Introduction to Environmental Justice using EJ Screen

February, 2023

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# About this Course

This is a collection of modules intended to teach students about environmental justice through the [EPA’s EJ Screen tool](https://www.epa.gov/ejscreen).

These modules use a three-tiered system to educate across experience levels.



# 1 Target Audience

This module is made to provide opportunities for students, especially underserved and minority students, at higher education facilities to explore and critically think about environmental justice data using EJScreen and other tools. It targets the lower division level (undergraduate) students, across a variety of disciplines (e.g., biology, social science). “Marketing” could focus on HBCUs, historically-women’s colleges, community colleges, etc. But, it is open to anyone and should be adaptable for that purpose.

# 2 Guide for Instructors

Tier 1

Why are we doing this? Value of: Env Justice exploration Increasing relevance of learning material for students Data science skills for career potential (even the most basic of exposure) Student-centered teaching approaches How to empathetically approach environmental justice issues Data Science ethics (and a slide for them to use in their courses?) Guide for assessing student learning

Tier 2

Video tutorial with associated R code Also a pdf (R Markdown) guide to follow Guide for assessing student learning

Tier 3

Best-practices for guiding/managing student independent projects and assessing students equitably Guide for assessing student learning

# 3 Learning Outcomes by Subject

When students complete this module, they will be able to:

## 3.1 Science/Data Science (?)

### 3.1.1 Overarching LOs - to be applied at all tiers

* Understand how data science can be used to create environmental solutions for communities
* Place data science questions in context (ecological, environmental, community solution, etc)
* Understand complexities and limitations of data
* Evaluate drawbacks/benefits of tools like EJScreen
* Interpret results in context (ecological, environmental, community solution, etc)

### 3.1.2 Tier 1 (Intro level)

*Prerequisite Knowledge: None!*

* Explain how environmental indices can affect their community
* Evaluate the differences in the tools (EJScreen vs CEJST vs state-based(?) tools)
* And the benefits/drawbacks of the tools and how underlying data influences results (e.g., EJScreen uses census data - that is biased)
* Evaluate the positives and negatives of abstracting a place to one number
* Understand how weighting can impact results
* Question policy-makers and land managers on environmental justice issues
* Collaboratively develop action plans to move forward from their findings (wording of this sentence?)
* Tier 2 (Mid level)

*Prerequisite Knowledge: Basic introduction to data science and statistical analyses, e.g.*

* Access data through R
* Execute pre-written example code and interpret the results
* Construct and modify R code to test hypotheses
* Choose a place and tell a story about why it is identified as an EJ place. What is missing? Is there a place that you thought would show up in EJ screen but does not? What data gap makes that happen?

### 3.1.3 Tier 3 (Upper Division)

*Prerequisite Knowledge:*

* Student-driven project initiatives (SMART principles)
* Formulate a testable question
* Justify why this question is interesting with appropriate background information
* Create a justified hypothesis
* Obtain data from public sources (like EJ screen)
* Process raw data into usable formats
* Analyze data with appropriate statistical methods to answer the question
* Visualize data
* Contextualize results in broader context ((ecological, environmental, community solution, etc)
* Communicate results through - e.g. a paper, poster, flash talk, other format
* quantitative models to address scientific questions?
* Testable question
* Placed in the context
* Obtaining, cleaning, transforming, and processing raw data into usable formats?
* Apply a range of statistical methods for inference and prediction…
* Build data science products that can be used by a broad audience - or can be transferable to other broader contexts

## 3.2 Social Science:

Geared towards students who - Never have made a map before

### 3.2.1 Tier 1:

* Explain how environmental data science tools reflect our understandings of race and can both perpetuate and challenge racism
* Interpret maps
* Navigate the EJScreen tool and/or other similar tools to answer relevant, student-generated research questions about environmental (in)justice
* Understand how these can benefit their own community and neighborhood

### 3.2.2 Tier 2:

* Involve in ethnographic studies
* Be able to infer data with a broad socio-economic context
* Visualization of data using programming languages such as R
* Maybe tie-up with different environmental law firms to get a hands-on learning experience by interning/volunteering!

### 3.2.3 Tier 3:

* Placement opportunities for students interested in continuing this field of science
* Introduce public health implications of the data and research?
* Discuss data ethics?

# 4 Assessment

## 4.1 Student assessment

* Exam questions
* Guided questions for any pre reading
* Guided worksheet for students throughout module
* Individual or collaborative project
* Low-pressure quiz questions

## 4.2 Assessment & evolution of the module itself

* Survey of students pre- and post- course (self efficacy, excitement for data science, data science is relevant to me, etc)
* Survey of faculty/instructors that are actually teaching the course
* Incorporate feedback into further development of the module

# 5 Introduction

When organizations/governments need to make decisions that impact communities, they have to take a lot of information and condense it. It is not practical to go out to every site and measure every environmental variable in every location that they want to make a decision about. It costs money and takes time, both of which are always limited. The government/organizations will often look to easily-accessible data to make decisions about whether/how to do potentially damaging actions that impact the environment.

