

Color	Descriptor
	Lesson Information
	NGSS
	PBE
	Unit Connections
	ELL
	The teacher Information
	Suggested Procedure

Culminating Synthesis Research Project

Unit: 5th Grade Ecology Unit: A Sagebrush Expedition Culminating Synthesis Research Project

Overview: Students will participate in a culminating research project where they will be able to express what they have learned throughout the unit. Students will work in small groups and have the opportunity to research a topic they are curious to explore further. These topics will be based on lessons that were covered throughout the unit. Students will participate in the scientific process and in doing so continue to think about what is special about their community and what they can learn from it. Students will have time to think of their question, make a hypothesis, decide how they will gather data, gather the data and creatively prepare how they will share this information with others. During their presentation they will share what they have learned as well as make connections to the three components of the landscape equation.

Main Goal: The main goal of this final project is not for students to come up with right answers, but for them to go through the scientific process while applying what they have learned about scientific practices and the sagebrush ecosystem. This project is intended to capitalize on their curiosities and give them the opportunity to share what they know and understand about their local community.

Learner Outcomes

Students will be able to...

- Ask a question and make a hypothesis about a topic they are interested in.
- Work in a small group to design how they will gather data in regards to this question and hypothesis.
- Use scientific practices and methods learned throughout the unit in order to make observations and gather data.
- Prepare and present their conclusion and what they have learned with teacher and peers.
- Make connections to the three components of the landscape equation.

Getting Ready

Materials: poster paper, markers, pencils, naturalist journals, any materials for research projects.

Preparation: Read through project description to understand how it will look. This will be a student-centered project but with guidance from the teacher. Materials for data collection will need to be gathered before the field trip and arrangements for field trip need to be planned ahead of time.

Location: Classroom and sagebrush ecosystem field trip.

Length of Time:

2 Periods for preparation before field trip

1 Field Trip

2 Periods for preparing posters and presentation

Approximately 60-75 min

Field Trip Approximately 2 hours

NGSS Standard(s) Addressed: 5th grade Life Science 2: Ecosystems: Interactions, Energy, and Dynamics

- **Connections to Nature of Science: 5-LS2-1:** Science, Models, Laws, Mechanisms, and Theories explain Natural Phenomena. Science explanations describe the mechanisms for natural events.

Place-Based Principle(s) Addressed:

- Learning takes place in the schoolyard, local community, and local environment.
- Engaging students in investigation, inquiry, and problem solving.
- Engaging students in experiential and project-based learning.

Unit Connections

(How specific lesson connects to overall goals and objectives of the unit)

Transfer Goals: *Students will be able to independently use their learning to understand that...*

- TG1- Science is a process that helps us gain a collective understanding of how the world works, it is a lifelong process, it is applicable every day, and accessible to everyone.
- TG2- Humans are an interconnected part of the natural world and can have both positive and negative impacts.
- TG3- Cultivating a sense of place, through intentional interactions, inspires curiosity about one's community and helps to develop a conservation ethic.

Unit Essential Question: *Students will keep considering...*

What is special about my community and what can I learn from it?

Specific Lesson Content Objectives: *students will be able to...*

- Ask a question and make a hypothesis about a topic they are interested in.
- Work in a small group to design how they will gather data in regards to this question and hypothesis.
- Use scientific practices and methods learned throughout the unit in order to make observations and gather data.
- Prepare and present their conclusion and what they have learned with teacher and peers.
- Make connections to the three components of the landscape equation.

Specific Lesson Language Objectives: *Students will be able to...*

- Students will be able to use vocabulary learned throughout the unit that is on the word wall throughout this project and presentation.

Key Vocabulary Words:

- Observation, question, hypothesis, methods, results, conclusion
- Landscape Equation ($L = A + B + C$)

Materials:

- Poster paper
- Markers
- Pencils
- Naturalist journals
- Materials for research projects (see below)

Set-up:

- Read through project description to understand how it will look. This will be a student-centered project but with guidance from the teacher.
- Materials for data collection will need to be gathered before the field trip
- Arrangements for field trip need to be planned ahead of time.

Background Information:

This type of inquiry-based, student-driven project can be difficult in terms of planning, because when you start the brainstorming process you are not sure what questions and topics the students will be interested in. This is ok and why the brainstorming part is very important. It is a time where students get to remember what they have learned and think about what they are interested in learning more about. This is where they will start forming their questions and where you, as the teacher, can help guide them.

