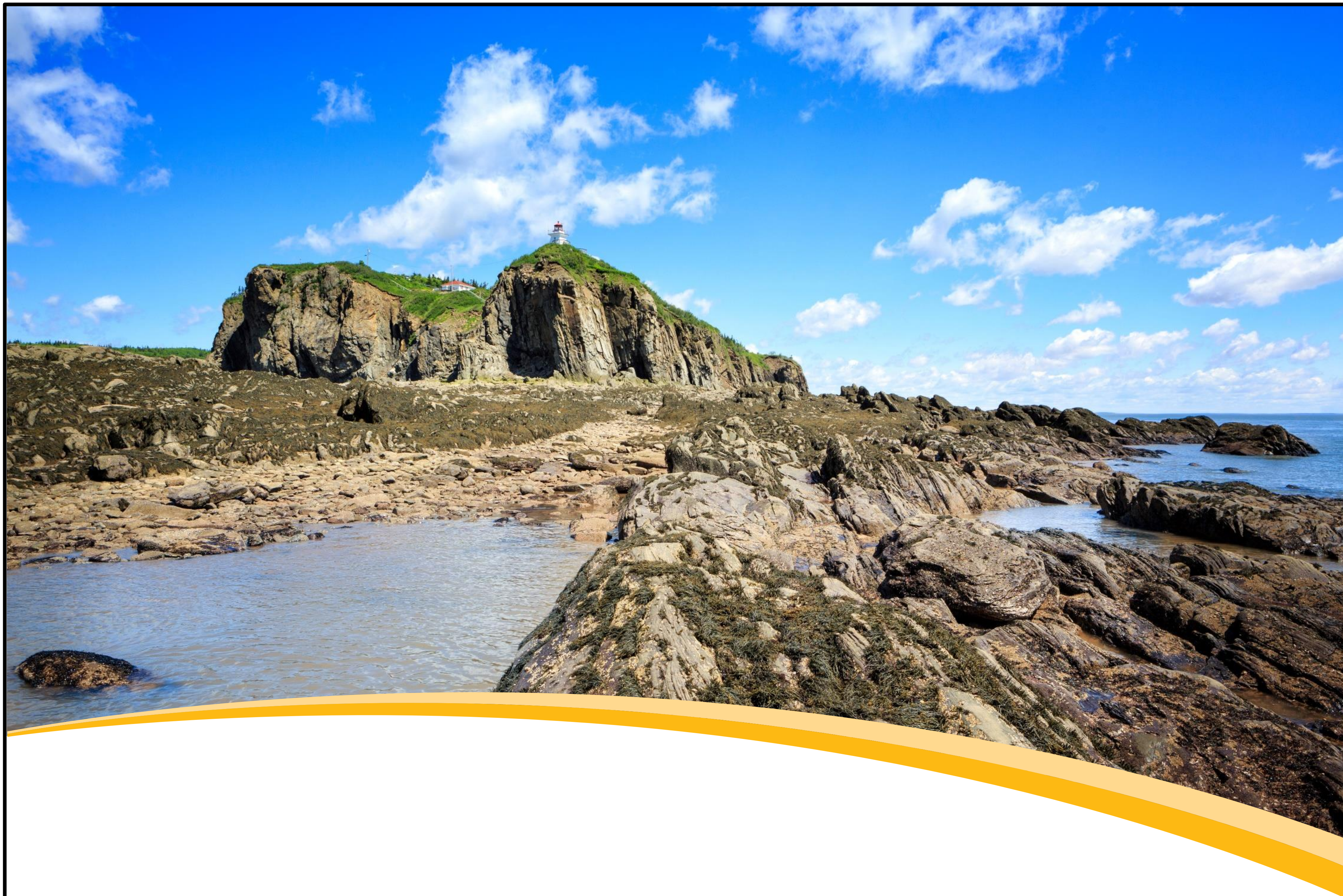


Environmental Geoscience 110

(Implemented in 2023/2024)

New Nouveau Brunswick

2022
Department of Education and Early Childhood Development
Curriculum Branch

Acknowledgments

The Department of Education and Early Childhood Development of New Brunswick (EECD) and Science Learning Specialist Ryan Jones gratefully acknowledge the time and guidance from the following individuals toward the development of the New Brunswick *Environmental Geoscience 110* curriculum document:

- Patsy McKinney, Elder
- Noel Milliea, Elder and educator
- George Paul, Elder, Sweat Lodge Keeper, storyteller, performer
- Walter Paul, Elder, Storyteller, educator and curriculum developer
- Imelda Perley, Elder, Sweat Lodge Keeper, Medicine Wheel Teacher, Sacred Pipe Carrier, Linguist, Former Elder-in-Residence at UNB, language teacher, Keeper of the Women's Ceremonies, cultural advisor, curriculum developer, co-founder Wolastoq Language and Culture Center
- David Perley, Former Director of the Mi'kmaq-Wolastoqey Centre at UNB, Elder, lecturer at UNB and St. Thomas University, co-founder Wolastoq Language and Culture Center

EECD and Ryan Jones gratefully acknowledge the writing contributions of the following individuals and groups toward the development of the New Brunswick *Environmental Geoscience 110* curriculum document:

- Kate Charette, Learning Specialist, Learning and Achievement (EECD)
- Beth Christie, Subject Coordinator (ASD-West)
- Department of Geodesy and Geomatics Engineering (University of New Brunswick)
- Winnie Hsu, Curriculum Support Teacher, Learning and Achievement (EECD)
- Matthew Sweezey, Subject Coordinator (ASD-North)
- Dr. Ann C Timmermans, Associate Teaching Professor/Curator, Department of Earth Sciences (University of New Brunswick)
- Adam Trider, Centre of Excellence Lead, Change Leadership: Applied Research, Virtual Learning and Strategic Partnerships (EECD)
- Alice Walker, Educator (ASD-North)
- Craig Williamson, Learning Specialist, Office of First Nation Education (EECD)

Table of Contents

1. Introduction

1.1 Mission and Vision of Educational System

The New Brunswick Department of Education and Early Childhood Development is dedicated to providing the best public education system possible, wherein all learners have a chance to achieve their academic best. The mission statement for New Brunswick schools is:

Each student will develop the attributes needed to be a lifelong learner, to achieve personal fulfillment and to contribute to a productive, just and democratic society.

1.2 New Brunswick Global Competencies

New Brunswick Global Competencies provide a consistent vision for the development of a coherent and relevant curriculum. The statements offer learners clear goals and a powerful rationale for school work. They help ensure that provincial education systems' missions are met by design and intention. The New Brunswick Global Competencies statements are supported by curriculum outcomes.

New Brunswick Global Competencies are statements describing the knowledge, skills and attitudes expected of all learners who graduate high school. Achievement of the New Brunswick Global Competencies prepares learners to continue to learn throughout their lives. These Competencies describe expectations not in terms of individual school subjects but in terms of knowledge, skills and attitudes developed throughout the curriculum. They confirm that learners need to make connections and develop abilities across subject boundaries if they are to be ready to meet the shifting and ongoing demands of life, work and study today and in the future.

See Appendix 6.1.

1.3 Science as a Way of Knowing

An inclusive science program recognizes that Eurocentric science, or western science are not the only forms of empirical knowledge about nature and aims to broaden learner understanding of ways of knowing the world. The terms “traditional knowledge” and “Indigenous Knowledge” are examples sometimes used when referencing Indigenous or local First Nation knowledge systems. The dialogue between scientific researchers and traditional knowledge holders continues, and there are examples of individuals who may self-identify or be welcomed within more than one group. Different ways of knowing the world may intersect when asking critical questions like,

- Whose research is it?
- Who owns the research or knowledge?
- Whose interest does the research or knowledge serve?
- Who will benefit from the research or knowledge?
- Who has designed the research questions and framed its scope?
- Who will carry out/who carried out the research?
- Who will write the research or knowledge?
- How will the research or knowledge be disseminated?
  (adapted from Smith, 2012 p. 10)

Education researchers suggest that an enhanced science curriculum is one that supports both Indigenous and Eurocentric methods, represents complementary, not separate or conflicting realities, and broadens the purpose of science education to become knowing-nature literacy.

“Two-Eyed Seeing means to see with the strengths of both Indigenous and Western knowledges. At times, certain problems or situations require us to privilege one or the other world view. At other times, the two work together in harmony. The two perspectives are not inherently compatible. For most of us, at least for now, Two-Eyed Seeing requires a great deal of conscious effort in order to respect the differences between the two perspectives and to focus on, and work from, a position of shared strengths.” (Marshall, Marshall and Iwama, p. 177)

Scientific Ways of Knowing

Scientific research, Eurocentric science, western science, are cumulative bodies of knowledge, know-how, practices, and representations that are actively developed and curated by scientists with histories of interactions. Some scientific bodies of knowledge are more widely known or valued in mainstream society, and some are less known or valued in mainstream society. To study the natural world, scientists use empirical methods, grounded in observations and experimentation, and rely on types of evidence and testing. These sets of understandings, interpretations, and meanings are part of cultural complexes that encompass language, naming and classification systems, resource use practices, conventions, and worldview, “There is no neutral knowledge system. All knowledge about nature is socially constructed. Thus, science based on certain accepted methodologies, on constructs such as reason, objective observation, and interpretation takes place in a context of contextualized assumptions, values, ideas, and beliefs” (Battiste, 2013 p. 119).

Indigenous Ways of Knowing

Traditional knowledge is a cumulative body of knowledge, know-how, practices and representations maintained and developed by Indigenous Peoples with extended histories of interaction with the natural environment, “Indigenous knowledge embodies webs of relationships within specific ecological contexts; contains linguistic categories, rules, and relationships unique to each knowledge system; has localized content and meaning; has established customs with respect to acquiring and sharing of knowledge … and implies responsibilities for possessing various kinds of knowledge.” (Battiste, 2013 p. 96). These sophisticated sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, resource use practices, ceremony, spirituality and worldview (adapted from International Council for Science, 2002 as cited by Restoule, 2019). As an example, “Our culture is based on oral histories, meaning that what we need to know is passed on from generation to generation through oral histories, mentorship, and hands-on learning experience. The Mi’kmaq used wampum, chewed birchbark, and wrote hieroglyphics; we also etched petroglyphs into stone as physical representations of information” (Mi’kmawey Debert Cultural Centre, 2015 p. 16).

