

Iskigamizigan: Sugar Bush

Teacher Unit Plan

https://bit.ly/sugarbush_cs

Unit Overview

This unit, designed for grades 5-7, explores the traditional practice of Iskigamizigan (Sugar Bush) and the use of micro:bits for data collection and analysis in maple sap production over 6 - 10 instructional days. Students will learn about the cultural and historical significance of maple syrup production in Native American communities, as well as the importance of good stewardship and gratitude towards the earth. Through hands-on activities, students will practice tapping trees, monitoring sap volume, boiling sap, and analyzing data to improve their sugar bush practices. They will also discuss the role of technology in modern-day sap production and reflect on the balance between tradition and innovation in preserving natural habitats. By the end of the unit, students will have a deeper understanding of the interconnectedness between culture, nature, and technology, and be inspired to make positive changes in their relationship with the environment.

Note on Timing: By using Part 1 combined with Part 2A, the instructional unit will last approximately 10 instructional days (45-minute lessons) along with extra time needed to visit and monitor the sugar bush. By using Part 1 combined with Part 2B, the instructional unit will last 6 instructional days (45-minute lessons).

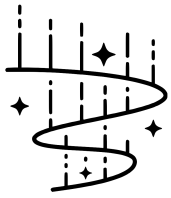
By the end of this unit, students will be able to

- use a micro:bit to create and modify programs related to traditional Native American sugar-making processes.
- develop a data collection plan for maple sap collection and analyze the collected data to improve sugar bush practices.
- demonstrate an understanding of the maple syrup production process and reflect on the connection between technology, culture, and the natural world.

IMPORTANT

As you consider implementing this unit, it is essential to gather information about the conditions that could potentially hinder this process or lead to cancellation of tapping for an entire year. Here are some key points to consider:

- **Temperature:** Maple tree tapping relies heavily on specific temperature conditions. Ideal tapping conditions require freezing temperatures at night and above freezing (around 40 degrees Fahrenheit) during the day. Inconsistent temperature patterns can impact the sap flow significantly.
- **Tree Health:** A tree must be healthy and mature (typically at least 10 inches in diameter) to be tapped. Trees that are diseased, damaged, or stressed should not be tapped as it could potentially harm them further.
- **Timing:** The sap generally runs between late winter and early spring. Tapping too early or too late will yield less sap and potentially harm the tree.
- **Environmental Factors:** Drought, excessive heat, or an overly cold winter can lead to a poor sap flow, and in extreme cases, the tapping season may need to be canceled.
- **Over Tapping:** Over tapping can lead to tree damage, reducing future sap yield. Each tree should only have a certain number of taps, depending on its size.
- **Sustainability:** Overexploitation of maple trees can also lead to a decline in sap production over time. Proper management and sustainable practices are crucial for the longevity of maple trees and syrup production.



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Please ensure to communicate these factors to the students, emphasizing the respect and care necessary for the environment and the sustainable harvesting of natural resources. **In the event that you are not able to tap maple trees, we have provided a simulation that will allow this unit to be completed - use Part 2B (with Simulator).**

Preparation

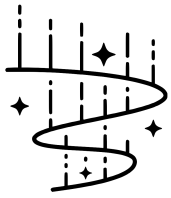
Materials

- Iskigamizigan: Sugar Bush - Slides
 - [Part 1](#)
 - [Part 2A \[without Simulation\]](#)
 - [Part 2B \[with Simulation\]](#)
- Student Activity Guide
 - [Part 1](#)
 - [Part 2A \[without Simulation\]](#)
 - [Part 2B \[with Simulation\]](#)
- Addition copies of Phenology Journal (located at the end of the Student Activity Guide Part 2A)
- Taps
- Bags
- Drill bits
- Speaker Notes for Slides ([Instructions](#))
- Hand or Power Drills
- Rubber mallet
- Axe
- Wood for burning
- Chains or stand for holding the kettle
- Kettle or evaporator
- Micro:bits version 2
- Bucket of water
- Something to stir the sap when boiling (like pine bows)
- Big buckets to collect sap
- [Sugar Bush Simulation](#)
- [Microbit + battery pack case and cover](#)

"We lay a cheese cloth wrapped around a clean big garbage size container with the cheese cloth ratchet strapped to stay on while pouring. This allows for some of the debris to be filtered out before the boiling step. We have a lid for our container because we leave it outside with snow packed against the bottom so it does not tip over and ensures it stays cool. There are certain temperatures we will start to boil the sap at if the weather is too warm. To ensure the sap does not go bad. We store ours in mason jars after the boiling process so maybe containers to keep the syrup in." - Brittany Heskin, Teacher at Fond du Lac Ojibwe Schools