Once students have expressed what topics they are interested in, they can be divided into small groups depending on interest and group management strategies. They can begin to think of a question they want to ask based on observations they have made throughout the unit. This is where it is very important for the teacher to help guide them towards a question that they can answer given the time constraint of the project.

Once they have a question, the next step is for students to design how they will collect their data. They need to think about what procedures and methods they will use and what materials they will need. The data collection will then happen on the final field trip to the sagebrush ecosystem. It is also important during this time to help them create data collection tables in their naturalist journals so they know what data they are going to be collecting and how to organize it.

Once students have collected their data they will need time to analyze it in order to come to a conclusion. It is important to remember that the goal of this project is not to have them get a right answer but rather go through the process. The goal is for students to take their curiosities and questions and know they have the power to expand

upon them. The goal is for students to know they can all be scientists and naturalists in order to explore and learn more about their local community.

The final step in the process is giving them guidance and time to prepare for sharing their conclusions and what they have learned. It is important to give them examples of how they can present and create a template they can follow. They will be making connections to the landscape equation in their presentation and therefore during this practice time they can be guided on how to make these questions with some guiding sentence starters. Encourage them to practice their presentation a few times before they give it.

Suggested Procedure:

Day 1: Brainstorm and Group Forming

Introduction of Project:

- Introduce the project to students. Explain that to finish this science unit they are going to have the opportunity to explore something they are curious about by practicing the scientific process.
- Explain that they will be engaging in a culminating research project in small groups where they will think about what they are interested in learning more about, they will ask a question about this topic, create a hypothesis, make observations and gather data, come up with a conclusion and present their findings to their class.
- It is important to emphasize that the purpose of the project is not to come up with a right answer. The purpose is to participate in the process and understand that they all are capable of participating in the scientific process and applying what they have learned.
- During their presentation explain that students will need to make connections to what they researched and the three components of the landscape equation.
- Introduce how the project will look to students:
 - Day 1: They will brainstorm ideas, form groups, and create their question and hypothesis
 - Day 2: They will decide what methods and procedures they will use to gather data and list what materials they will need.
 - Day 3: They will gather data on the sagebrush field trip.
 - Day 4: They will analyze their results and began mapping out their posters
 - Day 5: They will finalize their posters and practice giving their presentations.
 - Day 6: They will give their presentations!

Brainstorm:

- The first step is to have a brainstorm session with the class.
- Have students start thinking about what they have learned throughout the unit including what topics they have covered, what scientific methods they have practiced, and what things are they interested in learning more about.
 - This will be a think aloud session
 - These ideas can be written on the board
- Begin to narrow down their ideas into a few larger topics or themes
 - Examples:
 - Insects
 - Birds
 - Plants and Vegetation
 - Soil
 - Animal tracks and signs
 - Human influences on the land

Group Forming:

- Once there are ideas on the board of what students are interested in students can be placed in groups. The goal is to have students grouped according to what they are interested in but keeping groups to 2-4 students.
 - Groups may be decided according to teacher based on how peers work together
- Once in groups, students' job is to come up with their question. They need to think about what they want to explore further.
 - It is important help guide students at this point. It is not uncommon for them to come up with great questions that are too big or too hard to research with the time and resources they have for this

project. This is when the teacher can step in and help guide them to think about a question they can really attempt to answer given these constraints.

- Example Questions:
 - Insects:
 - How do the types of insects compare between the landscape around our school and the sagebrush landscape?
 - Are there more insects on the sagebrush shrubs or are there more insects on the ground?
 - What is the most abundant kind of insect?
 - Birds:
 - Are there more raptor birds like red-tailed hawks or songbirds like meadowlarks present in the sagebrush landscape we will visit on the field trip?
 - Do birds like to hang out on vegetation or human-made fences more?
 - Plants and Vegetation:
 - Is there a greater amount of shrubs or herbaceous plants in the sagebrush landscape?
 - What species of sagebrush are present where we are going on our field trip?
 - Are different species of sagebrush found on different soil types?
 - Soil:
 - How does the soil found at school compare with the soil found in the sagebrush ecosystem on the field trip?
 - What kind of soil supports the presence of sagebrush?
 - Does soil type affect the number or diversity of ground-dwelling insects like ants and beetles?
 - Animal tracks and signs:
 - What types of animals live and use the sagebrush ecosystem?
 - Are there more herbivore or carnivore signs in the sagebrush landscape?
 - Human Influences on the land:
 - Do the man-made structures at this site harm or support the wildlife that use this habitat?
- Once students have their question figured out and they have run it by the teacher they can create their hypothesis, which is what they think the answer will be. **The students must provide an explanation for their hypothesis, based on what they know about ecosystems.**
 - Examples:
 - There will be more diversity of insects in the sagebrush ecosystem compared to around the school.
 - There will be more birds using human-made fences to perch on.
 - The soil at school will have more sand particles than the soil found in the sagebrush landscape.
 - There will be more herbivore animal signs in the sagebrush ecosystem.
- Make sure students are recording their question and hypothesis in their naturalist journals.
 - Take a look at each groups question to start thinking about how to guide them into what methods and materials they will use.