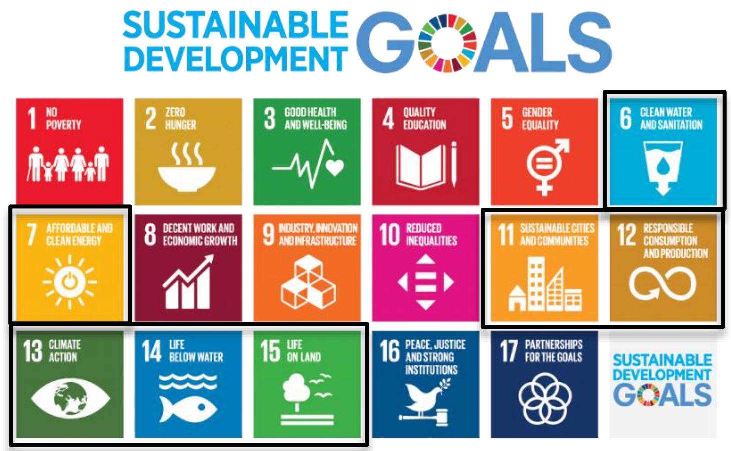
1.4 Teaching for Scientific Literacy

The emergence of a highly competitive and integrated global economy, rapid technological innovation, and a growing knowledge base will continue to have a profound impact on people's lives. Advancements in science and technology play an increasingly significant role in everyday life. Science education will be a key element in developing scientific literacy and in building a strong future for New Brunswick’s young people.

Science education for the future requires learning more than just the basic concepts of science. Learners need to be equipped with the skills to be able to use scientific knowledge to identify questions, and to draw evidence-based conclusions to understand and make decisions about the natural world and the changes made to it through human activity. They also need to understand the characteristic features of science as a form of human knowledge and inquiry and be aware of how science and technology shape their world. Lastly, learners need to be equipped with attitudes and values to engage in science-related issues as an ethical citizen.

A strong foundation in scientific knowledge and practices will include the development of reasoning and analytical skills, decision and problem-solving skills, flexibility to respond to different contexts and inspire learners at all grade levels to develop a critical sense of wonder and curiosity about scientific and technological endeavours. Important to a sustainable future, a foundation in scientific literacy will prepare learners to address critically science-related societal, economic, ethical, and environmental issues. These are skills and competencies that are aligned to the New Brunswick Global Competencies.

1.5 Science and the Sustainable Development Goals (aka SDGs and the Global Goals)



Science, Technology, and Innovation (STI) are recognized as the key drivers behind economic growth and prosperity. In the context of the SDGs for achieving, the Global Goals, STI plays a central role. The aim of the 17 Global Goals is to secure a sustainable, peaceful, prosperous, and equitable life on Earth for everyone now and in the future. To create a more sustainable world, and to engage with sustainability issues, learners must become sustainability change-makers. Education, therefore is vital for the achievement of sustainable development. By intentionally connecting classroom learning to these goals, educators create real-world (relevant) context for learners to help them become global citizens and critical thinkers. The concepts and content in this document are aligned learning objectives of specific goals and are identified in this section as well as the Curriculum Organizers and Outcomes section of this document.

Guiding Principles for Science in the Sustainable Development Goals

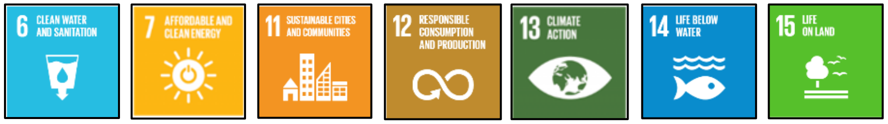
- Strengthen science education to increase science literacy and capacity-building in science at all levels.
- Recognize science as a universal public good that helps in laying the foundation for a sustainable world and is, therefore, more than a tool for the achievement of the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs).
- Enhance diversity in science for sustainable development by realizing gender equity in science and by building on the entire spectrum of society, including underrepresented groups and minorities.
- Promote an integrated scientific approach that addresses the social, economic, and environmental dimensions of sustainable development and respecting the diversity of knowledge systems. Building a sustainable world requires overcoming disciplinary boundaries.

The SDGs address the need to activate science at multiple levels and across disciplines to gather and create the necessary knowledge to lay the foundations for practices, innovations, and technologies that address global challenges today, and in the future.

Project Everyone aims to ensure everyone on the planet knows what the Sustainable Development Goals are, so they stand the greatest chance of being achieved. More information on the Global Goals as well as organizations to support and share can be found here.

In *Environmental Geoscience 110* learners may explore and investigate topics related to goals:

- 6 – Clean Water and Sanitation
- 7 – Affordable and Clean Energy
- 11 – Sustainable Cities and Communities
- 12 – Responsible Consumption and Production
- 13 – Climate Action
- 14 – Life on Land
- 15 – Life Below Water



The *Environmental Geoscience 110* specific curriculum outcomes are aligned to these Sustainable Development Goals for possible inquiry and exploration in **Appendix 6.4**.

2. Pedagogical Components

2.1 Pedagogical Guidelines

Diverse Cultural Perspectives

It is important for educators to recognize and honour the variety of cultures and experiences from which learners are approaching their education and the world. It is also important for educators to recognize their own biases and be careful not to assume levels of physical, social or academic competencies based on gender, culture, or socio-economic status.

Each learner's culture will be unique, influenced by their community and family values, beliefs, and ways of viewing the world. Indigenous cultures view the world in a much more holistic way than the dominant culture. Disciplines are taught as connected to one another in a practical context, and learning takes place through active participation, oral communication and experiences. Immigrant learners may also be a source of alternate world views and cultural understandings. Cultural variation may arise from the differences between urban, rural and isolated communities. It may also arise from the different value that families may place on academics or athletics, books or media, theoretical or practical skills, or on community. Providing a variety of teaching and assessment strategies to build on this diversity will provide an opportunity to enrich learning experiences for all learners.

Universal Design for Learning

Universal Design for Learning is a “framework for guiding educational practice that provides flexibility in the ways information is presented, in the ways learners respond or demonstrate knowledge and skills, and in the ways, learners are engaged. It also “...reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient.” (CAST, 2011).

To build on the established practice of differentiation in education, the Department of Education and Early Childhood Development supports Universal Design for Learning for all learners. New Brunswick curricula are created with universal design for learning principles in mind. Outcomes are written so that learners may access and represent their learning in a variety of ways, through a variety of modes. Three tenets of universal design inform the design of this curriculum. Educators are encouraged to follow these principles as they plan and evaluate learning experiences for their learners:

- Multiple means of representation: provide diverse learners options for acquiring information and knowledge
- Multiple means of action and expression: provide learners options for demonstrating what they know
- Multiple means of engagement: tap into learners' interests, offer appropriate challenges, and increase motivation

For further information on Universal Design for Learning, view online information at the CAST website, download the UDL reference handout.

UDL is neither curriculum nor a checklist. If it were either one of those things, it would oversimplify the act and professionalism of teaching. As an educator, you have taken courses in pedagogy, classroom management, and theory. You have a collection of tools, resources, and strategies you have learned recently or over the years. The structure of UDL guides you to actively, attentively, and purposely pull from that collection. It also asks you to possibly think differently. The Difference: Because UDL is a framework versus a curriculum, educators are in full control in designing the learning environment and lessons (p. 4, Design and Deliver).

Loui Lord Nelson (2104) suggests the following reflective questions to support planning (p. 134):

When I plan my lessons do I:

- *Have a clear goal?*
- *Know how I am going to measure whether students have met the goal?*
- *Create activities and assignments that guide students toward the lesson goal?*
- *Create lessons and activities designed with options mentioned under the three principles of Engagement, Representation and Action and Expression?*
- *Create assessments directly related to the lesson's goal?*
- *Create assessments designed with the options listed under Action and Expression?*
- *Use a variety of tools and resources to create my lesson plans?*

Nelson makes the following recommendation:

> *Start small. Choose one focus within the framework. Choose one focus within your practice. Enlist the involvement of other teachers and talk with each other about your experiences. Trade suggestions. Share experiences. Share successes. Watch for change.* (p. 136)

The curriculum has been created to support the design of learning environments and lesson plans that meet the needs of all learners. Specific examples to support Universal Design for Learning for this curriculum can be found in the appendices. The Planning for All Learners Framework will guide and inspire daily planning.

See Appendix 6.2

Cross Curricular Literacy and Multilingual Language Learners

Literacy occurs across learning contexts and within all subject areas. Opportunities to speak and listen, read and view, and write and represent are present every day - in and out of school. All subject-area teachers support all learners' language development with content-area vocabulary development, academic language structures, and structured classroom conversations.

Website References

Website references contained within this document are provided solely as a convenience and do not constitute an endorsement by the Department of Education and Early Childhood Development of the content, policies, or products of the referenced website. The EECD does not control the referenced websites and is not responsible for the accuracy, legality, or content of the referenced websites or for that of subsequent links.

Referenced website content may change without notice. School districts and educators are encouraged to preview and evaluate sites before recommending them for learner use. If an outdated or inappropriate site is found, please report it to Department of Education and Early Childhood Development, email: edcommunication@gnb.ca or phone: at (506) 453-3678.

Copyright Matters

Educators must ensure that they respect the fair dealing provision when accessing and using course resources and materials for instructional purposes. The works of others should not be used without their permission unless the use is permitted by the *Copyright Act*. Educators are expected to be aware of the copyright status of instructional materials in their possession. The *Copyright Act* permits use of a copyright-protected work without permission from the copyright owner or the payment of copyright royalties under specific conditions.

Consumable materials intended for one-time use in the classroom (i.e. workbooks and exercise sheets) are created with the understanding that each learner is to have their own copy. Unless educators have permission to copy a consumable, copying, scanning, or printing materials intended for one-time use is strictly prohibited. Copying from instructional materials intended for one-time use without permission exposes the educator, the school, and the school board to liability for copyright infringement

To learn more about the fair dealing guidelines and the *Copyright Act* visit, the Council of Ministers of Education Canada website here.