Teacher Prework

- The timing of this unit depends on many factors including temperature. In northern Minnesota (Duluth area), mid- to late-March is often when sap will begin to flow, so the timing of these lessons will depend on the timing of sap flow. The duration of sap flow and collection will vary as well, so the guide provided here will need to be adapted to the conditions allowed by environmental factors.
- Processes like collecting sap, maintaining a fire, and boiling sap will take place over a long duration of time. Classes will need to coordinate timing and efforts to plan for supervision and maintenance of the long process. Consider finding parent or community volunteers to supervise and maintain the fire and monitor boiling, while teachers coordinate student participation.
- Ojibwe culture and traditions: The following daily descriptions should be viewed as guidelines and not necessarily daily plans. In reality, the process used in a Sugar Bush is rarely the same step-by-step or daily process. The general ideas described here will need to be revised and adapted. Each family has their own customs and traditions around sap collection that should be recognized and embraced.



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Standards and Learning Objectives

MN Content Standards [[Math](#), [Science](#), [Crosswalk](#)]

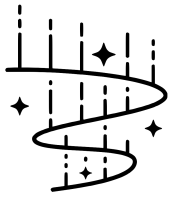
- **MN Science 5E.2.2.1.2** Use data to describe patterns in the daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.**
- **MN Science 6E.1.1.1.3** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (P: 1, CC: 7, CI: ESS3)
- **MN Science 6E.3.2.1.3** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* (P: 6, CC: 2, CI: ESS3, ETS1)
- **MN Science 7L.4.2.2.1** Gather multiple sources of information and communicate how Minnesota American Indian Tribes and communities and other cultures use knowledge to predict or interpret patterns of interactions among organisms across multiple ecosystems. (P: 8, CC: 1, CI: LS2, ETS2)

[CSTA Standards](#)

- **CSTA 1B-DA-06:** Organize and present collected data visually to highlight relationships and support a claim.
- **CSTA 1B-DA-07:** Use data to highlight or propose cause and effect relationships, predict outcomes, or communicate an idea.
- **CSTA 1B-AP-09:** Create programs that use variables to store and modify data.
- **CSTA 2-AP-11:** Create clearly named variables that represent different data types and perform operations on their values.

Assessment Criteria

Students will complete a phenology journal that allows students to describe patterns in the daily changes of the natural world (MN Science 5E.2.2.1.2).	Part 2A - Phenology Journal Part 2B - Lesson 5: Data Collection Log Using the Iskigamizigan (Sugar Bush) Simulator
Students will reflect upon factors that have caused rise in global temperatures over the past century (MN Science 6E.1.1.1.3).	Part 2A - Lesson 10: Michael Price - We will adapt to this climate change crisis (Discussion) Part 2B - Lesson 6: Michael Price - We will adapt to this climate change crisis (Discussion)
Students will discuss and conjecture on ways that humans can decrease their impact on their environment (MN Science 6E.3.2.1.3).	Part 2A - Lesson 9: Keller Paap - Leave no trace (Discussion) Part 2B - Lesson 6: Data Analysis (Discussion)
Students will discuss how Ojibwe culture and traditions help predict and interpret patterns of interactions among organisms (maple tree) across ecosystems (MN Science 7L.4.2.2.1).	Lesson 5: Michael Price - Traditional Ecological Knowledge understandings (Discussion)
Students will organize a data collection report to present collected data about daily temperature and sap flow to demonstrate trends and support a hypothesis (CSTA 1B-DA-06).	Part 2A - Lesson 9: Your Data Report Part 2B - Lesson 5: Data Collection Log Using the Iskigamizigan (Sugar Bush)

