Grade 7 Learning Experiences: Human's Impact on the Environment and Ecosystems

Experience 2: Ecological Footprint

Grade 7 Long Range Plan Model 1

In this STEM-based, engaging activity, students get to explore important ecosystem issues and apply learned concepts as new learning happens.

They will start by getting some fresh air to get soil samples from various sources around the school. (1 period of 50 minutes). Students will then conduct tests and experiments to evaluate the quantity and the quality of the living thing from their samples by comparing their findings with other classmates. (10 minutes per period for a few weeks)

Next, students will calculate their lifestyle footprint with the goal of being as reliable and honest as possible. Transferring the data by hand or by a computer program such as Google Sheets or Excel, they will compile all the class results. Combining and calculating how much land is needed for their actual lifestyle, students will make predictions. Relating the sustainable way of living and the importance of the pressure it's putting on ecosystems. (2 periods of 50 minutes)

Students will then explore how developments and exploitation of the land can impact the quality of available land in Ontario. This will be accomplished by studying before and after pictures of Hawkesbury, Ontario. They will then use their findings to make hypotheses or the causes that affected the water banks of Chenail Island. (1 period of 50 minutes). Then, in small groups, students will prepare a debate about the impact on the environment and economy of one human action. They will have to justify with facts and statistics so they will need time to research the subject. (2-3 periods of 50 minutes)

In the final step, students will explore how humans can help make conservation initiatives and garden restorations including indigenous contributions. They will then use any program of their choice based on what they would like to emphasize. They should present their findings in a one-pager of quality, infographic. (3 periods of 50 minutes).

Overview of learning experiences – why these activities	In this experience, students will calculate their lifestyle footprint. Combining and calculating how much land is needed for their actual lifestyle, students will make predictions.

	Big Idea: - Humans Impact - Environment and Ecosystems See Grade 7 Long Range Plan Model 1, March
Prior Knowledge / Prior Skill Set(s)	**Background Knowledge and concept (Teacher)** ● Knowledge of what has been explored in Grade 6 Biodiversity ● Knowledge of transferable skills. ● Understanding of the Learning For All Document ● Understanding of how to engage in the Engineering Design and Research process ● Understanding of safety procedures ● Understanding of block-based coding concepts and platforms like Microbit **Background Knowledge and concept (Students)** ● Knowledge of habitats and interactions between species ● Knowledge of different chemical cycle (water, carbon, nitrate) ● Knowledge of different life cycles (plants, fish, insects, mammals) ● Aware of safety behavior and procedures in case of accidents (example: no broken glass in a garbage bag) ● Aware of various collaboration strategies ● Knowledge of how to use technology for research and collaboration ● Ability to double check the facts before taking the data for granted. ● Prior knowledge of coding concepts (e.g. loops, timers, counters, and conditional statements) ● Prior knowledge and experience using basic block-coding and the use of Microbit
Strand A - STEM Investigation and Communication Skills	**A1.1** Identify various ways in which humans affect/impact their natural environment. **A1.5** Communicate ways through which we can promote positive, and mitigate negative, environmental interactions.

Overview / Big Ideas/Fundamental Concepts	**Overview** Students will learn about interaction (action and reaction) through a series of experiments that help them see the impact of humans on ecosystems. They will use their observational and communication skills to identify short term and long term effects on living things. Through the use of coding skills, they could create humidity control devices and temperature reading devices for their vivarium. Students will also think critically about how the quality of water can cause the loss of biodiversity and can affect people differently based on their locations on the planet. **Big Ideas** Every natural ecosystem needs water in order to reach biodiversity. Biodiversity provides benefits to all living things. Yesterday's solutions are today's problems. **Systems and Interactions** A system is a collection of living and/or non-living things and processes that interact to perform some function. A system includes inputs, outputs, and relationships among system components. Natural and human systems develop in response to, and are limited by, a variety of environmental factors. **Sustainability and Stewardship** Sustainability is the concept of meeting the needs of the present without compromising the ability of future generations to meet their needs. Stewardship involves understanding that we need to use and care for the natural environment in a responsible way and making the effort to pass it on to future generations no less than what we have access to ourselves. Values that are central to responsible stewardship are as follows: using non-renewable resources with care; reusing and recycling what we can, and switching to renewable resources where possible. **Automation**