2.2 Assessment Guidelines

Assessment Practices

Assessment is the systematic gathering of information about what learners know and are able to do. Learner performance is assessed using the information collected during the evaluation process. Educators use their professional skills, insight, knowledge, and specific criteria that they establish to make judgments about learner performance in relation to learning outcomes. Learners are also encouraged to monitor their own progress through self-assessment strategies, such as goal setting and rubrics.

Research indicates that learners benefit most when assessment is regular and ongoing and is used in the promotion of learning (Stiggins, 2008). This is often referred to as formative assessment. Evaluation is less effective if it is simply used at the end of a period of learning to determine a mark (summative evaluation).

Summative evaluation is usually required in the form of an overall mark for a course of study, and rubrics are recommended for this task.

Some examples of current assessment practices include:

• Questioning	• Projects and Investigations
• Observation	• Checklists/Rubrics
• Conferences	• Responses to texts/activities
• Demonstrations	• Reflective Journals
• Presentations	• Self and peer assessment
• Role plays	• Career Portfolios
• Technology Applications	• Projects and Investigations

Formative Assessment

Research indicates that learners benefit most when assessment is ongoing and is used in the promotion of learning (Stiggins, 2008). Formative assessment is a teaching and learning process that is frequent and interactive. A key component of formative assessment is providing ongoing feedback to learners on their understanding and progress. Throughout the process adjustments are made to teaching and learning.

Learners should be encouraged to monitor their own progress through goal setting, co-constructing criteria and other self-and peer-assessment strategies. As learners become more involved in the assessment process, they are more engaged and motivated in their learning.

Additional details can be found in the Formative Assessment foldout.

Summative Assessment

Summative evaluation is used to inform the overall achievement for a reporting period for a course of study. Rubrics are recommended to assist in this process.

For further reading in assessment and evaluation, visit the Department of Education and Early Childhood Development's Assessment and Evaluation site here.

Field Project

Environmental Geoscience 110 includes participation in an introductory field project (a traverse) as part of assessment instead of a paper-based exam. As local and school communities vary, a safe geographic traverse could mean a locale on school property, or another New Brunswick location. This experience is enhanced by revisiting the place throughout the year. EECD, District, Post-Secondary, and/or community guidance may aid study site selection. Support in planning and assessing an earth science, physical geography, and/or geology field project can be found in **Appendix 6.5**.

3. Subject Specific Guidelines

3.1 Rationale

Environmental Geoscience 110 is a New Brunswick high school science course intended to build on the retired *Physical Geography 110: Portraits of a Planet* curriculum published in the 1990s. Scientific knowledge, environmental issues and careers are set in the contexts of the 2020s. *Environmental Geoscience 110* blends science skills within earth science, geomatics, and physical geography, disciplinary approaches to thinking and learning specific to each of these fields of science complement the study of the other respective fields. Therefore, the curriculum provides transferrable skills and bridging points to areas of study in earth science, geology, geomatics, Canadian and/or physical geography.

3.2 Course Description

Geoscience, the study of planet Earth, can include geochemistry, geology, geomatics, geophysics, hydrogeology, palaeontology, physical geography, etc. Environmental geoscience can also include environmental sciences, meteorology, soil sciences, oceanography, etc. In *Environmental Geoscience 110*, learners will consider how Earth systems change over time. Geographic science is applied to the arrangement, interaction, and change of physical/natural features and human activity on and near Earth's surface including safer and more sustainable ways of searching for Earth resources, disposing of waste, selecting places to live and constructing new buildings, etc. Geomatics, a subset of geographic science, allows learners to explore technologies for collecting, managing, and analyzing data about Earth and phenomena arranged on and near its surface.

Environmental Geoscience 110 promotes the asking and answering of questions about planet Earth and may generate interest in professional geologists, engineers, and/or GIS specialists. By the end of this course, learners will have developed perspectives on Earth systems by exploring cultural values in relationship to place, exploring spatial positioning, and exploring geographic data. It is expected that learners will understand the importance of consultation with rights- and/or stake- holders and understanding perspectives on place before pursuing science in the field (i.e. Field Project).

3.3 Curriculum Organizers and Outcomes

Outcomes

The New Brunswick Curriculum is stated in terms of general curriculum outcomes, specific curriculum outcomes and achievement indicators.

General Curriculum Outcomes (**GCO**) are overarching statements about what learners are expected to learn in each strand/sub-strand. The general curriculum outcome for each strand/sub-strand is the same throughout the grades.

Specific Curriculum Outcomes (**SCO**) are statements that identify specific concepts and related skills underpinned by the understanding and knowledge attained by learners as required for a given grade.

I Can – Exemplars (Achievement Indicators) are one example of a representative list of the depth, breadth and expectations for the outcome.

Earth Science Literacy Principles

Some *Environmental Science 110* outcomes are framed by ideas presented in the Earth Science and Literacy Principles, as part of the Earth Science Literacy Initiative (ESLI) funded by the National Science Foundation. The community-based document and supporting materials can help learners and educators narrow their focus to systems or parts of systems that provide relevant concepts and content. Using the Earth Science Literacy Principles can complement approaches to learning using Geographical Thinking.

Essential Questions

Essential questions open doors to learner understanding when used to frame instruction and guide learning (McTighe & Wiggins, 2013). They are a pedagogical tool used to stimulate learners' curiosity, stimulate thought, activate learners' prior knowledge and transform instruction.

The essential questions listed below were previously asked in *Science 4: Properties and Uses of Earth Materials* and can be asked again or expanded upon. They can assist in uncovering the important ideas, content and processes so that learners can make helpful connections and are equipped to transfer their learning in meaningful ways:

1. How do humans change the planet?
2. How do we determine the uses of Earth materials?
3. What on Earth is in your stuff and where on Earth does it come from?
4. What are some of the concerns related to extracting Earth materials sustainably?

The essential questions listed below were previously asked in *Science 7: Earth Surface Processes*:

1. How does thermal energy affect matter?
2. How is energy transferred from one object or [between] system[s]?
3. What factors interact and influence weather and climate?
4. How does water influence weather, circulate in the oceans, and shape Earth's surface?
5. What impacts are climate change [and severe weather] having on people, places and ways of life in New Brunswick?

Geographical Thinking

Some *Environmental Geoscience 110* outcomes can be framed by portal concepts presented by Sharpe, Bahbahani, Huynh and The Critical Thinking Consortium in *Teaching Geographical Thinking Revised and Expanded Edition*: Spatial Significance; Patterns and Trends; Interrelationships; Geographical Perspective; Evidence and Interpretation; Ethical Judgement. Ideas from these portals can help learners and educators narrow their focus and invite critical thinking, "A major step in embedding geographical thinking is to make the curriculum problematic so that the study of geography poses challenges to think through problems … portals to turn the factual content of geography into a subject for analysis" (*Teaching Geographical Thinking*, Sharpe, Bahbahani, Huynh, 2016, p.3). Using Geographical Thinking can complement approaches to learning using the Earth Science Literacy Principles by adding additional context and value to perspectives and places.

- Spatial Significance
  - How deeply felt or profound is the influence?
  - How widespread or dispersed is the influence?
  - How long-lasting are the effects?
- Geographical Perspective
  - What are human features? Physical features?
  - What identities characterize a place?

    - What are economic, social, political, and environmental realities of a space?
- Patterns and Trends
    - What is the breadth of occurrence (spatial scale)?
    - What is the duration of occurrence (temporal scale)?
    - What is the depth of impact (magnitude of implications)?
- Interrelationships
    - Is there evidence of difference?
    - Is there evidence of causal connection?
    - Are alternative explanations absent?
- Evidence and Interpretation
    - What criteria are used for assessing sources?
    - Has selection, mode of representation or interpretation of the raw data created a misleading or skewed effect?
    - Are the techniques used for the analysis and representation of the spatial information appropriate?
- Ethical Judgement
    - Are the recommendations feasible financially, politically and technologically?
    - Will these measures be effective in significantly reducing the environmental and health-related damage?
    - Will these measures provide long-term and sustainable solutions?
    - Is this course of action fair to everyone who has a stake in the enterprise?

Smarter Science Framework

The Smarter Science Framework is an open-source framework for teaching and learning K-12 science and developing the skills of inquiry, creativity and innovation in a meaningful and engaging manner. An overview for educators can be found here. The 35 skills have been used to create some of the Skill Descriptors/Specific Curriculum Outcomes and exemplar I Can statements used in the *Environmental Geoscience 110* curriculum. The total 35 skills are found in the appendices. Learners and educators are encouraged to consider the categories of skills, defining characteristics, and complexity level when planning and assessing learning within the course.

See Appendix 6.3

Learning Outcomes Summary Chart

GCO 1	Learners will explore perspectives on position and place.
SCO 1.1	Learners will discuss the role of cultural values in relationship to place.
SCO 1.2	Learners will review spatial position and geographic data.
SCO 1.3	Learners will analyze spatial position and geographic data.

GCO 2	Learners will examine patterns and systems in the human and natural worlds.
SCO 2.1	Learners will analyze Earth systems and temporal scale and how they change.
SCO 2.2	Learners will predict impacts of change on Earth systems and temporal scale.

GCO 3	Learners will construct a land-based field project.
SCO 3.1	Learners will construct a plan for a field project.
SCO 3.2	Leaners will model spatial position, geographic, Earth systems, and/or temporal scale data from a field project.

4. Curriculum Outcomes

<table>
<tr><th colspan="3">GCO 1 Learners will explore perspectives on position and place.</th></tr>
<tr><th colspan="3">SCO 1.1 Learners will discuss the role of cultural values in relationship to place.</th></tr>
<tr><th>Concepts and Content</th><th colspan="2">I Can – exemplars:</th></tr>
<tr><td>

- Etuaptmumk - Two-Eyed Seeing

“[R]efers to learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western knowledges and ways of knowing ... and learning to use both these eyes together, for the benefit of all.” (Institute for Integrative Science and Health)

</td><td colspan="2">

- Discuss different ways of defining boundaries.
- Discuss personal places or specific locations to appreciate ways positions and places can be valued.
- Discuss the diversity of naming and concepts of place.
- Examine how social relationships and identities are shaped by natural environments.
- Explain how ways of thinking of the natural environment can facilitate sustainability and equity.
- Examine Wabanaki and western views of the natural environment.

