**Student Activities to Accompany BioTA Podcast Episode 23: Chocolate Is Life**

Michael Sitvarin

Visiting Assistant Professor, Union College

## Acknowledgements

The author thanks the fall 2023 faculty mentoring network participants: Phil Gibson (leader), Sarah Straud, Margaret Goodman, Katie Sandlin, Christin Monroe, and Carlos Goller. This guide was developed by adapting Mary Mulcahy’s listening guide for a previous podcast about bees.

*Instructors can email Michael Sitvarin (michaelsitvarin@gmail.com) for a key to the activities.*

# Information for Instructor

This instructional resource provides three activities to accompany a podcast on chocolate, including a focus on social justice and equity issues. The student activities were created during the BioTA Podcast Faculty Mentoring Network in fall 2023. In the podcast, Dr. Phil Gibson interviews Robert Bowden, President of Vivere Chocolates.

## Podcast Citation:

Gibson, J. P. (Host). (2021, Nov 3). Chocolate Is Life – 023 [Audio podcast episode]. In *BioTA*. <https://jphilgibsonlab.oucreate.com/uncategorized/chocolate-is-life-023/>

## Overview of Activities:

### Activity A: Pre-Class Listening Guide and Reflection

* Distribute the student assignment in the class prior to the podcast discussion.
* Direct students to listen to the podcast:
	+ <https://podcasts.apple.com/us/podcast/chocolate-is-life-023/id1529746107?i=1000540610452>

or

* + <https://jphilgibsonlab.oucreate.com/uncategorized/chocolate-is-life-023/>
* Have students take notes on the questions provided below and bring their completed notes to class.
* Instructors can have students work in pairs to discuss their answers to the questions.

### Activity B: Social Justice and Equity Issues Related to Chocolate

* After students have completed the listening guide associated with the podcast and discussed their answers, they will explore social issues surrounding the origin, cultivation, and future of chocolate.
* Take time to complete the reflection questions individually.
* Pair up with another student or form a small group and share your responses with each other.
* Collect perspectives from the entire class and contribute to a broader conversation.

### Activity C: Exploring the Impacts of Biodiversity in Cacao Agriculture

* Distribute the study by Vansynghel *et al*. (2022) to students along with reading guide.
* Students read the manuscript and complete the reading guide prior to joining a class discussion on the study.
* Lead a “journal club” styled conversation about the study, in addition to discussing broader topics related to biodiversity and agriculture.
* Alternatively, students could be assigned to lead the discussion of the study, or portions of the discussion.

# Activity A: Listening Guide (To Be Completed Before Class)

#### Learning Objectives:

1. Take notes on a scientific podcast about *Theobroma cacao*.
2. Describe the origins and human history of chocolate.
3. Explain the steps required to produce refined chocolate.
4. Consider social justice and equity issues inherent in the chocolate industry.
5. Describe the challenge climate change presents to the chocolate industry.
6. Consider personal interactions with chocolate and ways that consumers can improve sustainability.

Use the space below to answer this question **before** you listen to the podcast.

* + - 1. What do you think chocolate is made from? (consider the raw ingredients)
			2. Where do you think chocolate comes from? (consider geographical regions)

Scientific papers and scientific podcasts can be very detailed and daunting, sometimes filled with technical vocabulary. Reading a scientific paper (or listening to a podcast) ***twice*** can be a terrific way to understand a scientific topic better!

Recommendation: ***First* *listen to the entire podcast without taking notes.*** After the podcast ends, see how many of the prompts below you can answer. If you are missing some information, go back and re-listen to those sections (or even consider listening to the entire podcast again!).

