Components of S-E Synthesis Case Study Teaching Notes

1. **Title:** Environmental Justice in Houston

2. **Author Information**

Kevin T. Smiley, Rice University

3. **Summary:**

This case focuses on the case of Greater Houston, Texas, one of the polluted metropolitan areas in the United States. Inequalities in human exposure to toxins are found in Houston, and across much of the U.S. The unit uses a directed case study that links together the scientific measurement of pollution, the differential ways in which humans are exposed to pollution, and an understanding of the socioenvironmental systems at work in the creation of pollution. Using an online web tool from the EPA called EJSCREEN, the primary assessment will be the construction of a side-by-side map that details the inequities in exposure to pollution in a location that each student will select. This unit is intended to support two fifty-minute course meetings.

4. What course(s) might this case be appropriate for?

Upper division undergraduate environmental social science course. Additionally, introductory environmental studies courses might also find this case study useful.

5. What level is this case appropriate for?

Upper Division undergraduate.

6. **S-E Synthesis Learning Goals**

a) Understand structure and behavior of socio-environmental systems

Students will identify and investigate inequities in human exposure to environmental toxins.

b) Consider the importance of scale and context

Students will examine specific contexts – a place of their choice – to analyze how places within that context are differentially exposed to environmental toxins.

c) Co-develop research questions and conceptual models in inter- or trans-disciplinary teams

Students will develop research questions design and answer questions about socioenvironmental issues. They will work with classmates as they engage with these topics.

d) Find, analyze, and synthesize existing data, concepts, or methods.

Students will utilize online data tools to create real-world analyses of human exposure to environmental toxins.

7. **Learning Objectives**

1) Students will be able to define environmental justice, and discuss environmental inequalities.

2) Students will be able to study inequalities in pollution exposure in a context that stresses the socieoenvironmental connections across different contexts and scales.

3) Students will be able to access the online tool, EJSCREEN, and create analyses that pair data about human populations in conjunction with scientific data on environmental risks.

8. **Introduction**[1]

Human societies produce immense amounts of pollution. With resources extracted from the natural environment or chemicals refined in manufacturing processes, industrial facilities emit chemicals of every ilk. Motor vehicles, whether roaring across highways and idling in traffic, pump out toxins into the environment. And the energy that supports so much of our life – homes, workplaces, schools, grocery stores, to name but a few – is sourced by power plants whose dangerous fumes head upward and outward.

The problem of pollution is not only one of global scale – the overall impact on earth and its residents – but also one of distribution. Pollution provokes a simple question: where should it go? For more than a quarter century, environmental justice research in the social sciences has found that it has not been equally distributed. Instead, exposure to toxic pollutants is profoundly shaped by social factors, especially race and class. Neighborhoods with more residents who are racial minorities are often more polluted, as are many economically struggling neighborhoods. This pollution comes in the form of being closer to superfund sites or other defunct heavy polluting sites, near polluted water sources, or exposed to toxic air from highways or industrial facilities.

Greater Houston is characterized by high levels of environmental inequality. As discussed in the readings and in other research on the city, pollution levels are especially high in the Houston metropolitan area. Houston is also a place that, like much of the United States, has social inequalities along class and race lines that shape housing patterns and urban form. The combination of high levels of pollution and social inequalities connects to the core question of where should pollution go. In Houston, this exposure to pollution is unequal, and therefore is an environmental justice issue.

This case study provides undergraduate students the tools with which to identify and investigate environmental inequalities. It begins with Houston, one of America's most polluted places, and centers the discussion on the city as an entry point to give students the power to analyze a case of their own choice. It involves utilizing an online tool, the U.S. Environmental Protection Agency's EJSCREEN, to give students the ability to document environmental inequalities, using different measurements of pollution to do so.

9. **Classroom Management**[2]

Day One: Introduction to Topic

Activity	**Time Frame**	**Materials Needed**
Before Class	-	Before this class meeting, students should read: 1) Mohai, Paul, David Pellow, and J. Timmons Roberts. 2009. "Environmental Justice." *Annual Review of Environmental Resources* 34:405-430.[1] 2) Union of Concerned Scientists and t.e.j.a.s. 2016. Double Jeopardy in Houston: Acute and Chemical Exposures Pose Disproportionate Risks for Minority Communities. Washington, DC: Union of Concerned Scientists. Available at: http://www.ucsusa.org/sites/default/files/attach/2016/10/ucs-double-jeopardy-in-houston-full-report-2016.pdf
EJ Video Introduction	15 minutes	Youtube video ("Environmental Justice" by Grist): https://www.youtube.com/watch?v=dREtXUij6_c Discuss video: • What did you notice? • Along what lines can environmental exposure be unequal? • What natural resources involved in the study of environmental justice? What are examples of items that natural resources are transformed into? How does environmental justice connect to the natural environment? Discuss environmental inequality generally (Instructor can consult background section and readings for more information): • How can the environment be unequal for human populations? (Can list examples on board) ○ Students can be asked to refer to the Mohai et al. article.