</td></tr>
<tr><th colspan="3">Resources
•</th></tr>
<tr><td>Video</td><td>Website
Geographical Names in Canada
Climate Atlas of Canada: Indigenous Knowledges
Indigenous Peoples Atlas of Canada
Innu Place Names
Institute for Integrative Science and Health
Lnu Place Names in New Brunswick
Mi’kmaw Place Names
Native Land Digital
Pan Inuit Trails
Place Names in Nunavut
Stories From the Land
Stories of the Dawnland</td><td>Document
Self Awareness and Self Management
Sustainability and Global Citizenship</td></tr>
</table>

SCO 1.2	**Learners will <u>review</u> spatial position and geographic data.** **Review:** • **Picking out important items** • **Memorizing** • **Associating** • **Technologies** • **Interpretations** • **New observations**

Concepts and Content	**I Can – exemplars:**

• Spatial position and geographic data
  ○ Finding and evaluating existing data sets
  ○ Types of measurements
    ▪ Horizontal distance measurement systems
      • Latitude and Longitude
      • Military Grid Reference System
      • Universal Transverse Mercator Coordinate System
    ▪ Vertical distance measurement systems
      • Global Positioning System
      • Topographic mapping and contour lines
    ▪ Raster and vector data
    ▪ Indirect observation
      • Seismic waves, gravity, magnetic fields, laboratory experiments
  ○ Measuring technologies
    ▪ Cameras
    ▪ Compasses
    ▪ Digital distance measurement
    ▪ Electronic distance measurement
    ▪ GNSS
    ▪ Gyroscopes and other inertial sensors
    ▪ Sonar
    ▪ Telescopes
  ○ Accuracy and precision
	• Compare and contrast types of maps.
	• Gather types of spatial data for triangulating position.
	• Graph a map of a personal place or specific location.
	• Infer the cartographer's audience in creating a map.
	• Measure horizontal distances and bearings on a map.
	• Observe spatial and geographic similarities and differences across regions.
	• Record GPS coordinates.
	• Search for careers in environmental geoscience and related fields.

<table>
<tr><td colspan="3">

- Earth Science Big Idea: Earth scientists use repeatable observations and testable ideas to understand and explain our planet.
    - Earth science investigations take many different forms.
    - Earth scientists construct models of the Earth and its processes that best explain the available geological evidence.
    - Technological advances, breakthroughs in interpretation, and new observations continuously refine our understanding of Earth.

</td><td></td></tr>
<tr><td colspan="4">

Resources

- *Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science*, Big Idea 1 (1.3; 1.6; 1.7)
- *Physical Geography and Natural Disasters (Dastrup 2020)*, Part 1.4

</td></tr>
<tr><td>Video</td><td>Website
CGEN Earth Links
GeoNB
Google Earth
National Geographic: Teaching with Google Earth
SDG 11: Sustainable Cities and Communities</td><td colspan="2">Document
Critical Thinking and Problem Solving</td></tr>
</table>

SCO 1.3	**Learners will <u>analyze</u> spatial position and geographic data.**

Analyze:

- **Seeing implications and relationships**
- **Discerning causes and effects**
- **Locating new problems**

Concepts and Content

- Spatial and geographic data
  - Human population and natural resource distribution
    - Fossil fuel, renewable, uranium energy production
    - Natural resources in agriculture, manufacturing, and building
    - Oil and natural gas used in plastics, textiles, medications, fertilizers, and industrial products
    - Reduction of pollution, waste, and ecosystem degradation caused by extraction
    - Metallic, industrial and critical minerals and their uses
  - GIS Concepts
  - Principles of Cartography
- Earth Science Big Idea: Humans depend on Earth for resources.
  - Geology affects the distribution and development of human populations.
  - Natural resources are limited.
  - Resources are distributed unevenly around the planet.
  - Water resources are essential for agriculture, manufacturing, energy production, and life.
  - Soil, rocks, and minerals provide essential metals and other materials for agriculture, manufacturing, and building.
  - Earth scientists and engineers develop new technologies to extract resources while reducing pollution, waste, and ecosystem degradation caused by extraction.
  - Oil and natural gas are unique resources that are central to modern life in many different ways.

I Can – exemplars:

- Compare the visual, to the oral, to the written representations of regions.
- Compare and contrast types of criteria for assessing geographical importance.
- Compare and contrast the location, extraction methods and uses of energy resources.
- Infer the cartographer's criteria for geographic importance in creating a map.
- Reflect on the perspective of others' sense of place.
- Review the importance of specific geographic features through criteria.
- Review overlapping geographic regions and ways maps are delineated.
- Review the availability of and uses of minerals.
- Review the availability and uses of natural resources.
- Review the uses of oil and natural gases.

○ Fossil fuels and uranium currently provide most of our energy resources.	

Resources

- *Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science*, Big Idea 7 (7.2; 7.3; 7.4; 7.5; 7.6; 7.7; 7.8; 7.9)
- *Physical Geography and Natural Disasters* (Dastrup 2020), Part 1.4

Video	Website	Document
	CGEN Earth Links	Critical Thinking and Problem Solving
	GeoNB	Sustainability and Global Citizenship
	Google Earth	
	National Geographic: Teaching with Google Earth	
	SDG 6: Clean Water and Sanitation	
	SDG 7: Affordable Clean Energy	
	SDG 11: Sustainable Cities and Communities	
	SDG 14: Life Below Water	
	SDG 15: Life on Land	

GCO 2	Learners will examine patterns and systems in the human and natural worlds.
SCO 2.1	Learners will <u>analyze</u> Earth systems and <u>temporal scale</u> and how they change. **Analyze:** • **Seeing implications and relationships** • **Discerning causes and effects** • **Locating new problems** **Temporal scale:** • **Relative Time** • **Absolute Time** • **Geological Record**

Concepts and Content	I Can – exemplars:

• Earth systems, cycles and flow
    ○ Water and rock cycles
        ▪ Continental water sources
        ▪ Rocks and minerals and their properties
        ▪ Igneous, sedimentary, and metamorphic processes
    ○ Weathering, erosion and soil formation
    ○ Fluxes, reservoirs/stores and residence time within systems
• Feedback and loops (i.e. change)
    ○ Positive and negative feedback loops
    ○ Stability, slow change, abrupt change
• Temporal and spatial scales
    ○ Relative dating methods
    ○ Absolute dating methods
 	
• Earth Science Big Idea: Earth is a complex system of interacting rock, water, air, and life.
    ○ The four major systems of Earth are the geosphere, hydrosphere, atmosphere, and biosphere.
    ○ All Earth processes are the result of energy flowing and mass cycling within and between Earth's systems.
	• Classify common minerals and their properties.
	• Compare and contrast how human perception of magnitude and scale through new technologies and scientific knowledge have changed over time.
	• Compare and contrast the behaviour of phenomena in different regions or in different time periods.
	• Compare and contrast the effects of weathering and erosion on landforms.
	• Construct chronological sequences of regions over time.
	• Design a plan or strategy to detect spatial patterns.
	• Discuss types of Earth systems and cycles, and feedback loops.
	• Explain simple causal and non-causal geographic relationships.
	• Explain the formation of and properties of igneous, sedimentary and metamorphic processes.
	• Explain how nutrients are recycled through rock and water cycles.
	• Explain the process of and timelines of soil formation.

- Earth's systems interact over a wide range of temporal and spatial scales. - Earth's systems are dynamic; they continually react to changing influences. - Earth's climate is an example of how complex interactions among systems can result in relatively sudden and significant changes. • Earth Science Big Idea: Earth is continuously changing. - Earth's geosphere changes through geological, hydrological, physical, chemical, and biological processes that are explained by universal laws. - Earth materials take many different forms as they cycle through the geosphere. - Weathered and unstable rock materials erode from some parts of the Earth's surface and are deposited in others. - Shorelines move back and forth across continents depositing sediments that become the surface rocks of the land. • Earth Science Big Idea: Earth is a water planet. - Water is found everywhere on Earth, from the heights of the atmosphere to the depths of the mantle. - Water plays an important role in many of Earth's deep internal processes. - Earth's water cycles among the reservoirs of the atmosphere, streams, lakes, oceans, glaciers, groundwater, and deep interior of the planet. - Water shapes landscapes.	• Graph an Earth system, geologic map, and/or temporal scale. • Reflect on previous or current geographic predictions. • Search for direct and indirect effects and changes in Earth systems, geographic events, and/or locations over time.

Resources

- *Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science*, Big Idea 3 (3.1; 3.2; 3.4; 3.6; 3.8); Big Idea 4 (4.1; 4.6; 4.8; 4.9); Big Idea 5 (5.1; 5.4; 5.5; 5.6)
- *Exploring Geoscience Across the Globe* (King, Updated 2019), Chapter 1, 3, 4, 5
- *Physical Geography and Natural Disasters* (Dastrup 2020), Part 3, 4, 5, 6, 7, 8, 9

Video	**Website**	**Document**
Cosmic Zoom (1968)	Ancient Earth Globe	Critical Thinking and Problem Solving
Powers of Ten (1977)	CGEN Earth Links	
Cosmic Eye (2018 Remastered)	EdGEO	
What's In a Smartphone? (2019)	Google Earth	
Where Does Your Phone Come From? (2018)	Google Earth Engine	
	SDG 6: Clean Water and Sanitation	
	SDG 12: Responsible Consumption and Production	
	SDG 14: Life Below Water	
	SDG 15: Life on Land	

SCO 2.2	Learners will <u>predict</u> impacts of change on Earth systems and <u>temporal scale</u>. **Predict:** • **Prior knowledge** • **Observation** • **Reasoning** **Temporal scale:** • **Relative Time** • **Absolute Time** • **Geological Record**

Concepts and Content	I Can – exemplars:

• Earth systems, cycles and flow
  ○ Earth's layers, internal heat
  ○ Plate tectonics and boundaries, volcanoes, earthquakes
  ○ Landscape formation
  ○ Nutrient cycling (through geological processes)
• Feedback and loops (i.e. change)
  ○ Positive and negative feedback loops
  ○ Stability, slow change, abrupt change
• Temporal and spatial scales
  ○ Geological Time Scale
  ○ Relative dating methods
  ○ Absolute dating methods
 	
• Earth Science Big Idea: Earth scientists use repeatable observations and testable ideas to understand and explain our planet.
  ○ Earth scientists use a large variety of scientific principles to understand how our planet works.
  ○ Earth scientists must use indirect methods to examine and understand the structure, composition, and dynamics of Earth's interior.
  ○ Earth scientists use their understanding of the past to forecast Earth's future.
	• Classify the layers of the Earth.
	• Classify physical or social phenomena and their influence on Earth systems and temporal scale.
	• Discuss past, present and future effects of internal heat and plate tectonics on Earth's features.
	• Infer contributing and counteracting factors of climate change, geographic events and/or natural disasters.
	• Predict changes to landforms over time.
	• Predict future chronological sequences of regions over time.
	• Predict observations and changes across spaces (i.e. travel routes)
	• Predict the results or future behaviour of an Earth system or temporal scale.

