Brandi Matthews

The Buzz about the Bees 5E

Grades: 9-11 Conceptual Progressions Science

Time: 4 days

Materials: Internet access and possibly laminated graphs/photos

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem

SEP Engaging in Argument from Evidence : Engaging in argument from evidence in 9– 12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. x Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

DCI LS2.C: Ecosystem Dynamics, Functioning, and Resilience x A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability

Crosscutting Concepts Stability and Change : Much of science deals with constructing explanations of how things change and how they remain stable.

CCSS-Math

 MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

 MP.4 Model with mathematics.

If students are currently enrolled in an algebra class concurrently with my course, we can extend our math practices with the graphing of lines. This would be an awesome opportunity for cross curricular co-teaching with our Math teacher guest teaching and showing students how to write math equations and then apply those to the graph data that we have on google sheets. I personally do not feel comfortable at all with this content but I'm sure our department would welcome the opportunity to co-teach.

Objectives:

Students will describe the interactions between organisms and their ecosystem.

Students will examine the evidence that claims bees are indicator species.

Students will be able to correlate honeybee hive health to environmental health.

Students will understand the importance of stable honeybee populations.

Background:

Approximately 1 of every 3 bites you eat comes from a plant pollinated by a bee.   We depend on honeybees to pollinate so much of our agricultural products ($15 billion to be exact) and we also enjoy honey and beeswax. In fact, honeybee venom is used for arthritis medication! Unfortunately, we are seeing a general decline in honeybee hives. This is called colony collapse disorder (CCD). Scientists all over the world are studying the causes of CCD. NASA has even studied hive health to understand CCD (nextgenerationscience.org.)

Students in my class have learned about human impacts on the environment and have even created a proposal for saving the earth by changing one human impact. In this lesson they can see how honeybees are indicator species, and their health is a direct reflection of the health of their ecosystem. Are environmental issues causing a loss of bees?

Engage: Students will be presented with the two graphs/infographics on bees. We will use the strategy "Data Talk" (youcubed.org), which is similar to a Number Talk. I will project the two "graphs" on the screen and ask students "What do you notice? What do you wonder?" We will spend time discussing the importance of bees and hopefully students will realize how bees truly impact their lives.
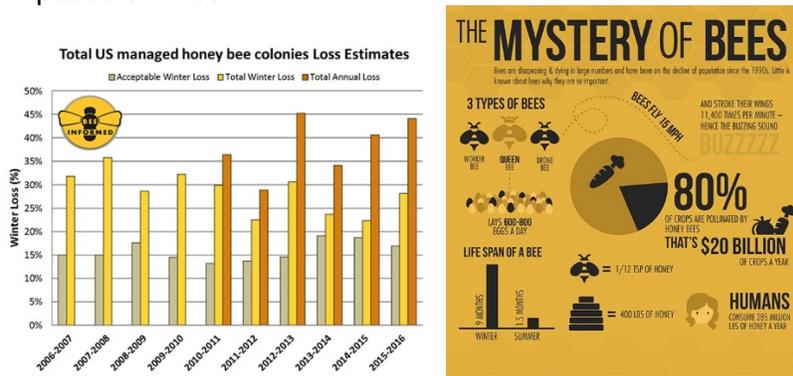
We will then move into the two photos below. I will ask students to see, think, and wonder with these two photos of supermarket shelves without bees. (I won't tell them this is a store displaying products without bees for pollination, but I believe they will make the connection.)

Click here to watch the video. Students will then watch the video as the reporter explains what is currently happening to our bee populations.

Explore: Students will dive into the data of honeybee disappearance with 2 data sets. The first is from next generation science.org and uses data from the entire US, South Dakota, and California. It also shows the population of people in these three states. Students will make the connection between human population rising and bee populations shrinking. NGS Bee tasks

 If this lesson is taught in person, I will show my students how to create graphs using Google sheets. (This is such a great skill to have.) They will be divided into groups and given a data set for which they must make a graph. If we are still virtual, I will probably provide the graphs to them along with the data. My students do not have the greatest computer skills and many are still struggling even with google classroom. I feel if we are not face to face, I will be spending too much time teaching them how to graph with the program rather than looking at and analyzing the content. I will provide the graphs and data and move on from there. In the future, this will also be a good modification for my struggling learners. A snapshot of the data and graphs is found below.