[1] The abstract for this article is included in Section 13 ("References") to introduce instructors to this reading. Note that the journal is a subscription-based journal, and that instructors will have to download a copy from their university library or obtain it with an inter-library loan.

The case: Houston, Texas	15 minutes	This section will primarily discuss the second reading (the UCS and tejas report).
		
		Students should be split into pairs. For the first half (7-8 minutes), students will discuss these questions in their pairs. These questions are included in the separate student handout document as well as below.
		
		For the second half (7-8 minutes), the instructor will lead the class in the discussion about these questions.
		
		Questions for the discussion:
		• What were each of the four neighborhoods that were studied? Describe their racial and economic make-up.
		  ○ Why were these neighborhoods selected?
		• What are the pollutants measured in the report?
		  ○ Why are these pollutants important?
		• What are the major findings across the neighborhoods?
		• What are the implications of these findings?
		• How are social inequalities in housing related to environmental inequalities?
		
		Key points that student should learn from this discussion:
		• There are racial and economic disparities in exposure to unhealthful toxins
		  ○ This is found for different types of pollutants.
		• Other social inequalities, such as those in housing, structure environmental inequalities

Houston and EJSCREEN	18 minutes	Houston and Pollution maps. Students will be divided into four groups. Each group will receive two maps: (a) Houston's neighborhoods symbolized with an environmental exposure variable, and (b) Houston's neighborhoods using a social variable (each group will receive a different map; these maps can be found in the Student Handout). Students are asked to compare the two maps in their groups, and write down three summary findings (9 minutes).

		• The primary goal is that students should be able to independently identify environmental inequalities. Then, each group briefly shares their three findings with the larger group (9 minutes). In this section, the instructor may wish to project each group's map so that all classroom participants can see it.
What is your case?	2 minutes	The first task of this assignment is for the students to pick one location in the United States that they would like to analyze. Examples of locations could be states, metropolitan areas, and cities. Students are instructed to come up with a location before the beginning of the next class.

Day Two: Using EJSCREEN

Activity	**Time Frame**	**Materials Needed**
Before Class	-	Students should have chosen a location to analyze for their final assignment. Note that this course meeting should take place in a computer lab.
Explanation of Assignment	5 minutes	Instructor will explain the final assignment for this unit: the side-by-side map. The instructor should hand out the final assignment instructions in the Student Handout document.
Introduction to EJSCREEN	15 minutes	Use Student Handout on step-by-step instructions for EJSCREEN. Students should be at computers.
EJSCREEN Analysis	20 minutes	Students will have independent work time to begin creating their side-by-side map. Students should consult the Student Handout for instructions on the assignment.

		Instructor will monitor students, and help accordingly. The student handout includes several questions that the instructor may want to use to guide students as they work with them as a class or on an individual basis.
EJSCREEN Peer Review	10 minutes	Pair students in groups of two or three. Each student should showcase what they have been working on, and what challenges they are having. Students are encouraged to help one another. For smaller classes, an alternate idea is to ask students to do short presentations to the class (approximately 2 minutes) about what they are discovering.

Conclusion

Students should turn in a side-by-side map and analysis for a grade at a time of the instructor's choosing. A recommended submission date is one week after the second course meeting.

10. **Assessment**

This case study employs two assignments:

1) Three findings from examination of Houston maps (Day 1)
2) Side-by-Side Map and Analysis (Day 2)

Assignment One – Three Findings from Examination of Houston maps

In groups of two to four, students are asked to review two maps of Houston, and write down three findings (1-2 sentences each) they found in the maps. These findings could include information about the overall levels of pollution, documenting the places where pollution is present and the places where it is not (each area of the city could be a distinct finding).

It is suggested that this could be graded as a participation exercise that students turn in at the end of the assignment during class. Completion of three findings would constitute full credit.

See classroom outline for more information.