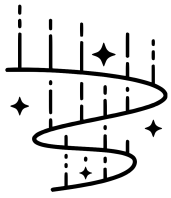


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	Simulator
Students will discuss the findings from the data collected about daily temperature and sap flow to predict conditions required for maple sap to flow (CSTA 1B-DA-07).	Part 2A - Lesson 9: Your Data Report Part 2B - Lesson 6: Data Analysis (Discussion)
Students will create an Indoor-Outdoor Thermometer program that uses variables to store and modify data (CSTA 1B-AP-09).	Lesson 4: Building an Indoor-Outdoor Thermometer
Students will create a Temperature Data program in which they will clearly name variables that represent data types and perform operations on those values (CSTA 2-AP-11).	Lesson 3: Temperature Data Program
Introducing New Vocabulary Strategies	
Use one of the following strategies as you introduce new Ojibwe words to students. Practice pronunciation by using the Ojibwe People's Dictionary. • Word of the Day: Begin each day by introducing the new vocabulary word on a poster or whiteboard. Provide the definition, pronunciation, and an example sentence. Have students repeat the word and its meaning after you. • Flashcards: Have students write the Ojibwe word and draw a corresponding picture. You can have the students write the English equivalent on the reverse side or leave it off. Students can review them in pairs at the beginning of each lesson by practicing saying the word, its meaning, and using it in a sentence. • Picture Association: Show a picture related to the new vocabulary word each day. Ask students to guess what the word might be based on the image, and then reveal the word, its definition, and an example sentence. • Word Wall: Create a word wall in your classroom where you add the new vocabulary word each day. Encourage students to look at the word wall and review the words as they enter the classroom. • Vocabulary Charades: Have a student volunteer act out the meaning of the new vocabulary word without speaking. The rest of the class must guess the word based on the student's actions. • Word in Context: Provide a sentence with a blank space where the new vocabulary word should be. Have students guess the word based on the context of the sentence, and then reveal the correct word and its definition. • Vocabulary Pictionary: Draw a picture that represents the meaning of the new vocabulary word. Have students guess the word based on the drawing, and then provide the word, its definition, and an example sentence.	



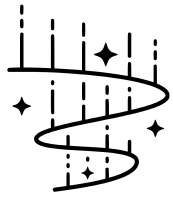
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Unit Outline

PART 1	
Lesson and Description	Learning Objectives
Lesson 1: Intro to Iskigamizigan & Micro:bits (50 min) In this lesson, students will be introduced to iskigamizigan (Sugar Bush) and basic programming using a micro:bit. Students will create a flashing heart on the micro:bit and then modify the program to display an Ojibwe word.	• Explain the maple syrup process. • Define iskigamizigan (sugar bush). • Use a micro:bit to write simple programs.
Lesson 2: The Sugar Bush Story (50 min) In this lesson, students will read/listen to Ininatig's (maple tree) Gift of Sugar: Traditional Native Sugarmaking and discuss ways that sugar has been made. Students will also examine how technology has helped Dakota artist, Marlena Myles. Students will explore a thermometer program created using a micro:bit and then modify it.	• Discuss the Native American way of making sugar. • Define ininatig (maple tree). • Modify a program to increase functionality.
Lesson 3: Data Logging (50 min) In this lesson, students will learn the importance of data logging in monitoring and understanding the natural world. They will discuss ways of good stewardship and how to miigwechiwendan (be thankful) to the earth. Students will also examine and practice using a micro:bit program that collects data related to sugar bush activities.	• Discuss ways of good stewardship and gratitude to the earth. • Define miigwechiwendan (be thankful). • Examine a program that collects data using a micro:bit.
Lesson 4: Analyzing Data (50 min) In this lesson, students will explore the importance of analyzing data to make informed decisions regarding the environment and sugar bush practices. They will discuss native perspectives on the natural world and what ani-ziigwang (as spring approaches) means. Additionally, students will use a variable to program an indoor-outdoor thermometer using a micro:bit.	• Discuss native perspectives on the natural world. • Define ani-ziigwang (as spring approaches). • Use a variable to build an indoor-outdoor thermometer.