	Automation involves implementing technologies to make systems run on their own, without further human intervention. Automation can facilitate and accelerate functions that are otherwise difficult, repetitive, or dangerous for human beings to perform. Coding and emerging technologies play an increasingly important role in controlling automated systems.
Learning Goals / Success Criteria	**Learning Goal**: We are learning about the contributions of emerging technology to solve diverse automated needs. **Success Criteria** ● I can explain why their contributions are important and needed to solve environmental problems. ● I can code a program that can read environmental changes such as temperature or humidity. ● I can predict some of the long term effects of emerging technology solutions. **Ministry of Education Key Points** **1. STEM Skills and Connections:** Perspectives and approaches that provide opportunities for students to investigate and apply concepts and skills from all areas of learning. **2 Research and Experimentation Processes:** Provides students with the scientific literacy skills needed to approach scientific questions that are becoming a part of everyday life. **4 Hands-on, Experiential Learning:** Includes hands-on, experiential learning opportunities to support classroom activities that encourage curiosity. **5 Coding:** Allows students to explore a wide variety of science and technology concepts and contexts through coding, while also learning valuable skills related to automation and control of systems. **8 Contributions to Science and Technology**: Showcases the important contributions made to science and technology by people with diverse lived experiences. Students also explore real-world issues by connecting scientific and technological knowledge

	systems and perspectives from various cultures, including connecting Indigenous sciences and technologies and Western science and technology. **9 Climate Change:** Students will develop the skills and knowledge needed to understand the causes and potential solutions and mitigation strategies related to climate change and other environmental issues, and how they can make the most environmentally responsible decisions possible, given the choices they have. **10 Food Literacy:** Skills and knowledge related to food literacy: from students developing an understanding of where food comes from and how it is grown and prepared to students investigating the importance of biodiversity in agriculture.
Learning Experience(s)  **A1.1, A1.5**	Curiosity and Wonder in Science and Technology **Experience 2** (2 periods of 35 to 50 minutes) **Ecological Footprints** Starting lesson by viewing explanations about the carbon cycle using this Let's Talk Science site. OPTIONAL: Share this paragraph with students: "Carbon is present in all organic matter, since it is found in the sugars produced by plants. This carbon is continuously recycled into the environment. When breathing, producers use the carbon dioxide released into the air to make the sugars. Herbivores eat growers, carnivores eat herbivores, and decomposers return material to the soil so growers can reuse it". Using the information given in the paragraph above, students show their understanding of the carbon cycle by using arrows to illustrate the movement of carbon from one organism to another. Students may be grouped by pairs or a group of three so that they can discuss interactions and develop their understanding of the scientific vocabulary related to this field of science.

	Answers will vary according to the media chosen. This could be evaluated as communication in literacy or as collaboration skills. Students investigate their personal lifestyle and its ecological footprint impact on a larger scale using the provided quiz (see Appendix A: Ecological Footprint Calculator). Suggested changes to their daily routine should be provided by the students. The quiz should be taken twice, once at the beginning of this unit and later or at the end of the unit, to see if the changes had an effect on the impact. The graphing of the results with a spreadsheet such as Excel or Google Sheets will require some coding skills. Throughout the unit, the teacher encourages students to post relevant articles in the News section in the classroom. These articles may come from local newspapers about the environment. In addition, this section can be used as reminders for work handovers and scheduled due dates.
Science and Technology Expectations	**STRAND B. Life Systems - Interactions in the Environment** B1.1 assess the impact of various technologies on the environment B1.2 assess the effectiveness of various ways of mitigating the negative and enhancing the positive impact of human activities on the environment B2.8 describe how different approaches to agriculture and to harvesting food from the natural environment can impact an ecosystem, and identify strategies that can be used to maintain and/or restore balance to ecosystems **STRAND C. Matter and Energy - Pure Substances and Mixtures** C1.1 analyze the social and environment impacts of the use and disposal of pure substances found in technological devices, considering local and global perspectives C1.2 assess environmental and social impacts of different industrial methods used to separate mixtures

Science and Technology Vocabulary	Biodiversity Biomes Community Conditional Statements (coding) Ecosystem Engineering Process Habitat Impact Interaction Interrelationship interspecies Intertidal Zone Intrinsic Loops (coding) Research Process Species True or False (coding) Vivarium
Equipment and Materials	REQUIRED ● Antidote software ● Online collaboration software ● Coding software such as Micro:bit ● Presentation software such as Pretzi, Powerpoint or Canvas ● Electronic spreadsheet such as Excel or Google sheets ● Organizational diagram software such as SMART Ideas For Experience 2: Ecological Footprint ● access to internet ● online notes software ● computer and a calculator
Timeline and Preparation	Time required for preparation – **Experience 2: Ecological Footprints** 2 periods of 35 to 50 min Time can be extended based on student engagement/interest/driving questions/inquiry
Safety Considerations	