Assignment Two – Side-by-Side Map

The following could be given to the students as a handout of instructions for this assignment. I would also suggest sharing the rubric. Both are included in a separate document for such purposes along with instructions on how to use EJSCREEN.

The primary assessment is for the students to create a map, and write a two page analysis and reflection on the map.

The map should use the "side-by-side" function in EJSCREEN. The map on the left should symbolize an environmental exposure variable (i.e. an "EJSCREEN Map"). The map on the right should symbolize a human exposure variable (i.e. "Demographics").

The overall objectives of this assignment are twofold. First, students should demonstrate a technical capacity to identify environmental inequality, and create a visual aid and written description of their findings. Second, students should be able to analyze and reflect on the environmental inequality that they have identified, and connect it to environmental justice or social justice concerns more broadly.

Students are instructed to choose their own location for the analysis because it can be illuminating about relationships in that community with which the student may or may not have been previously acquainted. Because the first day of instruction already features a few different maps of the Houston area, it is appropriate to expand the case study's single city focus to a case beyond Houston.

Here are a few questions that you might want to consider as you complete your analysis:

- What are the overall trends for your human exposure variable? You can think about trends across space (i.e. clustered in certain sections of the area), or by degree (i.e. is the variable relatively dispersed or concentrated in only one or two areas).
- What are the overall trends for the environmental exposure variable? Like the human exposure variable, think about trends across space, and to what degree those trends are seen.
- Using the environmental exposure variable, where are the most advantaged places? Where are the most disadvantaged places? What are the social characteristics of those places?
- More broadly, do you find evidence for environmental inequality and environmental injustice?
- What natural resources are relevant for the environmental exposure measure you chose? What can that tell us about the relationships you are analyzing?
- Using knowledge from the readings, can you reflect on the social and environmental processes at play in the maps you created?
- Using your own experiences or knowledge about the place you chose, can you reflect on the social and environmental processes at play in the maps you created?

The assignment should be graded in the following areas (with the following grading weights): the side-by-map (40% of grade), the analysis of the map (40% of grade), and reflection on map (20% of grade).

Additional Notes for the Instructor:

This assignment could be adapted to be longer by including more analysis and/or the creation of more maps. This will likely depend on the level in which the course is taught.

10.1 **Rubric**

An "A" assignment will:

- Design an effective map that communicates clearly the socioenvironmental issue that the student selected
    - The map should have an EJSCREEN variable, a demographics variable, and a legend.
- The analysis will fully describe both the EJSCREEN variable and the demographic variable
- The analysis will identify the geographic locales that are exposed to the worst of their chosen variable of environmental degradation.
    - They will identify the inequalities in human exposure that are seen across geographic locales.
- The paper will analyze the implications of the inequalities they have identified in an exemplary fashion
- The reflection will discuss the meaningful lessons that the student has learned from the unit, EJSCREEN, or about environmental justice. The student will relate their own knowledge on the environment, social justice, and/or measurement of pollution previous to the unit, and effectively reflect on what they have learned since.

A "B" assignment will:

- Design an effective map that somewhat clearly communicates the socioenvironmental issue that the student selected
    - The map should have the needed attributes (see above), but may have forgotten the legend
- The analysis will mostly describe both the EJSCREEN variable and the demographic variable
- The analysis will identify the geographic locales that are exposed to the worst of their chosen variable of environmental degradation.
    - They will identify the inequalities in human exposure that are seen across geographic locales.
- The paper will analyze the implications of the inequalities they have identified in an effective fashion.
- The reflection will discuss the meaningful lessons that the student has learned from the unit, EJSCREEN, or about environmental justice. This reflection will incorporate important themes, but not as deeply or as broadly as those in the "A" category.

A "C" assignment will:

- Design a map that does not clearly communicate the socioenvironmental issue that the student selected

- The map should have the needed attributes (see above), but may have forgotten the legend
- The analysis will partly describe both the EJSCREEN variable and the demographic variable. The student may have analyzed one effectively but not the other.
- The analysis will identify the geographic locales that are exposed to the worst of their chosen variable of environmental degradation.
  - They will identify the inequalities in human exposure that are seen across geographic locales. A "C" paper may not speculate on both the geographic locales or the human exposure, instead analyzing only one or the other.
- The paper will analyze the implications of the inequalities they have identified but with only a limited engagement with the unit's overarching topics
- The reflection will discuss the lessons that the student has learned from the unit, EJSCREEN, or about environmental justice. This reflection will incorporate some themes, but not all and not as deeply or as broadly as those in the "A" or "B" categories.