The time values below are approximate, and you may need to adjust the podcast timeline slider left or right to be confident in your answers.

|  |  |
| --- | --- |
| **Time (approximate) and Prompt** | **Your Notes** |
| 00:55 How and why was cacao consumed originally? |  |
| 03:35 What are three actions that Robert views as important for social justice and equity? |  |
| 08:00 Outline the main steps used to make chocolate, starting with the harvest of the cacao bean. |  |
| 11:00 Where did cacao originate and where can it grow? |  |
| 12:45 How did the form of chocolate consumption change after it was brought to Europe? Which nations were responsible? |  |
| 14:50 In which nations is most cacao farmed currently? |  |
| 16:45 Briefly describe the scale of cacao farming. |  |
| **Pause the podcast for a break – when you feel refreshed, resume the podcast.** |
| 19:00 How does European colonization of Africa connect cacao trade and slavery? |  |
| 19:55 How much money do the farmers make for cacao, and what determines how much they get paid? |  |
| 21:15 How can consumers of chocolate make ethical decisions that help growers? |  |
| 24:00 Climate change is causing equatorial regions to warm rapidly. Why *doesn’t* this mean cacao farming will simply expand geographically? |  |
| 27:20 What explains the myth that chocolate consumption causes skin problems? |  |
| 28:25 What makes white chocolate unique? |  |
| 31:35 What opportunities are there for plant biologists in the chocolate industry? |  |
| 36:45 How much of a role does the US play in chocolate consumption? |  |

# Activity B: Social Justice and Equity Issues Related to Chocolate

#### Learning Objectives:

1. Reflect on the history of human-cacao interactions.
2. Consider inequities in the cacao industry and possible solutions to address those inequities.
3. Connect climate change threats to social justice issues.
4. Discuss social justice and equity issues with classmates.

After listening to the podcast and completing the listening guide, answer the following questions. You should be prepared to share your answers with a partner or small group as well as contribute to a broader class discussion of these topics.

Reflection questions for **after** you’ve listened to the podcast.

* + - 1. Were you surprised to learn where chocolate comes from, botanically and/or geographically? Explain your answer.
			2. In Central America, cacao was used as currency, but the wealthy could afford to consume their money. Are there any modern-day parallels of such wealth signaling? If so, how does it compare to cacao?
			3. Do you consider the European modifications to how cacao products were consumed to be an act of cultural appropriation? Explain why or why not. (*contemplate whether you would prefer frothy, spicy, chalky water over a modern candy bar*)
			4. What do you think would be the most important change to make to the chocolate industry to ensure cacao farmers are treated more equitably? Explain your answer. (*consider the billions of dollars spent on chocolate and the meagre wages farmers earn*)
			5. Climate change poses a major threat to cacao cultivation in the wild and could lead to a future in which it can only be profitably grown in greenhouses. What do you think about this possibility?
				1. How would the geographical location of the greenhouses affect your opinion? (*e.g., what if all the greenhouses were owned and operated in the US?*)

# Activity C: Exploring the Impacts of Biodiversity in Cacao Agriculture

#### Learning Objectives:

1. Read primary scientific study by Vansynghel *et al*. in *Proceedings of the Royal Society B: Biological Sciences*.
2. Identify essential components of careful experimental design.
3. Interpret scientific communication in the form of tables and figures.
4. Critically evaluate scientific arguments.
5. Connect natural biodiversity to human modifications to natural systems (e.g., agriculture).

Reference:

Vansynghel J, Ocampo-Ariza C, Maas B, Martin EA, Thomas E, Hanf-Dressler T, Schumacher N-C, Ulloque-Samatelo C,

Yovera FF, Tscharntke T, Steffan-Dewenter I. 2022. Quantifying services and disservices provided by insects and vertebrates in cacao agroforestry landscapes. *Proceedings of the Royal Society B: Biological Sciences* **289**: 20221309. https://doi.org/10.1098/rspb.2022.1309

In this activity, you will read a recent primary literature article that explored the impacts of biodiversity in cacao agriculture. If you are new or relatively inexperienced at reading primary literature, that’s ok! This form of scientific communication can be challenging to read, so the following provides guidance to help you get the most out of the article.

