



HOLDEN
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GARDENS

TEACHER RESOURCES

Toxic Soils & Special Plants: Serpentine Endemism in California

by Tatyana Soto (Purdue University)

These educational materials were designed to accompany the video seminar “Toxic Soils & Special Plants: Serpentine Endemism in California” by Tatyana Soto, presented on January 13th, 2021 as part of a virtual Holden Forests & Gardens Scientist Lecture Series, Growing Black Roots: the Black Botanical Legacy. Learn more about the lecture series here. Access the talk here

Comprehend and Connect – Learn about genetic diversity in plants and connect with how it relates to humans

- 1) Listen to the talk to find out: How does Ms. Soto define genetic diversity? What factors does she note can reduce the genetic diversity of serpentine plant species? Why is genetic diversity important to the survival of serpentine plant species?
- 2) View the short Smithsonian video “One Species, Living Worldwide” on the role of human genetic diversity in the evolution of humans <https://humanorigins.si.edu/evidence/genetics/one-species-living-worldwide>
 - a. The video asks, where do we come from? Using information presented in the video, draw a timeline of important events in human evolution, including the date and location of the earliest known humans and when modern humans first evolved.
 - b. What does the video say happened 17,000 years ago that caused the human species to be reduced to a small population of no more than 10,000 adults? Why might this small population size have caused the near extinction of humankind?
 - c. What percentage of your DNA does the video say is identical to all other humans? How might the pattern of human similarity have been shaped by that event 17,000 years ago?

To Do – Identify dimensions of diversity in the STEM workforce and in your learning community

- 1) Listen to the talk to find out: what are the three serpentine plant species investigated by Ms. Soto? What features are similar about them? What differences can you find between these species?
- 2) Ms. Soto’s research is about genetic diversity of plants, but what is meant by “Diversity in STEM”?
 - a. Brainstorm with your learning group as many definitions of diversity as you can think of, and determine, what does diversity mean to you?
 - b. Read Box 1: *Excerpt from: Diversity in STEM: What It Is and Why It Matters*. Kenneth Gibbs, Jr., Scientific American Magazine, September 10, 2014
 - i. Was there anything in the excerpt that was also noted during your class brainstorm? Was there anything in the excerpt that surprised you?
 - ii. The article brings up the idea that people are multidimensional, and that some aspects of human diversity are already well-represented in STEM. What aspect of diversity is noted as already being well-represented in STEM? What aspects are not well-represented?

Box 1: Excerpt from: *Diversity in STEM: What It Is and Why It Matters*. Kenneth Gibbs, Jr., *Scientific American Magazine*, September 10, 2014

“What is diversity?”

One challenge to conversations about diversity is a lack of precision in language. The word “diversity” is used in many contexts to mean many different things. Often, and unfortunately, diversity is used as the antonym of heterosexual, able-bodied, middle-class-to-wealthy white male. This is not what diversity is about. The New Oxford American Dictionary gives us this definition:

diversity |diˈvɜːrsɪti, dʒ-| noun: (a) the state of being diverse; variety: there was considerable diversity in the style of the reports. (b) a range of different things: newspapers were obliged to allow a diversity of views to be printed.

Diversity refers to difference. As such, diversity is a property of groups, not individuals. Although I am a black man in a field where less than 2 percent of research grants are awarded to blacks, I am not diverse. An individual cannot be diverse, but groups of individuals (e.g., the scientific research workforce) can possess diversity.

There are many dimensions of difference (hence, some of the confusion about what diversity means). I will focus on differences across social identity. These include, but are not limited to, race/ethnicity, gender, disability status, nationality, religious affiliation, sexual orientation and socioeconomic background. Every person possesses multiple, intersecting social identities. For some dimensions of social difference (e.g., nationality), the scientific enterprise has a considerable degree of diversity. In other ways, the scientific enterprise lacks diversity—especially as it relates the participation of women, certain minority groups, and people with disabilities.

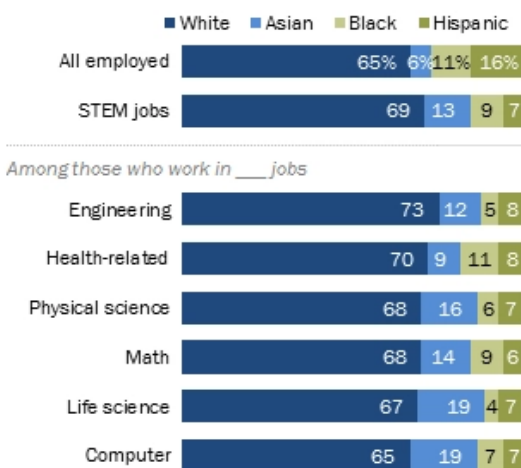
Diversity in science refers to cultivating talent, and promoting the full inclusion of excellence across the social spectrum. This includes people from backgrounds that are traditionally underrepresented and those from backgrounds that are traditionally well represented.”