Number of Bee Colonies (in thousands)					**Number of Bee Colonies (in thousands)**			
Year	California	South Dakota	United States		Year	California	South Dakota	United States
1939	380	13	4422			*(continued)*		
1940	380	14	4350		1977	525	165	4346
1941	395	14	4477		1978	504	171	4081
1942	435	17	4893		1979	504	204	4155
1943	448	18	4887		1980	504	220	4141
1944	470	18	5217		1981	500	180	4213
1945	470	16	5460		1986	520	201	3205
1946	461	18	5787		1987	500	250	3190
1947	470	18	5916		1988	520	245	3186
1948	442	17	5724		1989	535	230	3311
1949	438	16	5591		1990	480	245	3188
1950	451	15	5612		1991	520	225	3200
1951	487	17	5559		1992	470	240	3030
1952	521	19	5493		1993	500	245	2876
1953	537	23	5520		1994	400	260	2770
1954	537	24	5451		1995	420	240	2647
1955	537	35	5300		1996	390	240	2566
1956	548	36	5296		1997	400	240	2579
1957	559	40	5365		1998	450	225	2633
1958	559	49	5381		1999	505	224	2688
1959	570	59	5402		2000	440	235	2634
1960	564	67	5396		2001	425	235	2513
1961	581	74	5507		2002	440	225	2524
1962	587	83	5498		2003	480	200	2590
1963	599	89	5530		2004	390	215	2556
1964	599	96	5600		2005	400	220	2410
1965	605	92	5556		2006	380	225	2932
1966	559	95	4766		2007	340	255	2442
1967	559	101	4815		2008	360	225	2301
1968	565	104	4770		2009	355	270	2462
1969	559	110	4762		2010	410	265	2684
1973	500	131	4103		2011	370	250	2491
1974	500	148	4195		2012	340	270	2624
1975	500	158	4163		2013	330	265	2640

Data are compiled from the United States Department of Agriculture National Agriculture Statistics Service's "Honey Production" (1940's-1980's) and "Honey" (1970's-2010's) reports:
*http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1191*
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1670

Human Population (in thousands)			
Year	California	South Dakota	United States
1939	6785	645	130880
1940	6950	641	132122
1941	7237	613	133402
1942	7735	589	134860
1943	8506	587	136739
1944	8945	565	138397
1945	9344	579	139928
1946	9559	588	141389
1947	9832	601	144126
1948	10064	612	146631
1949	10337	631	149188
1950	10677	653	152271
1951	11134	655	154878
1952	11635	651	157553
1953	12251	648	160184
1954	12746	655	163026
1955	13133	663	165931
1956	13713	670	168903
1957	14264	666	171984
1958	14880	656	174882
1959	15467	667	177830
1960	15717	681	180671
1961	16497	693	183691
1962	17072	705	186538
1963	17668	708	189242
1964	18151	701	191889
1965	18585	692	194303
1966	18858	683	196560
1967	19176	671	198712
1968	19394	669	200706
1969	19711	668	202677
1970	19953	666	205052
1971	20346	671	207661
1972	20585	677	209896
1973	20869	679	211909
1974	21174	680	213854
1975	21538	681	215973
1976	21936	686	218035

Human Population (in thousands)			
Year	California	South Dakota	United States
		(continued)	
1977	22352	688	220239
1978	22836	689	222585
1979	23257	688	225055
1980	23668	691	227225
1981	24286	690	229466
1982	24820	691	231664
1983	25360	693	233792
1984	25844	697	235825
1985	26441	698	237924
1986	27102	696	240133
1987	27777	696	242289
1988	28464	698	244499
1989	29218	697	246819
1990	29760	696	249464
1991	30414	701	252153
1992	30876	709	255030
1993	31147	716	257783
1994	31317	723	260327
1995	31494	728	262803
1996	31781	731	265229
1997	32218	731	267784
1998	32683	731	270248
1999	33145	733	272691
2000	33999	756	282172
2001	34507	759	285040
2002	34916	762	287727
2003	35307	766	290211
2004	35630	774	292892
2005	35885	779	295561
2006	36121	787	298363
2007	36378	796	301290
2008	36757	804	304060
2009	36962	812	307007
2010	37334	816	309330
2011	37684	824	311592
2012	38041	833	313914

US Historical Population Data was compiled from: https://www.census.gov/popest/data/historical/
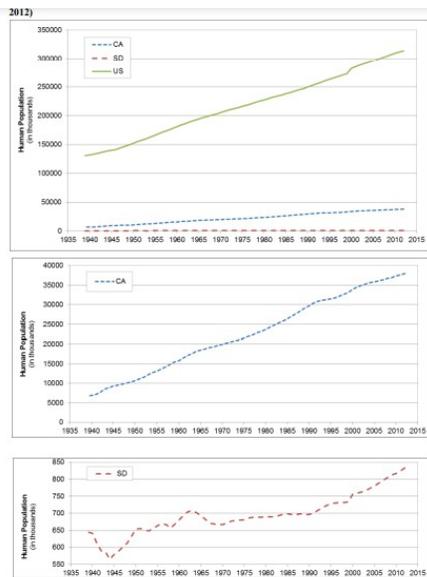
Number of Honey Bee Colonies Graphs: United States, California and South Dakota (1939-2013)
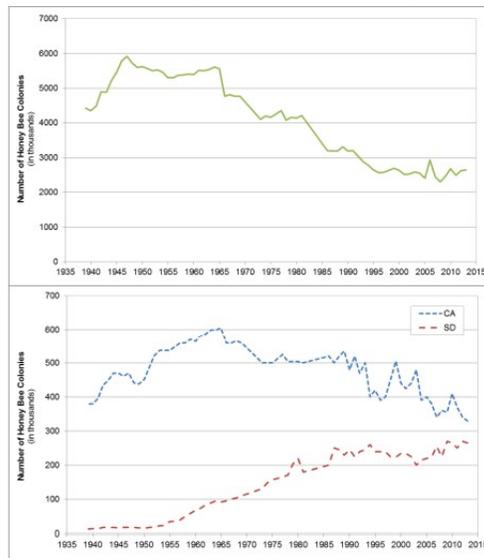
Students will utilize My Nasa Data literacy cubes to interact with the data. The specific cube we will use is the data cube. Students will take turns rolling the virtual dice in their group (or real dice if in person) and discuss the data. Data Literacy cubes