**How to read a journal article**

While reading journal articles, it is often helpful to write directly on the paper or to take notes separately. Be sure to look up the definition of any terms you don’t understand!

1. Skip the abstract (*You will come back to it later.*)

2) Read the introduction, paying attention to how the study fits in with what is already known. Focus on the last section where the authors state their questions and/or hypotheses. (*What methods would you use to address these questions/hypotheses?*)

3) Skim through the methods section. Don’t get bogged down in details, but do come away with an understanding of how the authors investigated their questions. (*Do you think the methods will be able to address the questions/hypotheses posed in the introduction?*)

4) Now that you know what the authors did, look at the tables and figures to see the results. Make sure you understand all the variables involved and look for any trends. Skim the written results section. (*What trends do you see? How would you interpret the results?*)

5) Read the discussion and feel free to flip back to the results to remind yourself about what the authors found. Pay attention to how the authors interpret the data and incorporate conclusions from previous research. (*Look for the big picture: What is the take-home message? Do you agree with the authors’ interpretations?*)

6) Read the abstract. You should be able to understand every sentence and recall the experimental methods used. If you find the abstract challenging, you didn’t read carefully enough.

After you’ve read the paper, go do something else for a while. Come back later and read it again. Journal articles are dense and complicated, and even professional scientists must read them multiple times before they fully comprehend everything. Skim the parts you understood the first time, read the methods in more detail, focus on the results and how they are interpreted. Read the abstract again as a way to quiz yourself.

Questions based on the study by Vansynghel *et al*.

**Introduction**

* + - 1. Provide an example of an ecosystem service:
			2. Provide an example of an ecosystem disservice:
			3. Explain how biodiversity can impact the balance of ecosystem services and disservices.
			4. Use the space below to draw a diagram that includes a cacao pest, herbivore, and pollinator in addition to cacao itself. Use arrows with +/- signs to indicate effects that each community member has on the other.
			5. What was the primary question the researchers sought to answer?

**Methods**

Where was the study connected?

Think back to the podcast: where is the majority of cacao grown?

Which vertebrates were excluded? How were they excluded? What other vertebrate treatments were used?

Which invertebrates were excluded? How were they excluded?

Why didn’t they just use insecticides to exclude invertebrates from the cacao trees?

What aspects of the cacao plants were quantified?

Why didn’t they just measure one aspect? (*consider the value of measuring multiple variables*)

**Results**

Focus on figure 2a. What was the overall effect of excluding flying insects? How can you tell?

Does the difference seem meaningful to you? Do you think it would be meaningful to a cacao farmer?

How did the presence of both birds and bats change this result? How can you tell?

Did it matter whether birds or bats were excluded when only one vertebrate was excluded? How can you tell?

Focus on figure 2b. How did canopy closure impact fruit set? How can you tell?

Was the canopy closure more relevant when flying insects were present or excluded? How can you tell?

Focus on figure 3a. Which treatments were most effective at reducing squirrel damage? How can you tell?

Focus on figure 3b. What effect did excluding ants have on fruit loss (not counting damage from squirrels)? How can you tell?

Focus on figure 5. Summarize the effects of the different groups, including the relative magnitude of effects.

**Discussion**

Why is it hard to provide a simple answer to a question about the impact of biodiversity on cacao farming?

What’s the primary impact of flying insects on cacao farming?

Why is it important to consider a broader biological community when interpreting the effects of the birds and bats on cacao yield?

Describe the kinds of interactions that could explain the mixed effects of ants.

How could snakes help cacao farmers?

Cacao farmers may not be very likely to read primary scientific literature, so what could scientists do to share their findings in a way that will have a meaningful impact on cacao production?

If you were a cacao farmer, what would you want scientists to study next? How could they build upon the knowledge gained from this experiment?

Re-visit your diagram from the introduction (question #4). Draw the community interactions based on the results of this study. Include ants, birds, bats, squirrels, flying insects, cacao, and any other community members you think are critical to understanding the impacts of biodiversity on cacao agriculture.