native American peoples regarding land use rights and environmental protection.

Part 2: Class discussion

In our upcoming class, we will discuss the Taylor article in light of our recent course lecture on the Coase Theorem. To prepare for this class discussion, please consider the following questions:

a. According to Taylor, how have Native American populations in the US been impacted by the following:
   - Availability of and access to natural resources on native lands
   - Compensation and gains from resource extraction
   - Exposure to toxic releases and hazardous wastes

   You may want to cite an example (case study) from the chapter to substantiate your responses.

b. What are the key assumptions behind the Coase theorem? If these assumptions hold, what does the Coase Theorem tell us about the allocation of economic resources?

c. Consider a standard (economic) application of the Coase theorem to any of environmental outcomes listed in part (a).

d. Now, apply a critical lens to examine whether the assumptions of the Coase theorem are valid for your example in part (c)? Which assumptions hold? Which do not?

e. In your opinion, are the environmental outcomes described in your example from part (a) more like "internal colonialism" (as described by Taylor) or similar to Coasian bargaining in a competitive market? Explain.

Part 3: Written assignment

The goal of this writing exercise is to encourage you to critique the relevance and applicability of the Coase theorem to the real-world environmental outcomes described in the "Internal Colonialism" chapter in Taylor (2014). In 500-600 words, respond to the following prompt:

> *Support or critique a Coasian bargaining application to the allocation of environmental resources and distribution of environmental burdens described in the Taylor chapter.*

References

Taylor, D. (2014). *Toxic Communities: Environmental Racism, Industrial Pollution, and Residential Mobility* NYU Press: New York.

Appendix D: Map Activity and Article Analysis on Discriminatory Politics and Policies

Impact of Historical Redlining on Environmental Quality Today

This exercise will introduce the historical practice of redlining and explore the impact of this past policy on current economic and environmental outcomes. We will read some background on the history of redlining and its practice and then view different maps to visualize different outcomes. Our exploration will utilize the following sources:

- "Mapping Inequality: Redlining in New Deal America" by *American Panorama*
- "How Decades of Racist Housing Policy Left Neighborhoods Sweltering" by *New York Times (2020)*
- "Historical Redlining is Associated with Present Day Air Pollution in US Cities" by Lane, Morello-Frosch, Marshall, and Apte in *Environmental Science and Technology Letters* (2022)

Part 1: History of Redlining

Review the *Mapping Inequality: Redlining in New Deal America* website. In the top toolbar, you'll see a link for "Introduction". Choose this link and read through the text on the site.

1. In a short paragraph, provide an overview of the practice of redlining.
2. What role did the government play in redlining? What role did the private sector (banks) play in the practice of redlining?

In the top toolbar, you'll see a link for "Downloads and Data." Choose this link and investigate the redlining map and area descriptions for two cities listed on the site. Please investigate Richmond, VA and the nearest urban city to either our university or your home city.

3. Open the file labeled 'Scan' map for each city. The map shows the assessed grade [A-D] of each residential neighborhood in the city. For Richmond and the other city you have chosen, describe the distribution of grades and clustering (if any) of the graded neighborhoods (Are there an equal number of neighborhoods graded as A as D? Are the neighborhoods of a given grade equally (or randomly) distributed across the city, or is there clustering?).
4. The "Area Description Images' provides some details on the different neighborhood characteristics as graded by the assessor. Review a few neighborhood files to get a sense of the characteristics of each graded neighborhood. Are neighborhoods graded "B" predominantly white or black (or foreign)? What about neighborhoods graded "D"?

A review of the *Mapping Inequality* website gives us an overview of the history of the policy of redlining as well as focused appreciation of redlining in two specific cities. Let's investigate the impact of these historical policies on environmental outcomes experienced today.

Part 2: Environmental Outcomes Today

Providing environmental quality in urban environments is challenging in many dimensions. In this section, we'll consider one of two different urban environmental outcomes: (1) air quality measures or (2) tree cover, shade, and urban temperatures. Please complete either part A or part B of this section.

Section A: Urban Air Quality

Read the 2022 article "Historical Redlining is Associated with Present Day Air Pollution in US Cities" by Lane, Morello-Frosch, Marshall, and Apte, which appears in the journal *Environmental Science and Technology Letters*.

5. Describe the data sources used in the article:
   a. Air pollution data: what is the source of the data, what are the drivers of the two pollution measures (NO_2 and $PM_{2.5}$), and how long lasting is each pollutant?
   b. Neighborhood data: how are HOLC classifications connected to present day socio-demographic measures?

6. Key findings from the authors' analysis are shared in Figure 1, panels a. and b.

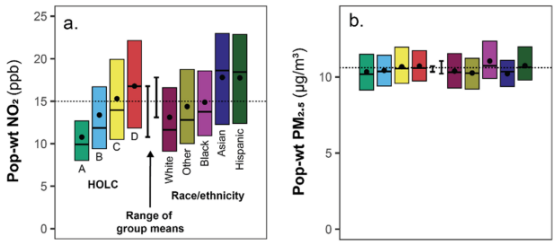

Figure 1: Population-weighted distributions of NO2 and PM2.5 levels within HOLC mapped areas at the census block level. Bars represent 25th and 75 percentiles. Medians are indicated with horizontal lines, and means by the dot marker; the overall mean is indicated by the dotted line.

   a. What relationship, if any, appears to exist between HOLC classification and each pollutant (NO_2 and $PM_{2.5}$)?
   b. What relationship, if any, appears to exist between the race/ethnicity of neighborhoods and each pollutant (NO_2 and $PM_{2.5}$)? How does your finding here reflect observations about the nature of each pollutant as described in question 5a?

Section B: Urban Tree Cover, Shade, and Temperatures

Read and explore the interactive news article "How Decades of Racist Housing Policy Left Neighborhoods Sweltering" in the *New York Times* (August 2020).

5. What is the relationship between tree cover, shade, and urban temperatures? Does this make the presence (or absence) of trees an environmental justice issue? Recognizing most land in cities is privately owned, what might you expect of your government authorities to address this issue?
6. The article uses Richmond, VA as a case study to explore the impact of historical redlining on urban temperatures today. Summarize the core findings presented in the article. Do you find the evidence convincing?

If interested, you might investigate tree cover in the other city you investigated by using the Tree Equity Score (https://www.treeequityscore.org/) as calculated by American Forests.

References

Lane, H.M., Morello-Frosch, R., Marshall, J.D., and Apte, J.S. (2022). Historical Redlining is Associated with Present-Day Air Pollution Disparities in U.S. Cities, Environmental Science and Technology Letters, 9(4): 345-350.

Mapping Inequality: Redlining in New Deal America (2022). https://dsl.richmond.edu/panorama/redlining/#loc=5/39.1/-94.58&text=intro (last accessed on March 28, 2022).

New York Times (2020). How Decades of Racist Housing Policy Left Neighborhoods Sweltering, 24 August 2020.