Link to full article: <https://blogs.scientificamerican.com/voices/diversity-in-stem-what-it-is-and-why-it-matters/>

3) What are some dimensions of diversity in the STEM workforce? Review the data below on racial diversity in STEM fields collected by the Pew Research Center.

Blacks and Hispanics underrepresented across most STEM job clusters

% of employed adults in each occupational group who are ...



Note: Based on employed adults ages 25 and older. Whites, blacks and Asians include only non-Hispanics. Hispanics are of any race. Other and mixed race non-Hispanics are not shown. Engineering includes architects. STEM stands for science, technology, engineering and math.

Source: Pew Research Center analysis of 2014-2016 American Community Survey (IPUMS).
"Women and Men in STEM Often at Odds Over Workplace Equity"

PEW RESEARCH CENTER

a. The first bar of the graph shows the representation of different races across all types of jobs, including everything from health care workers to accountants, to fire fighters. This provides a point of comparison, for example do STEM jobs show the same percentage of white people compared to all employed people. If the percentage of people from one race in STEM jobs is higher than in all employed people, then that group is over-represented, if the percentage is the same then their representation is equal, and if the percentage is lower then the group is under-represented.

b. Compared to all employed people in engineering jobs, which races are over-represented? Which races are under-represented?

c. Considering all the different types of STEM jobs, do any have equal representation of Black people? Are Hispanics equally represented in any field? Why might some STEM career paths be more accessible than other careers for Black and Hispanic job seekers?

Follow up work - Learn about community organizing as a tool to make social change

- 1) Listen to the Q&A portion of the talk to find out: what positive outcomes did Ms. Soto experience because of the #BlackBotanistsWeek organization? What does Ms. Soto suggest as advice for other Black students who are interested in pursuing a career in plants?
- 2) Learn more about Black BotanistsWeek, our partner organization for this Scientist Lecture Series. Read the following short article about Black BotanistsWeek https://www.dailyitem.com/news/local_news/bucknell-researcher-starts-social-media-movement-to-highlight-black-botanists/article_45f85956-f9cd-5ec2-9a18-fc6f7d163e8f.html
 - a. What community does this organization serve, and what is their mission?
 - b. What specific activities has this organization undertaken to make social change?
- 3) In organizing your community, it is key to understand the dimensions of diversity represented in your community. Re-visit the Excerpt in Box 1
 - a. What dimensions of human diversity are addressed?
 - b. Build a list of words that describe your class dimensions of diversity, are there students from different countries? Different genders? Different races? Are there dimensions of diversity included in the excerpt description that are not present within your class? Are there dimensions of human diversity in your class which are not included in the excerpt?
- 4) Community organization is all about empowering individual people to bring their own talents to the table in working together to solve problems faced by members of the community, based on the idea that “many hands make light work”.
 - a. Brainstorm problems faced by your learning community. Which problems are shared by all students? Are there some problems that fall disproportionately on some individuals or some groups of people? Choose one problem to focus on for the rest of the exercise.
 - b. Mobilize your community:
 - i. Make a list of potential resources available in the community that might help to solve the problem.
 - ii. Think of personal talents and skills for each member of your learning community, what do you bring to the table to solve this problem?
 - iii. Identify social networks that are available to support your efforts. Are there organizations, agencies, or other groups of people that can help?
 - c. Targeted use of media:
 - i. Determine who needs to know about the problem, and what media venues are best to “get the word out”
 - ii. Write a short description of the problem, who it is impacting, and provide an indication of what help is needed to solve the problem. Create a PDF poster “Call to Action”, remember to use visuals wherever possible to illustrate your point, a picture is worth 1000 words!
 - d. Take direct action:
 - i. Make a plan to do something about the problem. Consider what resources you have available, and what is still lacking. If there is a roadblock to solving the problem, what can be done to break down this barrier?

NOTE: This short exercise is based on an extensive curriculum on the topic of community organizing presented in *Introducing Youth to Community Organizing: A Curriculum on Community Organizing in African American Communities*, a Thesis by Anna Ball. Teachers can find more detailed information in this document, and some excerpts may be appropriate for student readings as well, depending on the grade level. <https://cpb-us-w2.wpmucdn.com/u.osu.edu/dist/1/3078/files/2012/06/Annahita-Ball.pdf>