**Title:** Graphing and mapping patterns of air quality in Los Angeles, California through an environmental justice lens.

**Author**

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**Course Information**

*Department/Program:* Department of Biological Sciences

*Biology 167 Advanced Environmental Science*

*Level*: Upper Division Undergraduate course

*Course Type:* Lecture 2x week 90 min

*Delivery mode:*  Online (Usually in-person)

*Students:* Biology Majors (as a Biology elective) and Non-majors (Interdisciplinary General Education course)

*Number of students:* 20

**Expected date or dates of implementation**

Three Parts, over three weeks. One full day in-class Activity

**Abstract**

Air quality is an environmental issue that impacts everyone in Los Angeles. We can see it with our eyes, feel it in our lungs and hear alerts along with the morning weather forecast. We are accustomed to “bad air days” in the summer and disturbances during fire season. However, on a day-to-day basis, not all communities are as evenly impacted, and the daily exposure levels vary across Los Angeles neighborhoods. These inequities can stem from systemic racist practices like redlining, the placement of industries (NIBY-ism), and proximity to freeways. This activity used a series of current popular press articles to frame air quality as an environmental justice issue and then visualized data trends through maps and graphs. The series of articles introduced the concept of redlining in Los Angeles and explored how historical systemic racist practices like redlining directly impact environmental health in communities today. The students were introduced to ESRI ArcGIS online as a tool to visualize the Los Angeles landscape. The students mapped the following Living Atlas Layers: a) Major Freeways, b) Historical HLOC Redlined Neighborhoods, c) Real-Time EPA AirNow Air Quality Monitoring Sites, and d) other Environmental Living Atlas Layers such as the locations of Oil and Natural Gas Wells. The students used Microsoft Excel to graph year-long trends in AQI or PM pollution. The students chose two contrasting Real-Time EPA AirNow Air Quality Monitoring Sites from the map and then downloaded a year of data from <https://www.epa.gov/outdoor-air-quality-data/download-daily-data>. The combination of mapping and graphing allowed students to look for patterns over time and space while the readings provided an environmental justice framework.

**Description:**

This is a three-part student activity that could be done in lecture or lab. Part 1 assigns a series of current popular press articles to read and a series of discussion questions. Students read and complete this section before the in-class activity. Part 2 takes place in class, students will be introduced to ESRI ArcGIS online and guided through a mapping activity using Living Atlas Layers. The students answer questions about their map. Part 3 is assigned as homework students select two Real-Time EPA AirNow Air Quality Monitoring Sites and download a year of data for the two locations from <https://www.epa.gov/outdoor-air-quality-data/download-daily-data>. The students will use Microsoft Excel to plot the data from each location and then use the graphs to answer questions.

**Quantitative learning objective(s)**

1. Quantitative Data Literacy- Visualize and analyze air quality data through maps and graphs. Visualize the spatial relationships of Los Angeles including traditionally redlined neighborhoods and locations of major freeways. Analyze long-term trends in daily air quality in two contrasting locations.

**Content learning objective(s)**

1. Air Pollution, Environmental Racism, Environmental Health

**Social justice and/or diversity/equity/inclusion learning objective(s)**

1. Linking institutional racism and historical discrimination to environmental health.

**Assessments**

For the objectives you listed in the previous section, what assessments will you use to measure student progress? Add rows as needed. Remember that a single assessment can measure multiple objectives.

|  |  |
| --- | --- |
| Objective(s) | Briefly describe assessment. Is it formative, summative? |
| Q1, Quantitative Data Literacy | Students will submit their maps and graphs and analysis questions. Summative |
| C1, Content | Students will answer a series of questions based on their activity and readings. Formative as they will again be quizzed on this content during future quizzes or exams. |
| SJ1, Social Justice | Students will answer a series of questions based on their activity and readings. Formative as they will again be quizzed on this content during future quizzes or exams. |
|  |  |

**Lesson sequence**

There are no prerequisite skills or knowledge as I expect for many students this will be new information.

**Part 1 Background reading Popular Press Articles**

**Part 2 In-Class Activity**

**Part 3 Homework Activity**

**Part 1 Background reading Popular Press Articles Read and the following Popular Press Articles and answer the following questions.**

Air Quality

* <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>
* <https://www.nytimes.com/interactive/2020/12/17/world/asia/india-pollution-inequality.html>

Environmental Justice:

* <https://www.latimes.com/environment/newsletter/2020-06-04/why-communities-fighting-for-fair-policing-also-demand-environmental-justice-boiling-point>
* <https://www.latimes.com/environment/newsletter/2020-10-08/boiling-point-air-pollution-and-covid-19-can-be-a-deadly-mix-boiling-point>

Redlining:

* <https://www.kcet.org/shows/lost-la/segregation-in-the-city-of-angels-a-1939-map-of-housing-inequality-in-l-a>

Redlining and Environmental Justice

* <https://www.nytimes.com/interactive/2020/08/24/climate/racism-redlining-cities-global-warming.html>
* <https://www.usnews.com/news/healthiest-communities/articles/2019-05-24/asthma-air-pollution-rates-higher-in-historically-redlined-neighborhoods>
* <https://scopela.org/between-the-110-and-the-405-environmental-injustice-in-south-los-angeles/>

Answer the following questions.