	Refer to these STAO and OCTE Safety resources: Safety in Elementary Science and Technology (STAO) Safe Activity Foundations in Education Document (SAFEdoc) Science and Technology, Grades 1-8 (OCTE) Ontario Curriculum Program Planning – Health and Safety
Opportunities For Assessment	See Appendix B: Collaboration Grid for a sample rubric. Assessment FOR is mostly at the beginning of the unit the Mind On. The outdoor activity provides an anchor for future references during the other activities. It also activates students' prior knowledge of nature and the interactions in their surroundings. Assessment AS is done throughout all activities, by discussion between students with the teacher, discussion between students and observations made during the hands-on periods. Assessment OF learning is mostly in activity 5 where students have to use what they have learned to suggest solutions for endangered species. The assessment grid is provided for the student's hand out. **According to the Ministry of Education Growing Success Document (2010) assessment is about improving student learning!** Assessment **FOR** Learning: Occurs frequently and in an ongoing manner during instruction, while students are still gaining knowledge and practicing skills and is used by teachers to monitor students' progress towards achieving the overall and specific expectations, so that teachers can provide timely and specific descriptive feedback to students, scaffold next steps, and differentiate instruction and assessment in response to student needs. Assessment **AS** Learning: Occurs frequently and in an ongoing manner during instruction, with support, modeling, and guidance from the teacher and is used by students to provide feedback to other students (peer assessment), monitor their own progress

	towards achieving their learning goals (self-assessment), make adjustments in their learning approaches, reflect on their learning, and set individual goals for learning. Assessment **OF** Learning: Occurs at or near the end of a period of learning, and may be used to inform further instruction and is used by the teacher to summarize learning at a given point in time. This summary is used to make judgements about the quality of student learning on the basis of established criteria, to assign a value to represent that quality, and to support the communication of information about achievement to students themselves, parents, teachers, and others Please use as a reference to the Ministy of Education documents assessment evaluation.
Instructional Strategies and Adaptability	Learning in an environment that is safe, respectful and inclusive (community building should be ongoing). Program Planning and Equity and Inclusion and CRP Teachers should adapt the lessons based on the needs of the students in their class. Please refer to the document. Learning for All Transferable Skills
Additional Supporting Resources	Science and Technology Curriculum Ministry of Education, Ontario site for more information Fundamental Concepts and “Big Ideas” in Science and Technology Exploring ecosystems in extreme climate condition Polar Quest 2 challenge: Technology in an extreme environment - Teaching Dossier - EducaPoles - International Polar Foundation's educational site Expo Science For Educators - Youth Science Canada | Sciences jeunesse Canada Free bilingual site about Canadian wildlife including invasive species and other habitat and biomes interesting material.

	(22) Hinterland Who's Who / Faune et flore du pays - YouTube Science North: Interactions in Ecosystems (scroll down to Interactions in Ecosystems Parts 1-5). Visual dictionary to help students visualize vocabulary English: IKONET.COM Exploring vertical agriculture for space ecosystems
Cross-Curricular Opportunities	**Language : Students will have to show communication skills when presenting their work.** **-** use speaking skills and strategies appropriately to communicate with different audiences for a variety of purposes **Mathematics:** Students will have to use DATA analysis for the ecological footprint and the infographic. **Geography**: All ecosystems vary from region to region. Therefore, take advantage of the teams covered in geography to guide students during their inquiry.
Future Opportunities / Next Steps	Students could explore the different biomes that are provided in Minecraft Education and compare the animals and plants of those different biomes. Students can explore STEM careers from Let's Talk Science. Students may want to organize a Science Fair within the school or for a larger audience (in the town's library or spring feast events)

Appendix A: Ecological Footprint Calculator

EXPERIENCE
formative

Ecological footprint calculator

sciences

Problem:

Every time you eat, dress, sleep and move around, you are consuming energy and matter. What is your ecological footprint?

Assumption: _____

*Teacher Note: Ask student to estimate how much of a print they think the leave behind their everyday actions. Answers will vary.