Google virtual dice

Checkpoint (formative assessment)

1. What is the data telling us?
2. What is the overall trend in honeybee populations?
3. Is there a correlation between honeybee populations and human population? If so, explain.
4. What impact do you believe humans may be having on the honeybee population?

Data set 2 is from NASA's Goddard Space Flight Center website. Students will read the transcript of an interview from a beekeeper who is participating in this study. For students with reading difficulties, there is a recording of the interview.   Beekeepers Collect climate data. We will discuss scale hives and how NASA is helping beekeepers and environmentalists determine the health of an ecosystem and the hive by actually weighing the scales. The more bees and honey that there are, the more the hive will weigh. The data for this phenonemon has been collected by beekeepers all over the eastern US as they volunteered to keep scale hives for NASA. Goddard Space Center scale hives

Students will choose three data points from the website. They will examine the overall hive weight trend and also the daily gains. The data shows also when the honey flow is the greatest. The data below is an example of a scale hive in Annapolis, MD.
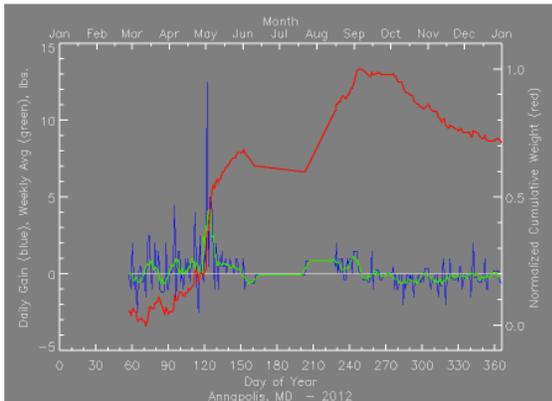
Questions for students to ask and receive feedback from the teacher and classmates (formative assessment item)

1. When did your chosen hives have the most honey (weight?)
2. What was the net gain of your hive?
3. If you were hypothesizing about ecosystem health in the area immediately around your hives, what would you say about the ecosystem?

Explain: Students will be introduced to the terms "indicator species." We have learned about keystone species and they could confuse the two. The video below will explain the different between indicator species and keystone species. https://youtu.be/xRfdDE6scWA

We will discuss if we believe honeybees are keystone species or indicator species. Students will reason with each other and determine that they are indicator species.

Students will then research all the different plants that honeybees pollinate. Most students will just begin by googling this and that is ok. I will start a running list of plants on some chart paper and

students will add to it as they find more. Once we have come to a consensus of as many plants (especially local) as we can find, students will each create a wordle (world cloud) of the plants that are pollinated by honeybees. The goal of this is for students to see how much we rely on honeybees. (And students love creating these world clouds!) http://www.wordle.net/create

Elaborate: Students will now take everything they've discovered about bees and respond to the following prompt.

Honeybees are an important aspect of our environment. In a well developed response, respond to the following questions/statements.

1. Explain the financial and nutritional importance of honeybees.
2. Describe the term "indicator species" and discuss how honeybees and honey production are an indicator of the environment in which they live.
3. Propose a solution to keep honeybee hives healthy and productive.

Rubric below:

	3	2	1
Honeybee financial/ nutritional importance	Student lists at least 6 foods that are pollinated by honeybees and explains the financial impact of honeybees on agriculture products.	Student lists at least 4 foods that are pollinated by honeybees and mentions the financial impact of honeybees on agriculture products.	Student lists less than 4 foods OR does not discuss the financial impact of bees on agriculture products.
Honeybees as indicator of healthy environment	Student explains indicator species and discusses how bees reflect the health of the local area.	Student's explanation of indicator species may be a bit vague or may not totally connect indicator species with ecosystem health.	Student attempts to explain indicator species but there are misconceptions or errors. Student doesn't connect indicator species with ecosystem health.
Propose a solution for hive health	Student explains CCD and proposes a solution that will keep hives healthy and bees active and productive.	Student mentions CCD and comes up with a solution that may work to keep hives healthy and productive.	Student doesn't explain CCD OR doesn't propose a solution for bee health.

Evaluate: Students will respond to a Flipgrid assignment. (My students love using Flipgrid as it gives them a chance to video themselves.) Students often are able to explain their learning in words rather than in writing. This will serve as a reflection/exit ticket formative assessment. In the flipgrid students will be asked:

What is something that surprised you about honeybees? (Your AHA moment?)

How would losing honeybees impact YOUR life?

How can we make sure that honeybees are being protected?

References

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