Day 2: Methods Design

- If students did not get a chance to finish creating their question and hypothesis they can take time to finish these.

- Next, students will need to start thinking about what methods and procedures that will use in order to gather the data they need to help answer their question.
- This is a good time to brainstorm with a think aloud about the different scientific methods they have practiced and learned about during the unit.
 - Transect Lines to look at proportions of shrub cover, herbaceous cover, and bare ground.
 - Point counts of birds (stand in one spot and record how many birds you see and hear).
 - Soil cores and ribbon tests to find out the physical properties of the soil
 - pH tests on the soil
 - insect traps
 - Observation skills for animal tracks and signs
 - Observation skills of human influences on the landscape (landscape quilt)
- Have students work in groups to brainstorm and decide what methods they will use to gather their data and what materials they will need.
 - Walk around the room to help guide students towards methods they can do in the time allotted for the field trip.
- Have students create a table in their naturalist journals to record their data. You can put an example table on the board and have them modify depending on what they are researching. (See example table below)
- Materials will need to be gathered and UW can be contacted for any materials not available at school.

Day 3: Field Trip and Data Collection

- Students will have an hour to an hour and half to collect their data.
- Teachers and adults on the field trip will be there to support students as they gather their research.
- It is important to emphasize the importance of writing down their observations and data they collected as they will need this information for their presentation.

Day 4: Analyzing Data and Poster Design

- Explain to students that they will spend the next two days looking at their results, making conclusions and preparing for their presentation.
- Students will create posters and it is important to give them guidance on how these can look. Below is an example of how they can be organized.
 - **Sections:**
 - Observations
 - Question and Hypothesis with explanation
 - Methods and Materials:
 - Results:
 - This poster should include a graphic representation of the data they gathered in the field
 - Can also include a table of the data collected if graphic representation is not possible.
 - Conclusion:
 - The conclusion should provide a summary of the results, and state whether or not the hypothesis was supported (correct). If not, the students should explain why they think their hypothesis was not supported (something they misunderstood, or not enough data to say one way or the other, etc.).
 - Also as part of the conclusion, the students should place their research topic into the landscape equation, describing how A, B and C relate to their topic, and how changes to one component of the equation could affect their study organism(s).
 - Reflection:
 - Students will end their presentation with a reflection about the essential question of the unit:

- **What is special about my community and what can I learn from it?**
- The following is an example prompt for students to address:
 - We have learned _____ about our community and feel it is special because _____