Hardware:

Notepad
Pen or pencil
Smile

Procedure:

1. You will have to observe your everyday habits as honestly as possible.
2. Attribute a score in each category below. Do not add a score if it doesn't apply to you. Some scores have negative values; therefore, make sure you add them correctly. For example, eating 2 eggs everyday gives you 40 points. But if your family doesn't own a car, you would get -20 points.

Observations: date: _____

SHELTER MY SCORE

1. Number of rooms per person (divides the number of rooms by the number of people living in the house):
- less than two rooms per person (10); _____
- two or three rooms per person (80); _____
- four to six rooms per person (140); _____
- a minimum of seven rooms per person (200). _____

2. We share the house with people who are not family members. (-50) _____

3. We own a second house or cottage that is often unoccupied.
- Not (0) _____
- We own, use or share the second house or cottage with other people (200) _____
- Yes (400) _____

Partial score _____

WATER MY SCORE

1. My daily shower or bath habits are:
• I do not take a shower or bath (0); _____
• I stay in the shower for two minutes or fill up the bathtub to the quarter (50); _____
• I stay in the shower for three to six minutes or fill up the half-bath (70); _____
• I stay in the shower for more than six minutes or fill up the bathtub to the brim (90). _____

2. I flush the toilet:
• every time I go to the bathroom (40); _____
• sometimes (10). _____

3. When I brush my teeth, I let the tap water run. (40) _____

4. The laundry is done:
• everyday or every other day (200); _____
• twice a week (150); _____
• once a week (50). _____

5. The car is washed or the lawn is watered:
• almost every day (200); _____
• twice a week (150); _____
• once a week (50). _____

6. The dishwasher is used every day. (50) _____

Partial score _____

FOOD **MY SCORE**

1. During an ordinary day, I consume:
• beef (150/serving); _____
• chicken (100/serving); _____
• aquaculture fish (80/serving); _____
• wild fish (40/serving); _____
• eggs (40/for two); _____
• milk and dairy products (40/serving); _____

• fruit (20/serving); _____
• vegetables (20/serving); _____
• cereals (20/serving). _____

FOOD **MY SCORE**

2. I eat local food:
always (0) sometimes (30) don't know (50) never (60) _____

3. I eat organic food:
always (0) sometimes (30) don't know (40) never (60) _____

4. I eat processed foods:
always (60) sometimes (30) never (0) _____

5. I eat packaged foods:
always (60) sometimes (30) never (0) _____

6. During an ordinary day: _____
• I do not throw away any food (0); _____
• I throw away a quarter of my food (100); _____
• I throw away a third of my food (150); _____
• I throw away half of my food (200). _____

Partial score _____

TRANSPORTATION **MY SCORE**

1. During an ordinary day, I move:
• on foot (0); _____
• by bike (each trip is worth 5 points); _____
• by bus or metro (each trip is worth 30 points); _____
• by car (each trip is worth 200 points). _____

2. Our vehicle consumes ___ L/100 km.
• less than 6 (0) _____
• from 6 to 9 (50) _____
• from 10 to 13 (100) _____
• more than 13 (200) _____

3. I spend _____ hour(s) per day in a vehicle.
- zero (0) _____
- less than half a- (40) _____
- half an hour to an hour (60) _____
- more than one (100) _____

TRANSPORTATION **MY SCORE**

4. I usually travel in:
- a very economical subcompact (50); _____
- a family car (100); _____
- a sport utility vehicle (SUV) or van (150); _____
- a luxury car or truck (200). _____

5. My family:
- does not own any vehicle (-20); _____
- owns a vehicle (50); _____
- owns two vehicles (100); _____
- owns more than two vehicles (200). _____

6. During an ordinary day, I run or walk:
- for more than five hours (-75); _____
- three to five hours (-25); _____
- from one to three hours (0); _____
- 30 to 60 minutes (10); _____
- less than 30 minutes (100). _____

Partial score _____

ENERGY CONSUPTIONMY SCORE

1. During the winter season, we maintain the temperature of the house:
- below 15 °C (-20); _____
- from 15 °C to 18 °C (50); _____
- from 19 °C to 22 °C (100); _____
- above 22 °C (150). _____