• Earth Science Big Idea: Earth is 4.6 billion years old.
  ○ Earth's rocks and other materials provide a record of its history.
  ○ Earth's crust has two distinct types: continental and oceanic.
  ○ Over Earth's vast history, both gradual and catastrophic processes have produced enormous changes.
• Earth Science Big Idea: Earth is continuously changing.
  ○ Earth's interior is in constant motion through the process of convection, with important consequences for the surface.
  ○ Earth's tectonic plates consist of the rocky crust and uppermost mantle, and move slowly in respect to one another.
  ○ Many active geologic processes occur at plate boundaries.
  ○ Landscapes result from the dynamic interplay between processes that form and uplift new crust and processes that destroy and depress crust.
• Earth Science Big Idea: Natural hazards pose risks to humans.
  ○ Natural hazards result from natural Earth processes.
  ○ Human activities can contribute to the frequency and intensity of some natural hazards.
  ○ Hazardous events can be sudden or gradual.
  ○ Natural hazards can be local or global in origin.
  ○ Earth scientists are continually improving estimates of when and where natural hazards occur.
• Earth Science Big Idea: Humans significantly alter the Earth.
  ○ Human activities significantly change the rates of many Earth's surface processes.
  ○ Humans cause global climate change through fossil fuel combustion, land-use changes, agricultural practices, and industrial processes.
  ○ Humans affect the quality, availability, and distribution of Earth's water through the medication of streams, lakes, and groundwater.
  ○ Human activities alter the natural land surface.
  ○ Human activities accelerate land erosion.	

Resources

- *Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science*, Big Idea 1 (1.2; 1.4; 1.5); Big Idea 2 (2.1; 2.4; 2.7); Big Idea 4 (4.3; 4.4; 4.5; 4.7); Big Idea 8 (8.1; 8.3; 8.4; 8.5; 8.6); Big Idea 9 (9.1; 9.3; 9.4; 9.5; 9.6)
- *Exploring Geoscience Across the Globe (King 2019)*, Chapter 6
- *Physical Geography and Natural Disasters (Dastrup 2020)*, Part 3, 4, 5, 6, 7, 8, 9

Video	Website	Document
	CGEN Earth Links EdGEO Google Earth Google Earth Engine SDG 6: Clean Water and Sanitation SDG 11: Sustainable Cities and Communities SDG 12: Responsible Consumption and Production SDG 13: Climate Action SDG 14: Life Below Water SDG 15: Life on Land	Critical Thinking and Problem Solving Innovation, Creativity, and Entrepreneurship

GCO 3	Learners will construct a land-based field project.
SCO 3.1	**Learners will <u>construct</u> a plan for a field project.** **Construct:** • **Putting together component parts** • **To build**

Concepts and Content	I Can – exemplars:

• Project goals
    ○ Topic of study (i.e. geological structures or features, specific locations, rock types, mapping, etc.)
    ○ How data will be collected, analyzed and modelled
    ○ Field safety
 	
• Earth Science Big Idea: Natural Hazards pose risks to humans.
    ○ An Earth-science-literate public is essential for reducing risks from natural hazards.
• Earth Science Big Idea: Humans significantly alter the Earth.
    ○ An Earth-science-literate public, informed by current and accurate scientific understanding of Earth, is critical to the promotion of good stewardship, sound policy, and international cooperation.
	• Classify costs, benefits, risks (of a field project).
	• Classify primary, secondary, tertiary sources of data.
	• Compare and contrast different scientific and geographic approaches to research and executing field projects.
	• Develop relationships with rightsholders and/or stakeholders (related to a field project).
	• Explain a geologic history of the study area.
	• Explain a position on a geographic issue.
	• Explain safety procedures required for safe field work.
	• Record field notes.
	• Search for citizen science projects to participate in.
	• Search for secondary data and findings.
	• Suggest which environmental geoscience tools are appropriate for a field project.

Resources		
• *Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science*, Big Idea 8 (8.8), Big Idea 9 (9.9) • *Exploring Geoscience Across the Globe* *(King 2019)*, Chapter 7		
Video	**Website**	**Document**
	#breakfreefromplastic Coastie Canada CLEAR Lab – Get Involved Google Earth Google Earth Engine iNaturalist - Projects Science Rendezvous SDG 12: Responsible Consumption and Production SDG 15: Life on Land Zooniverse	Collaboration Communication Critical Thinking and Problem Solving Innovation, Creativity, and Entrepreneurship Self-Awareness and Self-Management Sustainability and Global Citizenship

<table>
<tr><td>SCO 3.2</td><td colspan="2">Learners will <u>model</u> spatial position, geographic, Earth systems, and/or temporal scale data from a field project.

Model:
Constructing physical/concrete representations of ideas, objects or events
Constructing abstract representations of ideas, objects or events
Clarify explanations
Demonstrate relationships
Reinforce concepts
Demonstrate learning
Illustrate phenomena</td></tr>
<tr><td colspan="2">Concepts and Content</td><td>I Can – exemplars:</td></tr>
<tr><td colspan="2">Analyzing and modelling data
Observations
Maps
Field notes/report
Photos
Descriptions
Interviews
Earth Science Big Idea: Natural Hazards pose risks to humans.
An Earth-science-literate public is essential for reducing risks from natural hazards.
Earth Science Big Idea: Humans significantly alter the Earth.
An Earth-science-literate public, informed by current and accurate scientific understanding of Earth, is critical to the promotion of good stewardship, sound policy, and international cooperation.</td><td>Construct representations of primary and secondary data together.
Gather primary data.
Use digital environmental geoscience software or tools.
Use environmental geoscience instruments appropriate for a field project.
Measure while executing a field project.
Observe and record environmental geoscience data while on a field project.
Reflect on cost, benefits and risks of a field project.
Reflect on field project data/findings.
Reflect on rightsholders and/or stakeholders' interests in and tensions with a field project.
Report on field work safety procedures used and the result.
Write a field report.</td></tr>
</table>

Resources		
• *Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science*, Big Idea 8 (8.8), Big Idea 9 (9.9) • *Exploring Geoscience Across the Globe* (King 2019), Chapter 7		
Video	**Website**	**Document**
	#breakfreefromplastic	Collaboration
	CLEAR Lab – Get Involved	Communication
	Google Earth	Critical Thinking and Problem Solving
	Google Earth Engine	Innovation, Creativity, and Entrepreneurship
	iNaturalist - Projects	Self-Awareness and Self-Management
	Science Rendezvous	Sustainability and Global Citizenship

5. Bibliography

Common Content

Battiste, Marie (2013). Decolonizing Education: Nourishing the Learning Spirit. Vancouver, BC: Purich Publishing.

Center for Applied Special Technology (CAST). *Universal Design for Learning*. Retrieved on July 20, 2021 from http://www.cast.org/

McTighe, J., and Wiggins, G. (2013). Essential Questions: Opening doors to student understanding. ASCD: Alexandria, VA.

Marshall, A., Marshall, M., and Iwama, M. *Approaching Mi'kmaq Teachings on the connectiveness of Humans and Nature*. Ecosystem Based Management: Beyond Boundaries. Proceedings of the Sixth International Conference of Science and the Management of Protected Areas. Acadia University, Wolfville, Nova Scotia. 21–26 May 2007.

Mi'kmawey Debert Cultural Centre (2015). Mi'kmawe'l Tan Teli-kina'muemk: Teaching about the Mi'kmaq. Tim Bernard, Leah Morine Rosenmeier and Sharon L. Farrell (Eds.). Truro, Nova Scotia: Eastern Woodland Print Communications. Retrieved on July 20, 2021 from https://www.mikmaweydebert.ca/sharing-our-stories/education-and-outreach/school-curriculum/

Nelson, Louis Lord (2014). Design and Deliver: Planning and Teaching Using Universal Design for Learning. 1st Edition, Baltimore, MD: Paul H. Brooks Publishing Co.

Noel, W., and Snel, J. (2016). Copyright Matters! Council of Ministers of Education Canada. Retrieved on July 20, 2021 from https://www.cmec.ca/140/Copyright_Matters!.html

Restoule, J-P. (2019). Indigenous Education Resources. University of Toronto - Ontario Institute for Studies in Education: Toronto, ON. Retrieved on July 20, 2021 from https://www.oise.utoronto.ca/abed101/indigenous-ways-of-knowing/

Restoule, J-P. (2019). Understanding Indigenous Perspectives. University of Toronto - Ontario Institute for Studies in Education: Toronto, ON. Retrieved on July 20, 2021 from https://www.oise.utoronto.ca/abed101/

Smith, L. T. (2012). Decolonizing Methodologies: Research and Indigenous Peoples. 2nd Edition, London, UK: Zed Books Ltd.

Stiggins, R. J. (2008). Student-Involved Assessment for Learning. 5th Edition, Upper Saddle River, NJ: Prentice Hall.

Subject Specific

ArcGIS. *Lnu Place Names in New Brunswick website*. Accessed on March 15, 2022 at https://www.arcgis.com/home/webmap/viewer.html?webmap=c870f4f1550546a98112f718140b72c2&extent=-65.5512,46.0877,-64.537,46.4915

ArcGIS. *Stories of the Dawnland website*. Accessed on March 15, 2022 at https://www.arcgis.com/apps/MapJournal/index.html?appid=2b167c2e12f4442f8db853e10516b488

Break Free From Plastic Movement. *Breakfreefromplastic website.* Accessed on July 29, 2021 at https://www.breakfreefromplastic.org/

Canadian Federation of Earth Sciences (2014). Four Billion Years and Counting: Canada's Geological Heritage. Fensome, R., Williams, G., Achab, A., Clague, J., Corrigan, D., Monger, J., Nowlan, G. (Eds.). Toronto, ON: Nimbus Publishing/Canadian Federation of Earth Science.

