

# Sustainable Agriculture

Name: \_\_\_\_\_ Hour \_\_\_\_\_ Date: \_\_\_\_\_

Date Packet is due: \_\_\_\_\_ Why late? \_\_\_\_\_ Score: \_\_\_\_\_

Day of Week      Date

If your project was late, describe why

**Overview:** in this unit, you will be addressing the extent to which modern agricultural methods can support growing human populations while maintaining biodiversity and ecosystem services.

## Main Questions

- How are human populations affected by biodiversity and ecosystem services?
- How do modern agricultural practices impact biodiversity and ecosystem services?
- How could modern agricultural practices be improved to better support ecological, economic, and social sustainability?

## Weekly Schedule

### **Monday:**

- Sustainability Jig Saw Case Studies - The Dust Bowl
- Model development – What is Sustainability?

### **Tuesday:**

- Presentations of Jig Saw Case Studies
- Nutshell Video & Notes
- Class discussion & revisions of explanations
- Introduce and Prep for Lab Activity

### **Wednesday:**

- Qualitative Expert Interview

### **Thursday:**

- Review
- Group Quiz

### **Friday:**

- Weekly Reflection
- Career Connections

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## Semester Schedule

Week 1: Introduction & Lab Safety

## Sustainable Soils

Week 2: Sustainable Ag

Week 3: Soil Science

Week 4: BMPs

Week 5: Unit Project

## Plant Physiology

Week 6: Roots

Week 7: Stems

Week 8: Leaves

Week 9: Plant Systems

Week 10: Unit Project

## Plant Environments

Week 11: Light

Week 12: Temperature

Week 13: Water

Week 14: Biodiversity

Week 15: Unit Project

## Gardening

Week 16: Gardening 101

Week 17: Final Project

Week 18: Final Exam



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# Day 1: Data Dive –Dust Bowl Case Study

**Introduction:** In this activity, you will be considering how and why the Dust Bowl occurred in the United States in the 1930s. You will then use this case study as a guide for developing your understanding of the concepts of sustainability and resiliency.

**Directions:** Your instructor will begin by showing you a brief video that will provide an overview of the Dust Bowl in the US during the 1930s (such as this one: [https://www.youtube.com/watch?v=MYOmjQO\\_UMw](https://www.youtube.com/watch?v=MYOmjQO_UMw) ). After watching this video, you will work in your groups, using computers, laptops, or personal devices (if ok'd by your instructor) to look up information on the Dust Bowl using an internet search engine. Be prepared to summarize your findings for the rest of the class. You will also need to take time as a group to address the questions below prior to presenting. After each group has had a chance to present their case, you will take time as a class to try to summarize any similarities or patterns that you might have observed that are common to most or all of the examples provided. *Note: internet searches on some of these topics may result in graphic images.*

## Questions:

1. Briefly summarize this case.
  - a. What happened? Why was this a problem?
  - b. Who was involved? Who or what was at fault?
  - c. How and why did this situation become a problem?
  - d. Was this problem fixed? If so, how?
2. Sustainability consists of three components: ecological, social, and economic. In regards to the Dust Bowl specifically...
  - a. In what ways were natural resources being used in a way so that they could not be regenerated? In what ways did human decisions result in interference with ecosystem function and services?
  - b. In what ways were human social interactions disrupted? In what ways did some groups of people benefit at the expense of others?
  - c. How did this affect the ability of individuals to support themselves financially and earn a living wage?
3. Do some research on the sustainability of modern agricultural methods using credible sources. Do you think that this problem could happen again today? Could it happen here? Why or why not?
4. Based on this example, how would you define sustainable agriculture?
  - a. In what ways were the causes of the Dust Bowl also examples of agriculture that was not sustainable? Are any of these practices still occurring today?

### **How to tell if a website is credible: BAR**

**Bias:** who is the author of this website? Why did they write this? Was it purely to inform, or are they trying to persuade the reader for their own personal gain?

**Accuracy:** are their claims supported by valid data and/or logical arguments? Is the original primary source of this information cited? Are the authors sufficiently experienced and qualified to have reliable opinions on this topic? Is this website peer-reviewed, or can they post anything that they want regardless of its truthfulness?

**Relevance:** is this information valuable for my needs? Does the level of detail in this site hurt my ability to get this work done in a timely fashion? What do other sources say? Does this agree with sites that are credible?

