The Impact of Drought

Unit: **Strand BIO.1**: Interactions with Organisms and the Environment	Utah SEEd Standard / NGSS Performance Expectation: **(Core Guides)** **Standard BIO.1.4** **Develop an argument from evidence** for how ecosystems maintain relatively consistent numbers and types of organisms in <u>stable</u> conditions. Emphasize how changing conditions may result in changes to an ecosystem. Examples of changes in ecosystem conditions could include moderate biological or physical changes such as moderate hunting or a seasonal flood; and extreme changes, such as climate change, volcanic eruption, or sea level rise. (LS2.C) (Each standard is a student performance expectation that includes all three dimensions of science.)	Time: 75+ minutes

Access to all materials for this lesson: https://byu.box.com/s/dhd0idiigh5lwcoz35i32hpjg89n06yo

| **Anchor Phenomenon**	Drought vs Deer Population **Note: This lesson is dynamic and data will change from year to year. The teacher will need to view and update the worksheet portions as needed based on current data, or be clear about the dates being used in the current form.**
Driving Question(s)	What impact does drought have on the stability of the deer population?
Performance Task	Evidence is used to describe changes - verbal, written, video, presentation

	Lesson Summary: Using a "jigsaw" learning model, students will explore the impacts of drought on deer populations by analyzing various forms of data.		

	Time	Guiding Question / Learning Objective	How are students answering the guiding question or meeting the learning objective?
Engage	5-10 min	The guiding question for this lesson is: **What impact does drought have on the stability of the deer population?** There are videos, think pair share, and class discussions to introduce and engage in the phenomenon.	Observations on Sticky Note Think – Pair – Share
Explore	20-25 min	Here students are divided into groups. Each group will review one of three handouts that have data to show the impact of drought. Each group should be able to determine the variable(s) that drought impacts and how that in turn impacts the deer population.	Handouts with graphs, tables, and explanations
Explain	15-20 min	Jigsaw: Students will share what they learned with another group. The original group was made of 4 students, each new group will have 4 new students from different groups with different information to share. At the end of the new groups, the students will have all the information from all the groups.	Using data from the handout groups will be sharing graphs and insights.
Elaborate	15- 20 min	Finish watching the video from the point where you left off. (About 29 seconds) After watching the video students will analyze the trend graft showing precipitation levels. Upon completing the analysis, students will create **2** trend lines on the graph. These lines will represent the **deer population** and **quantity of edible vegetation**.	Finish watching the video. Analyze precipitation trend graft Plot trend graph lines **Deer Population** **Quantity of Vegetation**

		Students will be evaluated and receive feedback on their plot lines and the response questions based on the rubric.	Final assessment page.
Evaluate			

Three Dimensions Focused on in This Lesson

Disciplinary Core Idea: **NGSS Appendix E**	**Science and Engineering Practices:** **NGSS Appendix F**	**Crosscutting Concept:** **NGSS Appendix G**
Utah SEEd Bio1.4 **LS2-C -** Disruptions (drought) in the physical and biological components of an ecosystem can lead to shifts in the types and numbers of the ecosystem's organisms (deer population).	**Analyzing and interpreting data** Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) to make valid and reliable scientific claims or determine an optimal design solution.	**Stability and Change** (Students) quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability.

Learning Objectives

1. Use evidence to explain how disruptions in the physical and biological components of an ecosystem can lead to shifts in the types and numbers of the ecosystem's organisms.
2. What impact does drought have on the stability of a deer population?

Related Knowledge and Skills from Prior Grades

TMLS Meeting Disciplinary Core Idea: **NGSS Appendix E** **LS2-C(Grade 6-8)** Ecosystem characteristics vary over time. Disruptions to any part of an ecosystem can lead to shifts in all of its populations. The completeness or integrity of an ecosystem's	**Science and Engineering Practices:** **NGSS Appendix F** **(Grade 6-8)** Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships. Distinguish between causal	**Crosscutting Concept:** **NGSS Appendix G** **(Grade6-8)** Students explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales. Students learn changes in one part of a system

biodiversity is often used as a measure of its health.	and correlational relationships in data. Analyze and interpret data to provide evidence for phenomena.	might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time

Connections to Mathematics and ELA/Literacy Standards

ELA/Literacy Standards:	Mathematics Standards:
RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **RST.11-12.7:** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.	• **MP.2**: Reason abstractly and quantitatively. • **HSS-ID.A.1**: Represent data with plots on the real number line. • **HSS-IC.A.1**: Understand statistics as a process for making inferences about population parameters based on a random sample from that population. • **HSS-IC.B.6**: Evaluate reports based on data