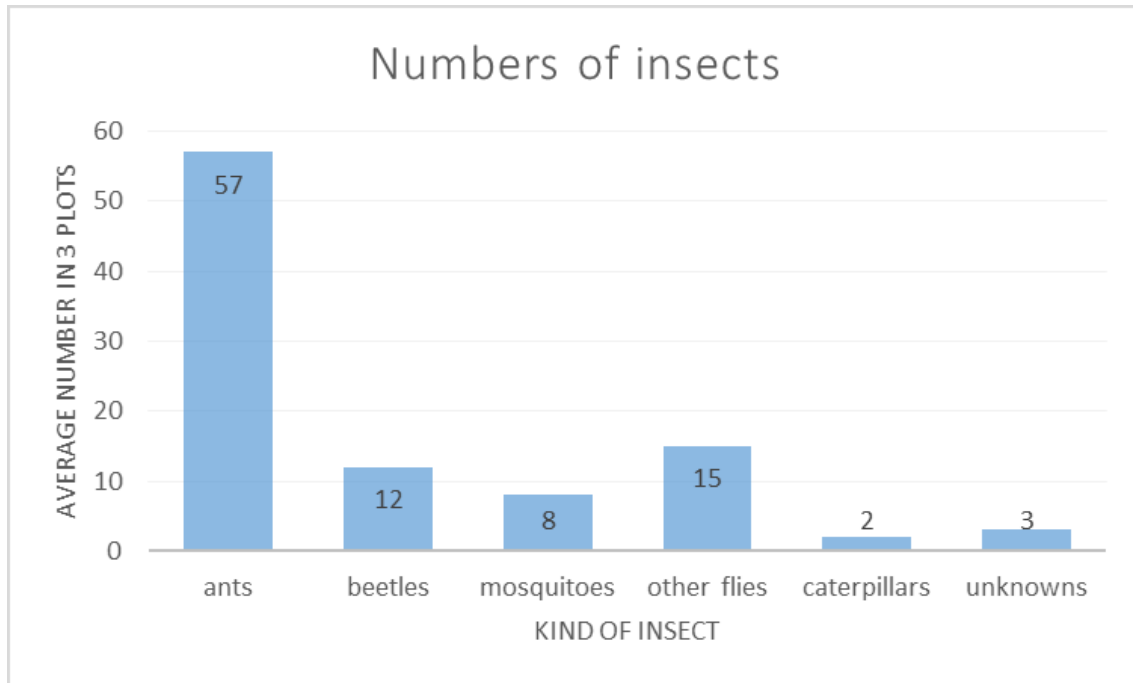
Day 5: Finalizing Posters and Preparing Presentation

- Students will finish working on their posters and decide who will do which part.
- Explain that each member of the team needs to have a part in the presentation.
- Once students decide who will talk about each part, it is important for them to practice.
 - Tips to give students:
 - Each presentation will be 10-15min long leaving time for questions at the end.
 - Have the person next to you hold up your poster so you can see it.
 - Only have one poster held at a time to reduce the noise.
 - It is ok to have notes to speak from but make sure to not read directly from these notes.
 - Practice!!! This will help to make sure you are not reading directly from note cards or the poster.
 - Plan out how you want to explain your methods and materials section.
 - It can be really fun to have them act out how they did their methods using the materials. They can do this silently, they can have a narrator, or they can all act and speak.
 - Make sure to include landscape equation connections and answer to essential question.
 - Speak in a clear voice and look at your audience. (Don't stare at your poster the whole time)
 - Stand still while your group members are speaking.
 - Ask the audience if they have any questions at the end of your presentation.
 - Have fun and celebrate all you have learned and done!

Day 6: Presentations and Celebration of Learning

- Give students a few minutes to do a final run through with their group.
- Each group will have 10-15min for their presentation.
- Remind students about good presentation etiquette.
- Remind students to ask the audience if they have any questions at the end of their presentation.
- Remind students that this is a celebration of all they have learned and done so let's have fun!

Suggested Example Graph for Data Representation



Possible Material List for Project

- **Measuring tapes for line transects**
- **Soil auger**
- **Bottle with water to filter soil samples**
- **Shrub dichotomous keys**
- **Vials for collecting insects**
- **Magnifying glasses**
- **Binoculars**
- **Rulers for measuring track or scat sizes**
- **Bird field guides**
- **Insect field guides**
- **Plant/wildflower field guide**
- **Track and Scat field guide**
- **Naturalist Journals**
- **Pencils**

Sagebrush Ecosystem Final Research Project Portfolio Assessment

Project Preparation: Every individual needs to engage and complete the steps needed in order to prepare for the final research project. These steps should be recorded in students' Naturalist Journals.

	0	1	2
Question and Hypothesis	No evidence of question and hypothesis.	Question or hypothesis present, but not both.	Question and hypothesis written clearly in journal.
Methods	Methods are missing from journal.	Some methods present but steps are not clear.	Brainstorm of methods clearly present.
List of Materials	Materials are not listed in journal.	Only a few materials are listed in journal.	List of materials needed for research project are written in journal.
Example Data Table	Data table is missing from journal.	Data table present but was not filled out during data collection.	Data table present and filled out during data collection.
Participation	One student did the majority of the work.	Only one or two students did the majority of the work.	All group members contributed equally to project preparation.

ELL Modifications:

- Students will work on the scientific process in groups. ELL students will have the opportunity to work alongside their peers and ask them questions. They can also work with a partner to record steps in their naturalist journals.
- ELL students can draw the various steps in their journals instead of write.
- ELL students can make lists instead of write complete sentences in order to show understanding.
- ELL students can be verbally evaluated, where they are able to point or speak about the various steps they will take for the final project.

