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# NEON Data in the Classroom: Implementing and Adapting an Open Education NEON Resource “Quantifying the Drivers and Impacts of Natural Disturbance Events-The 2013 Colorado Floods” for the Southern California Classroom.

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# Abstract

Natural disasters and subsequent ecological disturbance events illustrate the complexity of problems in ecology and environmental science, and can be used as effective teaching tools. Unpacking the diverse real-world factors leading up to events offers opportunities for students to learn about different sources of data and provides opportunities to handle and interpret large data sets. Leah Wasser and Megan Jones created a freely available interactive lesson “Quantifying the Drivers and Impacts of Natural Disturbance Events-The 2013 Colorado Floods” centered on the Colorado floods hosted on the QUBES education hub. In 2018, as part of a National Ecological Observatory Network’s (NEON) Faculty Mentoring Network (FMN) I implemented and adapted this resource for an introductory environmental science class for non-majors. The Colorado flood lesson explores drought, precipitation, and stream discharge as factors leading up to the intense floods of 2013. In southern California we rarely experience floods as natural disasters; however threats from fires and severe drought conditions are real-world problems that students constantly confront. In parallel with the lesson I gathered data for southern California: 1) drought indices, 2) precipitation, 3) temperature, and 4) stream indices to explore the ongoing drought and risks of fire. Students used Excel to create graphs and explore long-term trends in different types of local data. Students were also exposed to different agencies, data collection tools, and sources of open access data. NEON education products offer students an opportunity to work with real data, thus building quantitative skills, all while unpacking the ecological factors behind a complex environmental issue close to home.

Motivation:

In the spring of 2018 I participated in the National Ecological Observatory Network’s (NEON) Faculty Mentoring Network (FMN) hosted by QUBES (<https://qubeshub.org/>). As part of this community I implemented and adapted the interactive lesson “Quantifying the Drivers and Impacts of Natural Disturbance Events-The 2013 Colorado Floods” developed by Leah Wasser and Megan Jones (<https://www.neonscience.org/tm-disturbance-events-co13flood>). This lesson uses natural disasters and subsequent ecological disturbance events as a tool to illustrate the complexity of environmental science. The Colorado flood lesson explores: 1) drought, 2) precipitation, and 3) stream discharge as factors leading up to the intense floods of 2013. In southern California we rarely experience floods as natural disasters; however threats from fires and severe drought conditions are real-world problems that students constantly confront. Two recent examples are: 1) the state of California was in an official drought from 2011-2017, and 2) in December 2017 the Thomas fire located in Santa Barbara County burned 281,893 acres from Dec 4th to January 12th and the Skirball fire located in Los Angeles County burned 422 acres from Dec 6th through the 15th. Students at Mount Saint Mary’s University Chalon campus had to be evacuated and finals were postponed. I used the California drought and fires as personal examples to frame a lesson investigating the multi-layered environmental drivers of natural disasters in an introductory environmental science class for non-science majors.

Lesson Goals:

Introduction to Environmental Science is a lower division general studies course for non-science majors. This course fulfills the science requirement of general studies and might be the only science class students take in college.

Ecological Disturbance Lesson Goals

1. Identify and unpack the environmental drivers of natural disasters and ecological disturbance events. This reinforces the theme of the class—studying the Earth as a complex system.
2. Practice analyzing quantitative data. Skills include making and interpreting graphs, and identifying long term data trends.
3. Building awareness of scientific data as a freely available public resource. Awareness of State and Federal agencies that collect and host public websites. This hopefully imparts an appreciation of the value of long term data sets.

Lesson:

When asked “What factors contribute to fires as natural disasters?” students offered up environmental factors such as drought, rainfall, temperature, soil moisture, and forest overgrowth; as well as anthropogenic factors such as urban/suburban development and forest management/planning. This lesson focused on three environmental factors: A) Temperature, B) Precipitation, and C) Drought indices.

1. Temperature
   1. <https://data.giss.nasa.gov/gistemp/stdata/> Los Angeles CA
2. Precipitation (note needs to be requested a day ahead)
   1. <https://www.ncdc.noaa.gov/cdo-web/>
   2. <https://www.cnrfc.noaa.gov/rainfall_data.php>
3. Palmer Drought Index: The Palmer Drought Severity Index (PDSI) was devised by Palmer (1965) to quantify the severity of dry and wet periods calculated from: A) monthly temperature, B) precipitation, and C) soil-water holding capacity.
   1. <https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#eCode>

Real-time Fire data

1. <https://www.arcgis.com/apps/PublicInformation/index.html?appid=4ae7c683b9574856a3d3b7f75162b3f4>

Data

Students use excel to analyze and visualize data because this is an introductory class for non science majors. Students can download datasets in class (most of them download quickly) or the instructor can provide an excel file with lightly cleaned data. See example spreadsheet. Work though one variable at a time: 1) temperature, 2) precipitation, 3) Drought index. Use this example workflow 1) introduce the variable (ex rainfall), 2) give students time to look at the data and let them plot it-circulate the room offering help, 3) make the plot on the screen in front of the class and they can follow along, 4) ask questions of the data “What is the trend?” “How does this x set of years compare to y set of years?” “How much less rain did we get during the drought years?”, After working through the individual data make connections across the data.

Resources:

NASA <https://data.giss.nasa.gov/gistemp/stdata/>

NOAA [https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#](https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp)

<https://www.ncdc.noaa.gov/cdo-web/datatools/findstation>

<https://www.ncdc.noaa.gov/cdo-web/>

NEON <https://www.neonscience.org/resources/teaching-modules>

QUBES <https://qubeshub.org/>