A "D" assignment will:

- Design a map that does not clearly communicate the socioenvironmental issue that the student selected.
  - The map does not have all of the attributes. The student may have only done a map with only one variable symbolized.
- The analysis will poorly describe both the EJSCREEN variable and the demographic variable. The student may have analyzed one variable but not the other.
- The analysis will identify the geographic locales that are exposed to the worst of their chosen variable of environmental degradation.
  - They will identify the inequalities in human exposure that are seen across geographic locales. A "D" paper may not speculate on both the geographic locales or the human exposure, instead analyzing only one or the other, and do so poorly.
- The paper will not analyze the implications of the topic.
- The reflection does not discuss the lessons that the student has learned from the unit, EJSCREEN, or about environmental justice. The reflection is off topic.

A "F" assignment will:

- The student does not produce a side-by-side map.
- The student either has no analysis of their map or is largely off topic in their discussion of the description of the maps and implications of the map.
- The reflection portion is either not present or does not discuss the lessons that the student has learned from the unit, EJSCREEN, or about environmental justice. The reflection is off topic.

11. **Background**

Environmental justice research and advocacy investigates the inequalities in exposure to environmental degradation across human populations. For a primer on the subject, the Mohai,

Pellow, and Roberts review (assigned as a reading for the students) is perhaps the best and most comprehensive introduction to the subject.

Additionally, the "Principles of Environmental Justice," agreed to in a 1991 conference that formalized much of the advocacy and inquiry in EJ, is a short resource that instructors may find useful as well. It can be accessed here: http://www.ejnet.org/ej/principles.pdf.

Finally, environmental justice movements and conflicts are often in the news. At the time of this writing (2016), two recent examples concern the Standing Rock Sioux tribe's opposition to the Dakota Access Pipeline, and the recent (and ongoing) lead paint and contaminated water crisis in Flint, Michigan. Using recent examples to introduce the subject may especially animate students.

12. **Suggested Modifications –**

One possible area for suggested modification is to reorient the analysis from Houston to a different location, such as the place in which the university is located. A benefit of this approach is that the students may have greater immediate engagement with the course topics if it concerns local issues. A drawback is that this approach may presuppose many of the topics that the students may themselves be interested in analyzing, and would require the creation of new materials for some of the first day's instruction.

13. **References** –

Required Readings

Mohai, Paul, David Pellow, and J. Timmons Roberts. 2009. "Environmental Justice." *Annual Review of Environmental Resources* 34:405-430.

Abstract: The article reviews two decades of scholars' claims that exposures to pollution and other environmental risks are unequally distributed by race and class, examines case studies of environmental justice social movements and the history and politics of environmental justice policy making in the United States, and describes the emerging issue of global climate justice. The authors engage the contentious literature on how to quantitatively measure and document environmental injustice, especially the complex problems of having data of very different types and areas (such as zip codes, census tracts, or concentric circles) around polluting facilities or exposed populations. Also considered is the value of perspectives from critical race theory and ethnic studies for making sense of these social phenomena. The article concludes with a discussion of the globalization of the environmental justice movement, discourse, and issues, as well as with some policy implications of finding and understanding environmental justice. One unique feature of this review is its breadth and diversity, given the different approaches taken by the three coauthors.

Union of Concerned Scientists and t.e.j.a.s. 2016. Double Jeopardy in Houston: Acute and Chemical Exposures Pose Disproportionate Risks for Minority Communities. Washington, DC: Union of Concerned Scientists. Available at: http://www.ucsusa.org/sites/default/files/attach/2016/10/ucs-double-jeopardy-in-houston-full-report-2016.pdf

Supplemental Readings

Bullard, Robert. 1990. *Dumping in Dixie: Race, Class, and Environmental Quality.* Boulder, CO: Westview Press.

Mohai, Paul and Robin Saha. 2015. "Which Came First, People or Pollution? Assessing the disparate siting and post-siting demographic change hypotheses of environmental injustice."." *Environmental Research Letters* 10(11):1-17.

Pellow, David Naguib. 2002. *Garbage Wars: The Struggle for Environmental Justice in Chicago*. Cambridge, MA: The MIT Press.

Taylor, Dorceta E. 2014. *Toxic Communities: Environmental racism, industrial pollution, and residential mobility.* New York: New York University Press.

14. **Answer Key**[3]

There is no answer key provided. Instructors should consult the Assessment section for how to evaluate student output.

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