2. We dry our clothes in the open air:

• always (-50); _____
• sometimes (20); _____
• never (60). _____

3. We have an energy-efficient refrigerator.
• Yes (-50) _____
• Not (50) _____

4. We use compact fluorescent bulbs.
• Yes (-50) _____
• Not (50) _____

ENERGY CONSUMPTION **MY SCORE**

5. I turn off lights, computers, TVs and devices electronic when no one uses them.
• Yes (0) _____
• Not (50) _____

6. To refresh the rooms of the house:
• we use an air conditioner (30); _____
• we use an electric fan (-10); _____
• we do not use any device (-50). _____

7. Every day, I spend an average of ____ outside.
• seven hours (0); _____
• four to six hours (10); _____
• two to three hours (20); _____
• less than two hours (100). _____

Partial score _____

LIFESTYLE **MY SCORE**

1. I wear different clothes every day and put them on wash each time. (80) _____

2. I wear clothes that have been taken back. (-20) _____

3. A quarter of my clothes are handmade or used. (-20) _____

4. I buy new clothes every year and most of them
of them are new. (120) _____

5. I donate the clothes I no longer wear to a local self-help centre.
• Yes (0) _____
• Not (100) _____

6. I buy eco-friendly clothing (i.e. hemp and jute)
when I can. (-10) _____

LIFESTYLE **MY SCORE**

7. I wear ___ clothes that I own.
• at least 25% (25) _____
• 25% to 50% (50) _____
• 50% to 75% (75) _____
• more than 75% (100) _____

8. I own ___ pairs of shoes.
• two or three (20) _____
• from four to six (60) _____
• seven or more (90) _____

9. Add one point for every dollar you spend on average
every day. _____

10. This week, _____ were "no purchase days".
• more than four days (-100) _____
• two or three days (25) _____
• less than two days (100) _____

11. During an ordinary day, I spend ____ hour(s)
at the computer/in front of the TV/playing electronic games.
• zero (0); _____
• less than one (50); _____

• one to two (100); _____
• more than two (150). _____

Partial score _____

Discussion:

COMPILATION **MY SCORE**

Reporte all your partiel scores for each category and add them up.
to get the grand total.

FOOD _____
WATER _____
TRANSPORTATION _____
ENERGY CONSUMPTION _____
SHELTER _____
LIFESTYLE _____

Total score _____

Multiply your total by a 100 to obtain the number or square meters of land you require to sustain your actual basic needs.

Teacher note: Ask Students what small changes could they do to reduce their footprint. Answers will vary. Encourage them to take initiative and redo the quiz at the end of the unit.

Conclusion:

The size of my ecological footprint is equivalent to _____ square meters.

Going further

1. You could choose two different days of the week to cumulate your data.
2. Compare a day on the weekend to a school day.
3. You could redo the observation at the end of the month and compare it to the previous one to seek improvement?

Appendix B: Collaboration Grid

Name :

Scientific Skills and Processes: Teamwork

	Level 1	Level 2	Level 3	Level 4
Knowledge and understanding				
Knowledge of the elements under consideration •Written communication •Oral communication	The student demonstrates **limited knowledge** of the elements being studied.	The student demonstrates **a partial knowledge** of the elements under study.	The student demonstrates **a good knowledge** of the elements under study.	The student demonstrates **a thorough knowledge** of the elements under study.
Thinking skills				
Use of planning skills • Teamwork	The student uses planning skills **with limited effectiveness**.	The student uses planning skills **with some efficiency**.	The student uses planning skills **effectively**.	The student uses planning skills **very effectively**.
Use of information processing skills • Teamwork	The student uses information processing skills **with limited efficiency**.	The student uses information processing skills **with some efficiency**.	The student uses information processing skills **effectively**.	The student uses information processing skills **very effectively**.
Communication				
Communication of ideas and information, whether oral, written and visually, for specific **purposes and to specific audiences** • Teamwork	The student communicates ideas and information for specific purposes and to specific audiences **with limited effectiveness**.	The student communicates ideas and information for specific purposes and to specific audiences **with some efficiency**.	The student communicates ideas and information for specific purposes and to specific audiences **effectively**.	The student communicates ideas and information for specific purposes and to specific audiences **very effectively**.
Use of conventions and terminology under consideration	The student uses the conventions and terminology under study **with limited effectiveness**.	The student uses the conventions and terminology under study **with some efficiency**.	The student uses the conventions and terminology under study **effectively**.	The student uses the conventions and terminology under study **with great efficiency**.