*Generally, government [.gov] and university [.edu] websites are more credible than private [.com] websites. Wikipedia and other open-source sites are less reliable because they can be changed, but may provide potentially-credible sources in the citations.*



# Day 2: Notes & Discussion

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**Introduction & Directions:** In this activity, you will begin by watching a short video about agricultural sustainability. This will help to clarify some of the questions you may have had yesterday. After the video, you will look at a short slideshow presentation that will provide you with specific information about agricultural sustainability. Your instructor may decide to deliver the presentation as a classroom lecture or they may allow you to read the notes individually or in small groups (depending on your previous experience and capabilities with this content). After you have watched the video and finished with the slideshow, you will work in small teams to answer the questions listed below. You should take notes in a notebook, online, on a dry erase board, or on scratch paper so that you are prepared to deliver your responses during the class discussion that will follow. *Note: your instructor may assign your group to answer specific questions if time is limited.*

## URL Links

YouTube Video: <https://www.youtube.com/watch?v=oQIDyIIWrZY>

Slideshow Presentation: XXXX (or visit [www.factsnsf.org](http://www.factsnsf.org) and use the menu bar).

## Discussion Questions:

1. Summarize how biodiversity, ecosystem services, ecosystem resilience, and human populations are affected by each other.
2. Explain how the US Midwest is able to produce large amounts of food and support extensive human activity by addressing the following considerations: temperature, moisture, sunlight, photosynthesis.
3. Explain why regions of the world such as tundra and alpine regions are more fragile ecosystems and why they are less able to support large amounts of human activity.
4. How do human-caused ecosystem disturbances affect an ecosystem's ability to support human activity? Include the term "biodiversity" in your response.
5. How can you determine if an action is sustainable or unsustainable?
6. Briefly list and summarize the three kinds of sustainability.
7. What is the Triple Bottom Line of Sustainability?
8. In your opinion, are modern agricultural practices sufficiently sustainable? Could these practices continue for centuries? Justify your stance with evidence.
9. Define sustainable agriculture in your own terms and summarize how modern agricultural practices could become more sustainable based on the criteria provided in this lesson.
10. How is regenerative agriculture similar and different from sustainable agriculture?
11. Summarize the principles of regenerative agriculture?
12. What are the agricultural Best Management Practices? How are they similar and/or different from sustainable agriculture and regenerative agriculture?
13. What are the agricultural UN Sustainable Development Goals? How are they similar and/or different from sustainable agriculture and regenerative agriculture?
14. Use the example of the Dust Bowl in the United States during the 1930s to explain how human populations are affected when unsustainable practices impair biodiversity and ecosystem services.



# Day 3: Lab - Interview an Expert

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**Introduction:** In this activity, you will have an opportunity to interview an individual with professional expertise in this week’s content topics. This activity will be reflective of *social science* research, or gathering, analyzing and interpreting information about human interactions. Often this work is conducted using *qualitative interviews*, which are interviews designed for research and data collection.

This activity will be divided into three parts:

1. **Part 1 – Planning:** After your instructor describes today’s guest speaker, your group will identify your research question using the prompts below. Your research question should pertain to the topics covered in class this week. Based on your research question, you will develop questions that might help you to gather information that can help you to answer your research question. Your instructor will ask your group to share your research question and interview questions prior to the interview and make sure that a variety of questions are ready.
2. **Part 2 – Interview:** Your instructor will facilitate the interview; they may choose to ask groups to ask their questions in a specific order (semi-structured approach), or they may choose to use an unstructured approach to the interview. Your group should record field notes during this time that you will use at the end of the hour to address your research question.
3. **Part 3 – Analysis & Debrief:** You will be provided with some time to consider the responses that they receive and reach a tentative conclusion about their research question based on this data.

## Part 1 - Planning:

1. Briefly summarize the topics that were covered in class this week in one sentence: *This week in class,*

*we studied* \_\_\_\_\_

2. As a group, discuss what questions you still have about this week’s topics. Ideally, these questions should be open-ended (try to avoid Yes/No, Good/Bad, or Agree/Disagree kinds of questions). It can be helpful to use some of the following to start your questions: *Who, What, When, Why, How*

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

*Once you have developed three questions, ask for your instructor to provide you with some feedback.*

3. From this list, choose a research question for your group and complete the prompt below:

Research Question: *We are unsure if* \_\_\_\_\_

\_\_\_\_\_



4. Turn your research question into a hypothesis. What do you think is the answer to your research question given what you currently know?