We are going to show you one tool that people use to make decisions that can impact your community, EJ Screen. EJ Screen is an environmental justice screening and mapping tool.

First, let’s take a look at the [EJ Screen](https://ejscreen.epa.gov/) website. Spend a few minutes poking around the site: What data are available? How are they represented?

# 6 Introduction

EJ Screen incorporates many different data sources. Let’s dig into one of the data sources that is part of EJ screen so we can understand it better.

We will import the data source used to make the wastewater index that is part of the EJ screen tool.

# 7 Activity

library(ggplot2)  
data <- read.csv(file = ‘TRI\_table\_CA2.csv’)  
county\_name = “IMPERIAL”  
county = data[data$COUNTY\_NAME == county\_name,]  
## What do the columns mean?  
# TOTAL\_PRODUCTION\_RELATED\_WASTE. = sum of all reports  
# TOTAL\_PRODUCTION\_RELATED\_WASTE..1 = average of all reports  
# TOTAL\_PRODUCTION\_RELATED\_WASTE..2 = count of reports  
# county$TOTAL\_PRODUCTION\_RELATED\_WASTE..5 = std of all reports  
# county$TOTAL\_PRODUCTION\_RELATED\_WASTE..6 = variance of all reports  
## Plot total by facility  
county1 = aggregate(x = county$TOTAL\_PRODUCTION\_RELATED\_WASTE., # Specify data column  
 by = list(county$FACILITY\_NAME), # Specify group indicator  
 FUN = sum)  
county1 <- county1[order(county1$x),]  
p<-ggplot(data=county1, aes(x=Group.1, y=x)) +  
 geom\_bar(stat = ‘identity’)  
p + theme(axis.text.x = element\_text(angle = 90, vjust = 0.5, hjust=1))  
## Plot total by chemical  
chemical = aggregate(x = county$TOTAL\_PRODUCTION\_RELATED\_WASTE., # Specify data column  
 by = list(county$CAS\_CHEM\_NAME), # Specify group indicator  
 FUN = sum)  
p<-ggplot(data=chemical, aes(x=Group.1, y=x)) +  
 geom\_bar(stat = ‘identity’)  
p + theme(axis.text.x = element\_text(angle = 90, vjust = 0.5, hjust=1))  
## Plot chemicals that are released into the water  
county\_water <- county[county$WATER\_TOTAL\_RELEASE > 0,]  
chemical = aggregate(x = county\_water$WATER\_TOTAL\_RELEASE, # Specify data column  
 by = list(county\_water$CAS\_CHEM\_NAME), # Specify group indicator  
 FUN = sum)  
p<-ggplot(data=chemical, aes(x=Group.1, y=x)) +  
 geom\_bar(stat = ‘identity’)  
p + theme(axis.text.x = element\_text(angle = 90, vjust = 0.5, hjust=1))

# About the Authors

Coming soon!

# Resources

[ejscreen R package](http://ejanalysis.github.io/ejscreen/)

Google slides for instructor to give background: <https://docs.google.com/presentation/d/1hGCkesvIgccjunUQzVRuHEp1aZNIDyMW9BdAonpN40M/edit#slide=id.p>

Background readings (and/or intro lecture?) to frame: What is EJ and why is it relevant? What is EJScreen? Why was this tool created and how is it used (and by who)? What data was used/is used for the tool? What are the general outputs of the tool? - general overview, diving into issues and understanding later

Google slides for lecture for class to give students background Guided worksheet for readings to help students break them down (and key with example answers) Do we want to revise the existing EJscreen pdf document that describes how to use it? Clearly commented code that underlies the module with potential variations

Definitions and government resources: AY Environmental and Climate Justice Definitions and History WebQuest

Global Environmental Justice Atlas <https://ejatlas.org/>

There is page an EJScreen Office Hours & Training

HackMD document–Project Overview: <https://hackmd.io/o2GWqTwHSjCDtKB3zV-QRg>

HackMD document–Tier 1: <https://hackmd.io/VWg4OEozTNi_DYO-0QZToA>

This is a very helpful breakdown on EJ Screen

One activity could be to analyze EJ screen through algorithmic ecology: <https://stoplapdspying.medium.com/the-algorithmic-ecology-an-abolitionist-tool-for-organizing-against-algorithms-14fcbd0e64d0>

Example of citizen science x socially engaged art practices (listening to climate stories, documenting phenology:) <https://phenology.umn.edu/>

Pollinator / environmental awareness x art internship for youth <https://plainsartbuzzlab.wixsite.com/buzzlab/about-us>

Integrating indigenous science to learning promoting inclusive science <https://futurumcareers.com/what-if-indigenous-science-were-part-of-the-science-curriculum> Environmental Justice Dashboards <https://pubhealthgis.uic.edu/environmental-justice/>

# References