Lesson 5
Agricultural Biodiversity

Grade Level: 6th-8th
Time: 50-80 minutes

Lesson Adapted from: Ethnobotany: Tasting the Diversity of the Desert

AZ Science Standard:	6.L2U3.11 Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems. 8.L4U1.11 Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time
Learning Objective:	● Students will be able to describe the variety of agricultural crops grown in the Sonoran Desert
Scientist of the Week:	Claire Kremen -American Conservation Biologist -Ecologist and applied conservation biologist -working on how to reconcile agricultural land use with biodiversity conservation -Projects : -How can we enhance working land for more wild species? -How can we manage working lands more sustainably?

Vocabulary	Materials

English Vocabulary Terms: ● Ethnobotany ● Dichotomous Key	● Powerpoint ● Pinto beans, black beans, white beans, (pre-soaked, class set) ● Magnifying Glasses (class set) ● Pencils (class set) ● Plastic Knives (1 per team of 4) ● Rulers (1 per team of 4) ● Glue (class set) ● Crayons or colored pencils (class set) Bean Dissection Worksheet Coding Worksheet Online access to Intro to Coding Activity

Guiding Questions

- How can you incorporate desert plants into your daily life? Why would this be beneficial?
- What would happen if there was only one bean type? One cactus type? What do you think would be the effect of further urbanization on desert diversity? Why? What are some disadvantages of monoculture crops?
- How have certain cultures managed to preserve their locally-adapted farming traditions?
- How can you use code to look at datasets?

Teacher Preparation:

- Prepare the dry beans by soaking in water overnight. If possible provide several different types of beans so participants can try activity several times if needed.
- Discuss what a hypothesis, experiment, and observations are by defining the terms.
- Provide a bean, knife, Bean Dissection Lab sheet, and other tools to each participant. Have them examine the bean using a magnifying lens and measuring tape.

- Have the participants record their observations on the lab sheet. If possible, have the participants share their observations.
- Provide the bean diagram sheet after they have completed the first part of the lab. If participants are unable to write, provide a bean diagram for them to color.
- Highly recommend the teacher participates in the bean lab dissection before facilitating the lesson to students.

Engagement Activity(10 min):

- Ask students if they have ever grown a garden. Ask what different types of plants they grow in their garden. Use the amount of different plants as an introduction to agricultural diversity.
- Introduce the concept of genetic diversity and the importance of maintaining diversity in agricultural crops.
- Ask how many different types of beans they have eaten or are familiar with. (black beans, pinto beans, white beans etc)
- Go over the different types of beans that we will be looking at, where they come from, and why this might affect the cultures that eat them

Exploratory Activity(20 min):

- Prepare the dry beans by soaking overnight. If possible, provide several different types of beans.
- Provide some background information about beans, such as where and how they are traditionally grown.
- Discuss what a hypothesis, experiment, and observations are by asking students to define the terms.
- Provide a bean, knife, Bean Dissection Lab sheet, and other tools to each participant.
- Have them examine the bean using a magnifying lens and measuring tape.
- Have the participants record their observations on the lab sheet. If possible, have the participants share their observations.

Explain Activity(10 min):

- Ask students:
  - How was the actual inside of the bean different from your guess?
  - How do the different types of beans contribute to agricultural diversity?
  - What might happen if there is only one bean type?
  - What might happen if there was only one plant type grown in an area?

Extension Activity(:

Introduction to Coding(30 min):

- Tell students we will be starting to incorporate code into our lessons.
- Before we start coding, we will be looking at how commands work through a “Program your teacher” activity
- Working as a class, students will develop a list of commands for the teacher to follow to open a bin of candy, and hand it to a student so that all students can get a piece.

- Students have a list of simple commands that they can use in their program. They will type their commands into the shared google doc, and ask the teacher to run it when they think they have created a correct program, or if they want to know how a part of the program will execute when run.

Activity discussion(10min):

- Ask students:
    - What did this activity teach you about how coding works?
    - What are things you know that have to do with coding?
    - Can you think of why coding is an important tool?

Using coding to look at a data set activity(30 min):

- Have students open Google Colab and navigate to the Sonoran Crops Notebook
- Tell them that we will be using Google Colab to write parts of code that will give them output about the crops in the file.
- The Colab is set up in steps with instructions for each, but go through the steps on the slides to make sure everyone is understanding and not falling behind.
- Tell students to follow along on their worksheet with recording the information that is output by the program.
- Instruct them to use the information they gather through the code and create inferences about the crops.

Coding discussion(10 min):

- Once you have completed all the steps in the Colab, bring students together for a discussion about why agricultural diversity is important, as well as how writing code helped us to see the data easier
- Ask questions such as:

    For agricultural diversity questions:

    - What challenges might farmers face when growing crops in the desert? (need of water, extreme temperatures, soil quality, space taken)
    - How might farmers combat these challenges? (growing crops that use less water etc, biodiversity to keep soil healthy etc)
    - How does agricultural diversity benefit the ecosystem of the sonoran desert? (biodiversity conservation, soil health, water management, pest management, pollinator support, sustaining traditional practices)
    - What are ways we can support agricultural diversity? (growing diverse gardens, planting native species, supporting local farmers markets.

    For coding importance questions:

    - How did using code make it easier to understand the spreadsheet of data? What if instead of 50 crops, there were 100, or even 100,000?
    - What are other problems you can think of that could be solved by code?
    - What was challenging about this activity? What was fun?

Evaluation Activity(5 min):

In their journal, instruct students to answer the following questions in 1-3 sentences

- Why is agricultural diversity important?

- What problems can coding help with?
- What is one thing you learned today?
- What was your favorite part of the lesson?