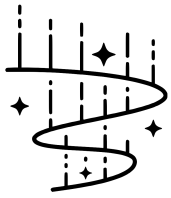


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Part 2A [without Simulation]	
Lesson and Description	Learning Objectives
Lesson 5: Data Collection Plan (50 min) In this lesson, students will learn to develop a data collection plan for the ziinzibaakwadaaboo (maple sap) that is both efficient and beneficial to the environment. They will discuss methods to build relationships with the natural world. Students will work in groups or individually to create their own data collection plans.	- Discuss methods to build relationships with the natural world. - Define ziinzibaakwadaaboo (maple sap). - Create a data collection plan.
Lesson 6: Tapping Trees, Monitoring Volume (50 min) In this lesson, students will learn the technique of using a negwaakwa (tap or spile) to tap trees for sap collection without causing damage to the tree. They will examine how to monitor the volume of sap collected each day. Students will also practice tapping trees and monitoring sap volume in a hands-on activity.	- Tap trees without causing damage. - Examine how to monitor the volume of sap collected each day. - Define negwaakwa (tap or spile).
Lesson 7: Niwii-izhaamin iskigamiziganing (50 min) Niwii-izhaamin iskigamiziganing (we're going to the sugar bush)! In this lesson, students will gain an understanding of phenology and its importance in sap collection. They will identify factors that may affect the process of sap collection. Students will also explore the relationship between phenology and sap collection through discussions and activities.	- Discuss phenology and its importance in sap collection. - Identify factors that may affect the process of sap collection. - Define niwii-izhaamin iskigamiziganing (we're going to the sugar bush.)
Lesson 8: Hanging Kettle & Boiling (50 min) In this lesson, students will learn the process of boiling sap in the akik (kettle) to create syrup, including when to stop boiling and how to transfer the syrup. They will discuss the importance of maintaining cleanliness and safety around the camp. Students will practice hanging kettles and boiling sap in a controlled environment.	- Explore when to stop boiling and how to transfer the syrup. - Explain the importance of maintaining cleanliness and safety around the camp. - Define akik (kettle).
Lesson 9: Sap Flow Data Analysis (50 min) In this lesson, students will learn how to analyze data collected from micro:bits to identify trends and make informed decisions. They will discuss ways to "leave no trace" in the natural world and define anishinaabe ziinzibaakwad (maple sugar). Students will analyze their own data from previous activities and identify trends to improve their sugar bush practices.	- Discuss ways to "leave no trace" in the natural world. - Define anishinaabe ziinzibaakwad (maple sugar). - Analyze data collected from micro:bits to identify trends.
Lesson 10: Reflection and Adaptation (50 min)	Discuss changes that can be made to help natural habitats.



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In this final lesson, students will reflect on the use of technology and iskigamizigan throughout the unit. They will discuss changes that can be made to help natural habitats and define ambe (let's go!). Students will share their experiences and insights gained from the unit, as well as discuss possible adaptations for future sugar bush practices.

- Define maajaadaa (let's go!).
- Reflect on the use of technology and iskigamizigan.

Part 2B [with Simulation]

Lesson and Description

Learning Objectives

Lesson 5: Data Collection Plan (50 min)

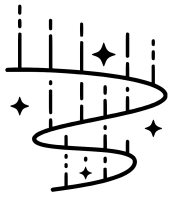
In this lesson, students will learn to collect data for ziinzibaakwadaaboo (maple sap). They will discuss methods to build relationships with the natural world. Students will work in groups or individually to collect data from a simulator.

- Discuss methods to build relationships with the natural world.
- Define ziinzibaakwadaaboo (maple sap).
- Create a data collection plan.

Lesson 6: Sap Flow Data Analysis (50 min)

In this final lesson, students will learn how to analyze data collected from micro:bits to identify trends and make informed decisions. Students will analyze their own data from previous activities and identify trends to improve their sugar bush practices.

- Discuss changes that can be made to help natural habitats.
- Define maajaadaa (let's go!).
- Analyze data collected from micro:bits to identify trends.



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Acknowledgements, References, and Resources

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- Friends of the Boundary Waters Wilderness (2022). [Anishinaabe gikendamawaa: Iskigamizigan story map](#)
- Krawec, P. (2022). Becoming Kin: An Indigenous Call to Unforgetting the Past and Reimagining Our Future
- [Ojibwe People's Dictionary](#)
- [Sugar Bush vocabulary flashcards](#)
- [Anishinaabe Gikendamawa Storymaps](#)
- [Iskigamizigan \(Sugar Bush\) guide](#) from Great Lakes Indian Fish & Wildlife Commission (2006)
- Book: [Ininatig's Gift of Sugar](#): Traditional Native Sugarmaking (suggested Gr. 3 reading lev., but can use with K-12)
- Book: [Rabbit & Otter Go Sugarbushing](#)
- How to identify a Sugar Maple ([site](#)) ([PDF](#)) ([video](#))
- Video (2 min): [Sugarbush \(Mille Lacs band of Ojibwe\)](#)
- Video (8 min): [Iskigamizigan \(Sugar Bush\)](#)
- 7 Grandfather Teachings ([video 1](#), 5 min,) ([video 2](#), 11 min) ([wikipedia](#))
- Book on 7 Grandfather Teachings: "[Mashkiki Road](#)"
- List of 7 teachings: ([website](#))