*We hypothesize that* \_\_\_\_\_

\_\_\_\_\_

5. What information could today's guest speaker provide that might help you to answer your question? Briefly describe how this individual's background and expertise is relevant to your research question:

\_\_\_\_\_

\_\_\_\_\_

6. Create three interview questions that you could ask this individual that may provide information related to your research question. Try to focus on their particular area of expertise as you craft your questions.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

7. Be prepared to briefly describe your research question and hypothesis, and how your interview questions will provide you with information that will help to address your research question.

## Part 2 – Interview Field Notes

Use the space below to record some field notes as the guest speaker presents to the class. Record anything that you hear or observe that might be relevant to your research question. **Note:** you should also consider recording the guest speaker's responses to other group's questions if they are relevant to your own research question.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



**Part 3 – Analysis & Debrief** (*your instructor may choose to use oral responses as well as or instead of written*)

What are your conclusions based on the guest speaker’s responses? Answer the questions below.

1. What was your hypothesis? \_\_\_\_\_

\_\_\_\_\_

2. Does your data (your observations and field notes from your interview with the guest speaker) support or refute your hypothesis? Circle one:      *Supports it*    /    *Refutes it*    /    *Not sure*

Explain: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Does your data adequately answer your research question? What are the limitations of your findings? Could *bias* or *representativeness* be a concern? (*Ask you instructor for guidance if needed*).

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. List two new questions that emerged as a result of your interview today:

1 \_\_\_\_\_

2 \_\_\_\_\_

5. If you were to continue this work, what kinds of investigations would you do next? Describe a potential research experiment that would be a suitable follow-up for today.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



# Day 4: Review & Assessment

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**Directions:** you will begin by reviewing the unit objectives in your small groups. For each objective, rank it as a 1 (*completely unsure*), 2 (*somewhat unsure*), or 3 (*completely sure*) based on your comfort with that objective. After a few minutes of review, your instructor will lead a whole-class review. This is your chance to ask any questions you still might have about the concepts in this unit. Begin with anything you ranked as a “1”.

After you have completed the unit review, you will be taking an individual multiple choice quiz and/or a group short answer quiz. These quizzes may be graded in class to help you better understand the question and the correct answer.

## Unit Objectives:

1. Summarize how biodiversity, ecosystem services, ecosystem resilience, and human populations are affected by each other.
2. Explain how the US Midwest is able to produce large amounts of food and support extensive human activity by addressing the following considerations: temperature, moisture, sunlight, photosynthesis.
3. Explain why regions of the world such as tundra and alpine regions are more fragile ecosystems and why they are less able to support large amounts of human activity.
4. How do human-caused ecosystem disturbances affect an ecosystem’s ability to support human activity? Include the term “biodiversity” in your response.
5. How can you determine if an action is sustainable or unsustainable?
6. Briefly list and summarize the three kinds of sustainability.
7. What is the Triple Bottom Line of Sustainability?
8. In your opinion, are modern agricultural practices sufficiently sustainable? Could these practices continue for centuries? Justify your stance with evidence.
9. Define sustainable agriculture in your own terms and summarize how modern agricultural practices could become more sustainable based on the criteria provided in this lesson.
10. How is regenerative agriculture similar and different from sustainable agriculture?
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12. What are the agricultural Best Management Practices? How are they similar and/or different from sustainable agriculture and regenerative agriculture?
13. What are the agricultural UN Sustainable Development Goals? How are they similar and/or different from sustainable agriculture and regenerative agriculture?
14. Use the example of the Dust Bowl in the United States during the 1930s to explain how human populations are affected when unsustainable practices impair biodiversity and ecosystem services.



# Day 5: Career Connections

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**Directions:** Begin with a group and class discussion about the topics of this week. What is still unclear? What is still confusing? What seemed most important to remember? How does this relate to horticulture?

If time allows, you will also have time to work on one or two semester projects:

The Garden Project involves creating your own garden as a group. Your instructor will provide you with more details, but in a nutshell you will work as part of a team to plan, design, and create some kind of garden. This might be a community garden, a school-based garden, or a container garden. The goal is to utilize the knowledge and practices that you gain over the course of this semester to maximize the productivity and sustainability of your garden.