Science Circle: Steps of the scientific process need to be included in the final product of the research project.

	0	1	2
Question	Piece not included on poster.	Included but not measurable.	Question is clearly measurable.
Hypothesis	Piece not included on poster.	Included but no connection to unit.	Hypothesis has connection to unit.
Methods	Piece not included on poster.	Methods for data collection are not clear.	Methods of data collection are clear.
Data	Piece not included on poster.	Data table is incomplete or not clear.	Data table is complete.
Conclusion	Piece not included on poster.	Conclusion does not connect back to hypothesis.	Conclusion connects back to hypothesis.
Observations and Further Questions	Piece not included on poster.	Observations or questions do not connect to current research.	Observations and questions are connected to unit and research.

ELL Modifications:

- Each group needs to include the steps of the science circle in the final product of their research project. ELL students can contribute these steps on the poster through copying the key vocabulary words that they have practiced writing in their naturalist journals or by using the word wall that was created throughout the unit.
- Kinesthetic movements can be used to remember the different steps. These movements can be used to evaluate students understanding of the scientific process.
- ELL students need to contribute to the poster through either writing the words or drawing pictures that represent these different steps.

Poster and Presentation: Each group will create a poster to accompany their presentation. Each person must contribute to the completion of the poster and engage in the presentation.

	1	3	5
Neatness	Poster is not organized and messy.	Poster is either organized or messy.	Poster is neatly written and organized.
Information	Some of the Science circle is visible, but no examples from the field are included.	The entire Science circle is visible, but no examples from the field are included.	The entire Science circle is visible, as well as, several examples from the field.
Participation	One student did the majority of the work.	Two students did the majority of the work.	All students contributed equally.
Presentation	Presentation was not creative or clear and information was read directly off of poster.	Presentation was creative but disorganized and some parts were read directly from poster.	Research project was presented in a clear and creative manner. Information was not directly read from poster.

ELL Modifications:

- The poster will be partially graded on neatness and organization based on the steps of the science circle. Students will not be graded based on grammar and spelling. ELL students need to engage in the creation of the poster which can include writing, design, or drawings based on their proficiency level.
- ELL students can contribute to the information that will go on the group poster through verbally expressing their thoughts, pointing out their ideas, drawing or writing their ideas, or acting out their ideas.
- ELL students must participate in the creation of the poster but this can vary depending on their proficiency level as stated above.
- ELL students must participate in the presentation but this can be through pointing, acting, kinesthetic movements that represent understanding, or speaking.

Connections to Unit: During presentation students need to make connections to the unit. Specifically, students need to discuss how their research question and findings connect to the three components of the landscape equation; abiotic, biotic and culture.

	0	1	2
Abiotic Connection	Students do not connect to the abiotic component of the landscape equation.	Students connect their topic to abiotic components to the sagebrush landscape but the example and connection is not clear. They only give one example.	Students clearly connect their research topic to the abiotic components of the sagebrush landscape using at least two examples.
Biotic Connection	Students do not connect to the biotic component of the landscape equation.	Students connect their topic to biotic components of the sagebrush landscape but the example and connection is not clear. They only give one example.	Students clearly connect their research topic to the biotic components of the sagebrush landscape using at least two examples.
Culture Connection	Students do not connect to the cultural component of the landscape equation. They do not mention how their topic connects to humans.	Students connect their topic to abiotic components to the sagebrush landscape but the example and connection is not clear. They only give one example.	Students clearly connect their research topic to the cultural components of the sagebrush landscape using at least two examples. They inform us how their topic is connected to humans.
Overall Unit Connections	Students do not connect their research topic to anything they have learned throughout the unit.	Students make one connection to what they have learned throughout the unit.	Students make at least two additional connections to what they have learned throughout the unit.

ELL Modifications:

- Since the landscape equation is a major component of the sagebrush unit, ELL students must use the following key vocabulary words to demonstrate understanding in the presentation of their research project. This can be done by pointing to the words abiotic, biotic, culture, and landscape. They can also demonstrate understanding verbally, kinesthetic movements, or pointing to words or examples of these words.
- ELL students must share at least one connection they can make between their final group research project and something they learned throughout this unit. This can be done verbally or through a drawing.

Total score = _____ or _____%