1. What is PM air pollution? What are two sources? Name and Describe two health impacts of PM pollution?
2. Define redlining? How is it an example of institutional racism?
3. How does redlining impact environmental health in the United States and Los Angeles?
4. Describe three inequalities related to air pollution include one international example, and one local example relative to where you live.
5. If you were to chat with your friends and families after readings these articles what would you share with them? What stood out to you most in the readings?
6. Describe two questions you have after the readings.

**Part 2 In-Class Activity ~90 min**

**Use ArcGIS to map current air pollution data in Los Angeles Turn the answer to the questions and a link to your map.**

**Mapping (My example map** [**https://www.arcgis.com/home/webmap/viewer.html**](https://www.arcgis.com/home/webmap/viewer.html) **)**

Log in with your ArcGIS account-I sent the students invitations via their school emails.

\*If students do not have access to ArcGIS use the viewer link and follow along with the instructor <https://www.arcgis.com/home/webmap/viewer.html> Ignore Prompt to Log on.

1. Save map-title YourName\_Bio167\_S21
2. Type Los Angeles into the search bar
3. Set Basemap to “Topography”
   1. What features show up on the map?

Add Freeways

1. Click Add and select “Browse Living Atlas Layers” from the drop-down
   1. Search “USA Freeways system”
   2. Many layers should show up- choose one.
      1. Click the title to learn more about the layer.
      2. Add this layer to the map.
      3. Click the plus sign on the lower right to add this layer to the map
      4. Think about the placement of our two campuses- what major freeways are close?

Overlay Redlining Information

1. Click Add and select “Browse Living Atlas Layers” from the drop-down
   1. Search “redlining”
   2. Two layers should show up- choose one.
      1. Click the title to learn more about the layer.
      2. Give a brief description of the data and the color codes.
      3. Add this layer to the map.
      4. Click the plus sign on the lower right to add this layer to the map

Overlap Air pollution data.

1. Click Add and select “Browse Living Atlas Layers” from the drop-down
   1. Search “PM 2.5”
   2. ~20 layers show up
   3. Add “AirNow Air Quality Monitoring Site Data (Current) Feature Layer by OAR\_OAQPS\_EPA
   4. What is this data? What is the source of this data, How was it collected? Who generated this data?

Overlap Another measure of Environmental Health. (Suggestions)

1. Click Add and select “Browse Living Atlas Layers” from the drop-down
   1. Search “XZY”
      1. Click the title to learn more about the layer.
      2. Give a brief description of the data.
      3. Add this layer to the map.
   2. Describe this layer why did you choose this variable.

Explore your Map (Hit Save and also Share)

Turn in: A single file (Word Doc) with your map link and answers to your questions.

What is the link for your map?

Click on the air quality circles- what information does it have?

Where are the redlined neighborhoods?

If you were adding additional Air Sensors, where would you place them?

**Part 3 Homework Download and graph a years’ worth of air quality data.**

Based on the map- choose two stationary air sensors and write down the name and ID numbers

1. Got to: Air Data: Air Quality Data | US EPA

<https://www.epa.gov/outdoor-air-quality-data/download-daily-data>

2. Choose Download Daily Data

3. Pollutant: Select PM 2.5

4. Year: 2020 (Or your choice)

5. City: Los Angeles-Long Beach-Anaheim

6. Monitoring Station- Choose one of interest from the map. (Click on the circle on the map to get the station name.

7. Download the data

8. Repeat for the second sensor

Open with Excel

**Save as**: This step is important because you need to convert the file type to an excel file type otherwise your plots won't save.

File Name: “XYZ”

File Type: Choose **Excel Workbook**

Select the year and the PM 2.5 data

Make an X-Y scatter plot

Lable your axes

Describe the yearly trends, do any data points stand out? What drove those patterns?

How does the current estimate from the map compare with this data?

Compare the two locations? Do you see similar patterns? What do you think drives these differences (location, history)?

How many days were above the EPA limit for PM 2.5

Turn in: A single file (Word Doc) with your graphs and answers to your questions.

1. Optional: Your Map: A screenshot of your map. Or a link to your map. To share your map, hit the share icon and make your map available to everyone at Mount Saint Mary’s
2. Answers to the questions about the maps
3. Your two graphs with brief descriptions of the graphs
4. Answers to the questions in this exercise.