Canadian Geographic. *Indigenous Peoples Atlas of Canada website*. Accessed on March 15, 2022 at https://indigenouspeoplesatlasofcanada.ca/forewords/maps/

Canadian Geoscience Education Network. *Earth Links*. Accessed on July 21, 2021 at https://www.cgenarchive.org/earthlinks.html

Civic Laboratory for Environmental Action Research. *CLEAR website*. Accessed on July 21, 2021 at https://civiclaboratory.nl/

Climate Atlas of Canada. *Climate Atlas of Canada: Indigenous Knowledges website*. Accessed on March 15, 2022 at https://climateatlas.ca/indigenous

Coastie Canada. *Coastie Canada website*. Accessed on November 26, 2021 at https://coastiecanada.ca/

Dastrup, A. (2020). Physical Geography and Natural Disasters. Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. Retrieved on July 20, 2021 from https://slcc.pressbooks.pub/physicalgeography/

Eames Office LLC (1977). *Powers of Ten (Youtube) video*. Accessed on July 21, 2021 at https://www.youtube.com/watch?v=0fKBhvDjuy0

Earth Science Literacy (2010). Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science. National Science Foundation. Retrieved on July 20, 2021 from http://earthscienceliteracy.org/index.html

Google. *Google Earth website*. Accessed on July 21, 2021 at https://www.google.com/earth/versions/

Google. *Google Earth Engine website*. Accessed on July 21, 2021 at https://earthengine.google.com/

Government of Canada. *Geographical Names in Canada website.* Accessed on March 15, 2022 at https://www.nrcan.gc.ca/maps-tools-and-publications/maps/geographical-names-canada/10786

Government of Canada. *Stories From the Land: Indigenous Place Names in Canada*. Accessed on March 15, 2022 at https://maps.canada.ca/journal/content-en.html?lang=en&appid=0e585399e9474ccf932104a239d90652&appidalt=11756f2e3c454acdb214f950cf1e2f7d

Government of New Brunswick/EECD. *New Brunswick Global Competencies* (poster and individual competencies). Accessed on March 18, 2022 at https://www2.gnb.ca/content/gnb/en/departments/education/k12/content/anglophone_sector/curriculum_anglophone.html

Government of New Brunswick/Service New Brunswick. *GeoNB website*. Accessed on July 21, 2021 at http://www.snb.ca/geonb1/e/index-E.asp

Innu Nation and Sheshatshiu Innu First Nation. *Pepamuteiati nitassinat: Innu Place Names website.* Accessed on March 15, 2022 at https://www.innuplaces.ca/aboutPlaceNames.php?lang=en

Institute for Integrative Science and Health*. Institute for Integrative Science and Health website: Two-Eyed Seeing*. Accessed on July 29, 2022 at http://www.integrativescience.ca/Principles/TwoEyedSeeing/

InTeGrate. *Geoscience Habits of Mind*. University of Carleton. Accessed June 13, 2022 at https://serc.carleton.edu/integrate/teaching_materials/themes/expert_thinking/habits.html

Inuit Heritage Trust. *Place Names Program: Place Names in Nunavut website*. Accessed March 15, 2022 at http://ihti.ca/eng/place-names/pn-index.html

King, C. (2019). Exploring Geoscience Across the Globe. International Geoscience Education Organisation. Retrieved on July 21, 2021 from http://www.igeoscied.org/teaching-resources/geoscience-text-books/

Mi'kmaw Place Names. *Mi'kmaw Place Names website*. Accessed on March 15, 2022 at https://placenames.mapdev.ca/

National Film Board of Canada (1968). *Cosmic Zoom (Youtube) video*. Accessed on July 21, 2021 at https://www.youtube.com/watch?v=VgfwCrKe_Fk

National Geographic. *Teaching with Google Earth website*. Accessed on July 21, 2021 at https://www.nationalgeographic.org/education/google-earth/

Native Land Digital. *Native Land website*. Accessed on March 15, 2022 at https://native-land.ca/

Pan Inuit Trails. *Pan Inuit Trails website*. Accessed on March 15, 2022 at http://www.paninuittrails.org/index.html

Project Everyone. *The Global Goals for Sustainable Development*. Retrieved July 20, 2021 from https://www.globalgoals.org/

Science Odyssey. *Science Rendezvous website*. Accessed on August 4, 2021 at https://www.sciencerendezvous.ca/

Scientificus (2018). *Cosmic Eye (Youtube) video.* Accessed on June 10, 2022 at https://www.youtube.com/watch?v=8Are9dDbW24

Sharpe, B., Bahbahani, K., Huynh, N. T. (2016). Teaching Geographical Thinking: Revised and Expanded Edition. Case, R., Wearing, J. (Eds.). Vancouver, BC: The Critical Thinking Consortium.

The Economist (2018). *Where does your phone come from? (Youtube) video*. Accessed on June 10, 2022 from https://www.youtube.com/watch?v=cKvGzS8LYbY

United Nations Department of Public Information. *The Sustainable Development Goals.* United Nations, S-1018. New York, NY 10017. Retrieved July 20, 2021 from https://sustainabledevelopment.un.org/sdgs

United Nations Department of Public Information. The Sustainable Development Agenda. *Teach SDGs: Assets*. Retrieved July 20, 2021 from http://www.teachsdgs.org/

University of Plymouth (2019). *What's in a smartphone? (Youtube) video*. Accessed June 10, 2022 from https://www.youtube.com/watch?v=bhuWmcDT05Q

Webster, Ian. Ancient Earth Globe. Dinosaur Pictures. Retrieved June 10, 2022 from https://dinosaurpictures.org/ancient-earth#

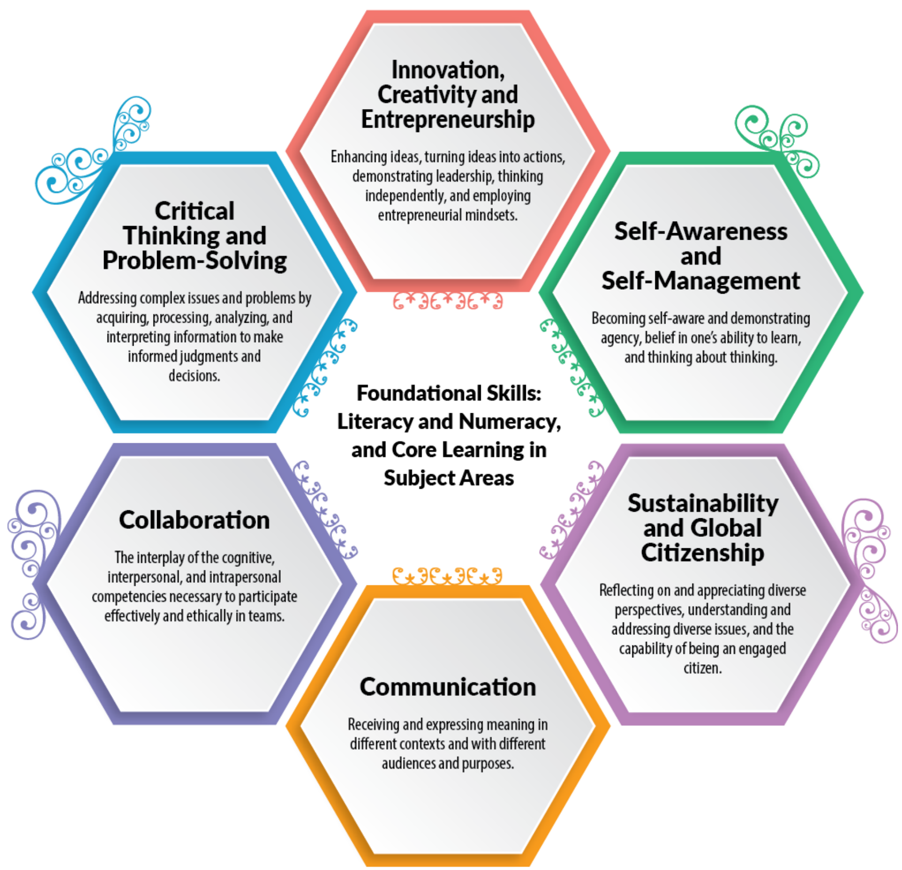
Youth Science. Framework poster. Smarter Science Framework. Retrieved July 20, 2021 from https://youthscience.ca/for-educators/

Zooniverse. Zooniverse website. Accessed on November 29, 2021 at https://www.zooniverse.org/

6. Appendices

6.1 New Brunswick Global Competencies

The individual and collective New Brunswick Global Competencies posters can be downloaded here.



6.2 Universal Design for Learning (UDL)

UDL helps meet the challenge of diversity by suggesting flexible instructional materials, techniques, and strategies that empower educators to meet these varied needs. UDL research demonstrates that the challenge of diversity can and must be met by making curriculum flexible and responsive to learner differences. UDL provides guidelines to minimize barriers and maximize learning for all.