Materials

Handouts	Lab Supplies	Other Resources
Group 1 Data Sheet Group 2 Data Sheet Group 3 Data Sheet Trend Analysis Practice Alternate Trend Graph Assessment (For ELL)	Sticky Notes	Teacher Power Point Student assessment rubric Drought and Mule Deer video: https://www.youtube.com/watch?v=Ujr3GgOEY1U Short clip for beginning of lesson: https://youtube.com/clip/UgkxerzHA1OE02w-4XJqDsYQvBlq8onZVoEo Group 1 digital resources: • Observed annual precipitation: https://statesummaries.ncics.org/chapter/ut/ • DWR Resources • Snowpack

		Group 2 digital resources:
		• Big Game Annual Report - Deer populations/hunting data
		Group 3 digital resources:
		• DNR Season Effects

ENGAGE

- Use evidence to explain how disruptions in the physical and biological components of an ecosystem-which can lead to shift in the type and number of the ecosystem's organisms.
- What impact does drought have on the stability of a deer population?

Teacher do: (Pass out 3-5 sticky notes) Ask students the questions: What are the possible impacts of drought on a system? Specifically: • On you and your family • On the environment **Students do:** Students write their prior knowledge, experiences, feelings, etc. on a sticky note, and share with a neighbor. **Teacher do:** Invite students to share their responses with the class. **Teacher do:** After students share experiences open the DNR video Intro and load to time 0:12. Pause the video and give the following prompt: (Based on open frame from video) "I want you look at this image and write down your initial observations, feeling, or thoughts on your sticky note." **Students do:** Students write their initial observations, feelings, etc. on a sticky note, and share with a neighbor. **Teacher do:** Invite students to share their observations with the class Play video. DNR video Intro 0:12 – 0:29 (Show clip multiple times to allow students to fully see what is there) **Teacher do:** "I want you to write down what you already know about the drought and/or large game animals like mule deer." • Have students individually record their prior knowledge, questions, and wonderings from the prompt.	**Teacher Tips**: Pass out sticky notes to students as they come in. **Adaptation**: During the clip allow for CC to be turned on for those who have hearing impairment.

Students do: Record observations and questions they have or things they wonder about regarding drought and mule deer population. – Share with neighbor.

Teacher do: (Teacher moves around the classroom to listen to the discussion). Have each group post 2-3 questions on sticky note, padlet, jamboard, etc.)

As a class, discuss the observations and wonderings of the students.

Guide students to the question: **"What impact does drought have on the stability of the deer population?"**

EXPLORE

- Use evidence to explain how disruptions in the physical and biological components of an ecosystem-which can lead to shifts in the type and number of the ecosystem's organisms.
- **What impact does drought have on the stability of the deer population?**

Teacher do: Divide the class into three groups *Explain that they all have a different handout and that each groups needs to become "experts" about this topic to share with a different group after.*(15-20 minutes to work on reading and talking 5 minutes to finish)
 	
Group 1 Data Worksheet
*Resources:
Data Precipitation numbers, Drought and Snowpack numbers
https://statesummaries.ncics.org/chapter/ut/ - Observed annual precipitation
DWR Resources
Snowpack (if digital)
 	
**Note: This lesson is dynamic and data will change from year to year. The teacher will need to view and update the worksheet portions as needed based on current data, or be clear about the dates being used in the current form.
 	
Prompts:
- What conclusions do you draw from the Current Utah Drought Monitor Map?
    o What does it mean to be in D0 vs D1 drought?
    o What does it mean to be in D2 vs D3 drought?
	Teacher Tips:
	For ELL students or other students who may need literacy accommodations use the following info to help you determine group makeup:
	- Group 1 focuses primarily on understanding charts, tables, and graphs for data.
	- Group 2 has both reading sets and graphs to use for data.
	- Group 3 focuses primarily on reading sets for data.
	
	Teacher moves around each group to help with understanding or clarification:
	
	Group 1:

- o What are some bigger issues/problems that can be caused by D4 droughts?
- What conclusions do you draw from the Utah Snowpack Graph:
    - o What year do you notice that has the best snowpack?
    - o What changes do you notice?
    - o What is occurring on a year-to-year basis that is contributing to drought in Utah?
- What conclusions do you draw from the Observed Annual Precipitation graph?
    - o When was total precipitation most stable over time?
    - o What was the total average precipitation (green bar) for the years for 1980-1984?
    - o According to the graph, what individual year (black dot) had the lowest precipitation levels on record?
    - o Since 1950, how many 5-year periods have been above average? How many have been below average?
- What new conclusions do you draw after analyzing all three:
    - o What patterns or trends do you see in the graphs above?
    - o How did you use these 3 graphs to identity the patterns in the data?
    - o How would these patterns help you explain the phenomenon of Drought vs Deer population?