The Adopt a Farmer Project involves working with a farm, greenhouse, or community garden in your community in order to determine some new methods that they could try to improve the sustainability of their operation. Your instructor will provide you with more details about this project.





**3. Define sustainable agriculture in your own words and summarize the characteristics that you would use to determine if a farm's operations were sufficiently sustainable. Be sure to fully address the Triple Bottom Line of Sustainability.**

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*Writer's Name:*

**4. In what ways are sustainable agriculture, regenerative agriculture, and Best Management Practices similar, and how do they differ?**

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*Writer's Name:*



# Appendix: Dust Bowl Case Studies

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**Introduction:** The purpose of the Dust Bowl case study is to help students understand the relationship between biodiversity and ecosystem function and human activity (especially food production). This is to help students appreciate that many of the agricultural practices in use today played a key role in the worst ecological disaster in US history, and that this had widespread ramifications on the social and economic wellbeing of many Americans.

**Directions:** students should work in their assigned groups for this activity. They will need internet access via computers, laptops, or their personal devices (*if permitted*). It might be advisable to use your school computer and a projector to go through an example with them. This would be particularly helpful for enabling students to better understand what constitutes as a credible source online. Critiquing a website with students can be a valuable means for guiding their understanding of what online sources they can trust. (*Note that this topic is covered in more detail later in the semester.*)

Because students will be working on the same topic, it is possible to divide specific subtopics to individual groups if you are concerned about having sufficient time for this activity. Students should be prepared to answer the questions listed below the directions as part of whole-class discussion. Because time is limited for this activity, it would be wise to encourage students to choose their roles before seeking information, and to share valuable sites that they find with the rest of their group.



# Appendix: Interview an Expert

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**Introduction:** In this activity, students will interview a member of your community with expertise in agriculture and/or sustainability. Examples could include local farmers, extension agents, researchers, etc. As an instructor, you will need to make arrangements for a guest speaker at least a week in advance (ideally sooner). Once you have found a volunteer who is willing to speak to your class, please inform them that this class activity is being designed to reflect how social scientists conduct research. Your guest speaker should know that students will be preparing research questions and hypotheses, and will be designing their interview questions to provide insights that may help them to address these questions in a manner similar to a social scientist.

This activity will be divided into three parts:

1. **Part 1 – Planning (15-20 min):**
  - a. Inform students of the guest speaker (or introduce them if they are there in person). Explain how their work pertains to this week’s content.
  - b. Have student groups identify their research question using the prompts on the worksheet. Their research question should pertain to the topics covered in class this week. Remind students that questions should be thoughtful, insightful, and respectful. You should provide examples to students if they might struggle with this.
  - c. Have groups share your research question and interview questions prior to the interview and make sure that a variety of questions are ready.
2. **Part 2 – Interview (15-20 min):**
  - a. Serve as the facilitator of the interview. You may choose to ask groups to ask their questions in a specific order (semi-structured approach), or you may choose to use an unstructured approach to the interview.
  - b. Remind groups to record field notes during this time to use at the end of the hour to address their research question.
3. **Part 3 – Analysis & Debrief (10 min):**
  - a. Have students address their hypothesis using their observations and field notes. This can be either verbal, oral, or both depending on what you think will work best.

It is recommended that you introduce this activity to your students earlier in the week (e.g. Monday or Tuesday) so that they can begin to mentally prepare their research questions in advance. Make sure that your students avoid turning this activity into something that might feel accusatory or incriminating to the guest speaker (especially if they are a farmer – they may not appreciate having their expertise and experience drawn into question by teenagers). Emphasize that this should be a respectful exercise in finding information by asking thoughtful questions, not an opportunity to criticize an individual for their work.

The guest speaker can either appear in person or via an online platform such as Skype. An in-person guest speaker tends to be more impactful but can be harder to arrange. You may choose to ask an introductory question to model a proper approach for your students. Whether students ask their questions in a specific order or utilize a free-for-all approach to asking questions is up to you as the instructor. Time may run short, but if possible allow time at the end of class for debriefing and analysis (ideally at least 10 minutes). You might choose to have students answer the Analysis and Debrief questions orally rather than in writing to save time if that would be helpful. It is also an option to postpone the Analysis and Debrief to a later day.