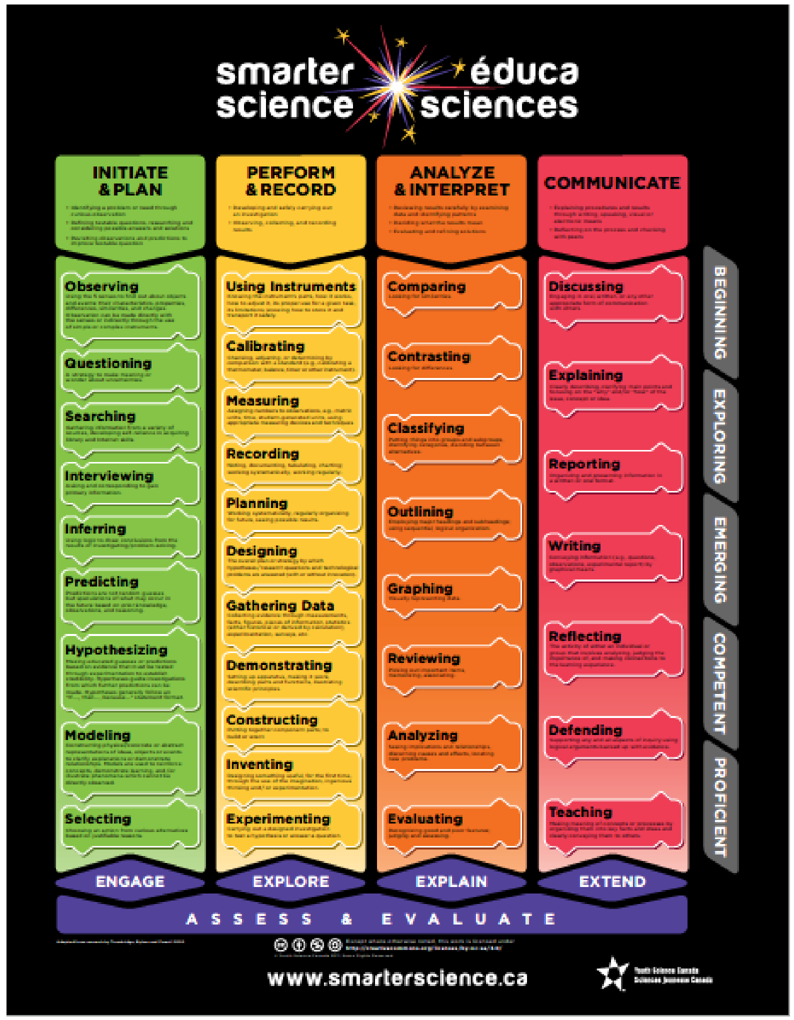
Is there a form of **assistive technology** that could be used to enhance/facilitate this lesson?	Screen readers, screen magnifiers, speech-to-text, text-to-speech, alt. tags, image descriptors, etc.
Are there **materials which can appropriately challenge** readers to enhance this learning?	Increasing complexity of environmental geoscience equipment and tools, and techniques. Case studies and existing data sets. Post-secondary level resources.
Are there learners in this group who cannot **access this learning (PLP background)** and whose needs I must revisit before teaching?	Consider and honour the needs of all learners. For example, select accessible field project sites, select alternative field project sites and allow learner choice, provide accommodations to allow site accessibility, consider the sensory experience and provide safe spaces or breaks for neurodiverse learners, etc.
Are there other **choices** that can be provided in this learning opportunity?	Digital site tours, online modules, NBVLC blended learning, etc. Alternative forms of field reporting.
Is there another/a **variety of media** available? Only paper-based? Can it be listening? Can I add a visual component?	Textbooks, online textbooks, computer modelling software, videos, audio lessons (through text-to-speech), etc.

Can **movement** be involved?	Content instruction can be accomplished outdoors, in addition to the field project (GCO 3). Environmental geoscience equipment, tools, and techniques require various types of manipulation or movement. Guided tours. Software can be accessed on different devices and in different locations.
Grouping and regrouping?	General learning can be team-based or cooperative. It is expected that learners participate on a team during the field project (GCO3).
Educator versus non-educator centered? **Instructional design strategies** –…	Exploratory and inquiry approaches encourage learner centred instruction. Guests and experts allow for different instructional methods. It is expected that the field project (GCO 3) is learner generated and led.
Opportunities for learners to **propose variations** to the assignments/projects?	Environmental geoscience represents a snapshot of many fields of science, therefore there are many approaches, techniques, and demonstrations of learning that can be suggested as variations. For example, alternatives to paper-based field reports. Art, music, and technology can facilitate variations to assignments/project and assessment.
Use of **art /music / technology**?	It is expected that learners will interact with environmental geoscience equipment and tools, and software. Art and music are elements that can be considered when exploring perspectives on position and place, and the role of cultural values in relationship to place. Art, music, and technology can facilitate variations to assignments/projects and assessment.
Can I use **drama**? Art….	Drama is an element that can be considered when exploring perspectives on position and place, and the role of cultural values in relationship to place.
Is there a plan to support the learner/s who might already know this subject matter? **Enrichment**	Learners can prove prior learning and have opportunities to advance and enrich their own learning, this can be through self-initiated project proposals at various degrees of independence. Learners may explore post-secondary resources, post-secondary level techniques, or generate additional inquiries, etc.

Does the **language level** need to be adjusted for the learner to access this learning?	This course is highly dependent on the use of the English language and scientific vocabulary. While learners can use online translators for context, the demonstrations of learning are usually done in English. Educators should prepare glossaries and provide universal accommodations for language to all learners. (Microsoft Word can determine the reading level of text.) In some cases, working with a translator may be appropriate (e.g. a translator to accompany guided site tours)
Is there an **independent or collaborative activity-project** that would be better meet the needs of one or more learners?	This course is taught using an inquiry approach, which lends itself to project-based learning. Course work can be done independently or collaboratively, based on the needs of the learner, however it is recommended that pairing with a mentor, expert, or community member will enhance an independent approach.
Are there any **experts** that I could bring into the classroom electronically or as a guest speaker?	First Nation Elders (contact local First Nation subject coordinator), environmental geoscientists, post-secondary professors, site tour guide/curator, etc.
Have I linked the goal to as current event or a cultural event in the learner's lives? Can I make the learning more **relevant**?	The learning should be applied to local community contexts, and can consider the Sustainable Development Goals.
Is there a **hands-on experience** that we could do to launch this lesson or this learning?	Learning should include use of environmental geoscience equipment and tools, include a traverse, and be based in a local community context.

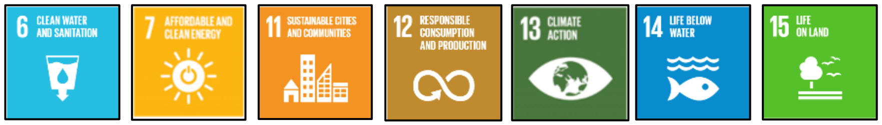
6.3 Smarter Science

The Smarter Science Framework skills poster can be downloaded **here**.



6.4 Sustainable Development Goals Alignment

Learners may explore concepts and topics related to UN Sustainable Development Goals. The following are possible alignments with *Environmental Geoscience 110* specific curriculum outcomes.



SCO 1.2

- 11 – Sustainable Cities and Communities
  - 11.A Strong National and Regional Development Planning

SCO 1.3

- 6 – Clean Water and Sanitation
  - 6.6 – Protect and Restore Water-Related Ecosystems
- 7 – Affordable and Clean Energy
  - 7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services
  - 7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix
- 11 – Sustainable Cities and Communities
  - 11.3 – Inclusive and Sustainable Urbanization
  - 11.4 – Protect the World's Cultural and Natural Heritage
- 14 – Life Below Water
  - 14.5 - Conserve Coastal and Marine Areas
- 15 – Life on Land
  - 15.1 – Conserve and Restore Terrestrial and Freshwater Ecosystems
  - 15.4 – Ensure conservation of mountain ecosystems

SCO 2.1

- 6 – Clean Water and Sanitation
  - 6.3 – Improve water quality, waste water treatment and safe reuse
- 12 – Responsible Consumption and Production
  - 12.2 - Sustainable management and use of natural resources
  - 12.8 – Promote Universal Understanding of Sustainable Lifestyles

- 14 – Life Below Water
    - 14.2 – Protect and restore ecosystems
    - 14.A – Increase scientific knowledge, research and technology for ocean health
- 15 – Life on Land
    - 15.5 – Protect Biodiversity and Natural Habitats

SCO 2.2

- 6 – Clean Water and Sanitation
    - 6.4 – Increase water use efficiency and ensure freshwater supplies
    - 6.A – Expand water and sanitation support to developing countries
- 11 – Sustainable Cities and Communities
    - 11.5 – Reduce the adverse effects of natural disasters
    - 11.6 – Reduce the environmental impact of cities
    - 11.B – Implement policies for inclusion, resource efficiency, and disaster risk reduction
- 12 – Responsible Consumption and Production
    - 12.1 – Implement the 10-Year Sustainable Consumption and Production Framework
    - 12.B – Develop and implement tools to monitor sustainable tourism
- 13 – Climate Action
    - 13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
    - 13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
- 14 – Life Below Water
    - 14.4 - Sustainable fishing
    - 14.C – Implement and enforce international sea law
- 15 – Life on Land
    - 15.2 – End deforestation and restore degraded forests
    - 15.3 – End desertification and restore degraded land
    - 15.8 – Prevent invasive alien species on land and in water ecosystems

SCO 3.1

- 12 – Responsible Consumption and Production
    - 12.4 – Responsible management of chemicals and waste
    - 12.7 – Promote sustainable public procurement practices
- 15 – Life on Land
    - 15.9 – Integrate ecosystem and biodiversity in governmental planning

6.5 Land-based Field Project

A field project (a traverse) facilitates understanding of environmental geoscience concepts. An introductory environmental geoscience field project requires pre-trip consultation, planning and activities, safety protocols, as well as post-trip assessment and evaluation.

Possible field project goals (please see *Physical Geography 110* SCO 3.1 and 3.2 for specific science skills and demonstratable indicators):

- Consult with appropriate rights- and/or stake- holders.
- Apply field safety before, during, and after field project.
- Demonstrate a positive attitude in all safe weather conditions.
- Use field equipment and data collection tools and skills, examples: topographic maps, satellite photos, pace skills, Bruton or Silva compass skills, GPS technology.
- Gain knowledge about various geographic/geologic structures in the field, examples: identify rocks, recognize sedimentary structures, measure stratigraphic sections.
- Make observations and record notes.
- Summarize the field project data and communicate results.

Selecting a field study area

Selecting a study area to achieve learning goals for an introductory level field project can be made from a wide range of possibilities as professional field work can include sequencing, numerical and relative field dating, laboratory work, remote imagery and base mapping, modern field techniques, and digital analysis of data. As local and school communities vary, a safe geographic traverse could mean a locale on school property, or another New Brunswick location. This experience is enhanced by revisiting the place throughout the year. EECD, District, Post-Secondary, and/or community guidance may aid study site selection.

In advance of finalizing the selected study area, it is helpful for the educator to visit the location and test the planned investigative work. It is important to make sure: the appropriate rights- and/or stake- holders have been contacted, the study area is suitable for the selected questions and investigation, schedule (book the area) for field work if appropriate and for when the site is accessible, identify potential hazards are present (including seasonal hazards), identify the nearest medical facility, identify roads or access points available (and during what seasons).