Group 2 Data Worksheet
*Resources:
Data Population Numbers, Hunting Permit Numbers
- Big Game Annual Report - Deer populations/hunting data

**Note: This lesson is dynamic and data will change from year to year. The teacher will need to view and update the worksheet portions as needed based on current data, or be clear about the dates being used in the current form.

Prompts:
- What observations do you make about mule deer population trends from the Historical Mule Deer Population Graph?
- What observations do you make about the Deer Harvest Graph? Specifically how do the trends of the Hunters Afield and the Deer Harvested compare?
- What is your explanation of the graph trend in 1993 to 1995?

Group 3 Data Worksheet (If there are not enough students, you can cut this handout. However, depending on the makeup of the class the information in this handout may be easier to comprehend for emerging level students)
*Resources:
Other effects – Fawn Births, Antler growth, Vegetation

Teacher: In Group 1 Data Sheet, help the group with the Observed Annual Precipitation graph. Help them to understand that the green bars are the average for that 5-year period. Direct them to focus on the dots to see the fluctuations in annual precipitation. The black flat line is the overall average precipitation.

Group 2:
Guide students to the idea for what is considered stable in this environment. Do these numbers represent a stable or instable environment population? WHY?

Group 3:
What type of Data would you expect to be seen with this type of reading?

[DNR Season Effects](#)

Note: This lesson is dynamic and data will change from year to year. The teacher will need to view and update the worksheet portions as needed based on current data, or be clear about the dates being used in the current form.

Prompts:
- How does drought affect vegetation that mule deer rely on?
- How does drought affect bucks, does and fawns differently?
- How does drought affect antler growth with bucks?

EXPLAIN

- Use evidence to explain how disruptions in the physical and biological components of an ecosystem-which can lead to shifts in the type and number of the ecosystem's organisms.
- What impact does drought have on the stability of the deer population?

Teacher do: Jigsaw: Have one student from each group join with one student from each of the other groups. **Student do:** Students will teach a summary of the information they studied in their content groups to their new groups and share conclusions they came to, based on the data they were given. (2-4 minutes each to explain what they learned) (total 8-10 minutes) **Teacher do:** When finished with the jigsaw, ask each group to use evidence from the data to answer the question: **"What impact does drought have on the stability of the deer population"**. Have each group share at least one example of evidence with the class.	**Teacher tips:** Move around to each group: What types of things stood out to each student? "Why did these stand out the most to you" (this makes it personal/relatable to other students) Writing answers on the board helps to focus the discussion.

ELABORATE

- Use evidence to explain how disruptions in the physical and biological components of an ecosystem-which can lead to shift in the type and number of the ecosystem organism.

• What impact does drought have on the stability of the deer population?	

Teacher do: Finish watching the video that was started in the engage section.
 DNR video Intro.
 	
 Hand out the Trend Analysis Practice. Explain to students that the lines on the trend graph represents drought conditions (annual precipitation) in Utah from 2012-2022.
     • In student groups have them draw in trend lines on the graph to represent what they think the trend of the following will be:
         ○ Deer population
         ○ Quantity of vegetation .
	Teacher tips:
	 Alternate Trend Graph Assessment

EVALUATE

1. Use evidence to explain how disruptions in the physical and biological components of an ecosystem can lead to shifts in the types and numbers of the ecosystem's organisms.
2. What impact does drought have on the stability of a deer population?

Student do:
     • Students will explain why they drew the trend line the way they did.
     • Students will develop an argument to explain the potential impacts of drought on the stability of an ecosystem.
	Teacher tips:
	 For ELL students, or those needing an alternative assessment tool use the following:
	 Alternate Trend Graph Assessment

POSSIBLE EXTENSION / ALTERNATIVE ADAPTATIONS

Have students come up with a solution to manage deer populations during drought. (This could connect with BIO 1.5)

Interactive Snowpack 1981-2023
Snowpack graphs

**Note: This lesson is dynamic and data will change from year to year. Reviewing current data and comparing it to the conclusions made based on previous years would work well as an extension activity.

ASSESSMENT MATRIX

This matrix supports three-dimensional assessment across this 5E instructional sequence. For each E phase, list the artifacts/strategies that provide evidence of what students know and can do as they work towards proficiency. These formative assessment opportunities should be used to track student progress. The dimensions that are reflected in the Evaluate are the ones that can be assessed summatively at the end of this 5E plan. Make sure to call out these connections in the lesson above so they are explicitly addressed.

.	Engage	Explore/Explain	Elaborate	Evaluate
DCI	X	X	X	X
SEP		X	X	X
CCC		X	X	X

This lesson was developed by: Jens Andreasen, Bryan Holder, Kelly Peterson, & Thomas Wilder