Focus of the study area

The focus of the study should be clearly presented in the project plan, this includes identifying any appropriate rights- and/or stake-holders. Some study areas naturally direct participants toward specific questions, others explore more general questions or solicit learners to examine and develop questions. Depth of investigation is influenced by the study area, prior science knowledge and experiences of the learners, and capacity of the educator(s).

The following are sample elements that could be used to create an assessment rubric for evaluating participation in a field project.

Excelling	Meeting	Approaching	Working Below
The science learner independently and consistently -	*The science learner generally -*	*The science learner sometimes (or with support) -*	*The science learner rarely -*
Asks questions that arise from careful observation of phenomena, models or unexpected results.	Asks questions that arise from careful observation of phenomena, models or unexpected results.	Asks questions that arise from careful observation of phenomena, models or unexpected results.	Asks questions that arise from investigations.
Selects appropriate tools, materials and equipment to carry out a field project.	Selects appropriate tools, materials and equipment to carry out a field project.	Selects appropriate tools, materials and equipment to carry out a field project.	Selects appropriate equipment to participate in a traverse.
Develops (with guidance) investigation procedures for a field project or to solve a practical problem.	Develops (with guidance) investigation procedures for a field project or to solve a practical problem.	Develops (with guidance) investigation procedures for a field project or to solve a practical problem.	Develops scientific procedures.
Uses tools and equipment appropriately (proper handling, transport, etc.) during a field project.	Uses tools and equipment appropriately (proper handling, transport, etc.) during a field project.	Uses tools and equipment appropriately (proper handling, transport, etc.) during a field project.	Uses tools and equipment appropriately in an investigation.
Records qualitative and quantitative data using tools as appropriate.	Records qualitative and quantitative data using tools as appropriate	Records qualitative and quantitative data using tools as appropriate.	Records appropriate data.

Excelling	Meeting	Approaching	Working Below
The science learner independently and consistently -	*The science learner generally -*	*The science learner sometimes (or with support) -*	*The science learner rarely -*
Develops a model to demonstrate relationships.	Develops a model to demonstrate relationships.	Develops a model to demonstrate relationships.	Develops models.
Evaluates the accuracy of various methods for collecting data.	Evaluates the accuracy of various methods for collecting data.	Evaluates the accuracy of various methods for collecting data.	Evaluates the accuracy methods for collecting data.
Constructs graphical displays (e.g., drawings, charts, maps, tables, and graphs).	Constructs graphical displays (e.g., drawings, charts, maps, tables, and graphs).	Constructs graphical displays (e.g., drawings, charts, maps, tables, and graphs).	Constructs graphical representations.
Applies concepts of scale, magnitude, probability and statistics.	Applies concepts of scale, magnitude, probability and statistics.	Applies concepts of scale, magnitude, probability and statistics.	Applies concepts of mathematical and statistical thinking.
Identifies possible sources of error.	Identifies possible sources of error.	Identifies possible sources of error.	Identifies sources of error.
Draws a conclusion based on evidence gathered from a field project.	Draws a conclusion based on evidence gathered from a field project.	Draws a conclusion based on evidence gathered from a field project.	Draws a conclusion based on evidence collected.
Works cooperatively to examine own knowledge or knowledge of peers.	Works cooperatively to examine own knowledge or knowledge of peers.	Works cooperatively to examine own knowledge or knowledge of peers.	Works cooperatively to examine own knowledge.
Chooses a format of communication appropriate to purpose (e.g., reports, data tables, scientific models, etc.).	Chooses a format of communication appropriate to purpose (e.g., reports, data tables, scientific models, etc.).	Chooses a format of communication appropriate to purpose (e.g., reports, data tables, scientific models, etc.).	Chooses appropriate communication method.
Discusses procedures, results and conclusions of field projects using appropriate scientific terminology.	Discusses procedures, results and conclusions of field projects using appropriate scientific terminology.	Discusses procedures, results and conclusions of field projects using appropriate scientific terminology.	Discusses investigations using appropriate scientific terminology.
Communicates answers to questions or solutions to problems based on evidence.	Communicates answers to questions or solutions to problems based on evidence.	Communicates answers to questions or solutions to problems based on evidence.	Communicates understandings based on evidence.
Follows guidelines for safe use of equipment to conduct a field project.	Follows guidelines for safe use of equipment to conduct a field project.	Follows guidelines for safe use of equipment to conduct a field project.	Follows science safety guidelines.

Excelling	Meeting	Approaching	Working Below
The science learner independently and consistently -	*The science learner generally -*	*The science learner sometimes (or with support) -*	*The science learner rarely -*
Uses science and technological knowledge when considering issues of concern to them.	Uses science and technological knowledge when considering issues of concern to them.	Uses science and technological knowledge when considering issues of concern to them.	Uses science and technological knowledge to consider issues.
Uses cultural understanding when considering issues of concern to them.	Uses cultural understanding when considering issues of concern to them.	Uses cultural understanding when considering issues of concern to them.	Uses cultural understanding to consider issues.
Reflects on various aspects of an issue to make decisions about possible actions.	Reflects on various aspects of an issue to make decisions about possible actions.	Reflects on various aspects of an issue make decisions about possible actions.	Makes decisions about action to take.

7. Resources

Ancient Earth Globe: This visualization is created and maintained by Ian Webster. Plate tectonic and paleogeographic maps by C.R. Scotese, PALEOMAP Project. <https://dinosaurpictures.org/ancient-earth#240>

ArcGIS – Lnu Place Names in New Brunswick: "L'nu" is a Mi'gmaw word meaning “the people” and refers to all the original inhabitants of Turtle Island (the Americas). The original inhabitants of New Brunswick, the Mi'gmaq, Wolastoqiyik and Peskotomuhkati nations have occupied and cared for the lands and waters of New Brunswick since time immemorial. Place names given to geographic features and landmarks reflect the deep relationship between L'nu and their environment. " Mi'gmaq, Wolastoqiyik and Peskotomuhkati place names, as with most ancient place names, are based on descriptive words. They describe the features of the landscape and, to a lesser extent, how oral history is woven into specific places in the landscape. In this way, when people discuss their travels and the routes they followed, at the same time, they draw a portrait of the landscape and what happened there. This allows other travellers to "recognize" many of the landmarks on the landscape even when they see them for the first time." <https://www.arcgis.com/home/webmap/viewer.html?webmap=c870f4f1550546a98112f718140b72c2&extent=-65.5512,46.0877,-64.537,46.4915>

ArcGIS – Stories of the Dawnland: “The Wabanaki have many stories, passed down from one generation to the next […] Some explain how rivers or islands or mountains were formed. Others tell of the connections between people, animals, and place, or explain the role of the land in Wabanaki history […] These written versions are adapted and abbreviated, providing just a glimpse of the full narratives. Their traditional, dynamic form can only be fully experienced when shared by a gifted Wabanaki storyteller.” <https://www.arcgis.com/apps/MapJournal/index.html?appid=2b167c2e12f4442f8db853e10516b488>

#breakfreefromplastic: A global movement envisioning a future free from plastic pollution. BFFP member organizations and individuals share the common values of environmental protection and social justice, and work together through a holistic approach in order to bring about systemic change under the #breakfreefromplastic core pillars. This means tackling plastic pollution across the whole plastics value chain - from extraction to disposal – focusing on prevention rather than cure and providing effective solutions. BFFP Common Goal:

Bring systemic change through a holistic approach tackling plastic pollution across the whole plastics value chain, focusing on prevention rather than cure, and providing effective solutions. <https://www.breakfreefromplastic.org/>

Canadian Geographic – Indigenous Peoples Atlas of Canada: Cartography has long been an imperial enterprise used to claim territory and to imagine the geographic reach of empires. In its imperial usage, map-making is an instrument of Indigenous erasure. It reconceptualizes the world in ways that ignore ongoing Indigenous presence, usage and governance. When Canada sent surveyors to the Prairies in the 1870s — its most ambitious mapping project — it reorganized the prairie world into 640-acre (2.6 sq. km) sections without regard for natural landmarks or Indigenous territorial boundaries.
<https://indigenouspeoplesatlasofcanada.ca/forewords/maps/>

CGEN: The Canadian Geoscience Education Network (CGEN) is the education arm of the Canadian Federation of Earth Sciences. CGEN is concerned with all levels of geoscience education in Canada and encourages activities designed to increase public awareness of geoscience. CGEN exists to stimulate the development of geoscience awareness activities in Canada and to coordinate the efforts of the Canadian geoscience community in matters related to geoscience education and public awareness of geoscience.
<http://earthsciencescanada.com/cgen/>

CGEN Earth Links: Earth Links is a collection of online resources selected by the members of CGEN which is a national network of Canadian educators and professionals interested in promoting awareness of the Earth Sciences. All of the EarthLinks were submitted and/or suggested by CGEN members. <https://www.cgenarchive.org/earthlinks.html>

CLEAR Lab: "We respectfully acknowledge the territory in which CLEAR works as the ancestral homelands of the Beothuk, and the island of Newfoundland as the ancestral homelands of the Mi'kmaq and Beothuk. I would also like to recognize the Inuit of Nunatsiavut and NunatuKavut and the Innu of Nitassinan, and their ancestors, as the original peoples of Labrador. We strive for respectful relationships with all the peoples of this province as we search for collective healing and true reconciliation and honour this beautiful land together. This Land acknowledgment for Memorial University, which has campuses in various parts of the province, was created by the five Indigenous groups in the province together." Civic Laboratory for Environmental Action Research (CLEAR) is a feminist, anti-colonial, marine science laboratory, which means […] methods foreground values of humility, equity, and good land relations. CLEAR is a collective of researchers from a wide range of disciplines (from ocean science to filmmaking), career levels (high school students to full professors), and skillsets. <https://civiclaboratory.nl/>

Climate Atlas of Canada – Indigenous Knowledges: The Climate Atlas of Canada is an interactive tool for citizens, researchers, businesses, and community and political leaders to learn about climate change in Canada. It combines climate science, mapping and storytelling to bring the global issue of climate change closer to home, and is designed to inspire local, regional, and national action and solutions. <https://climateatlas.ca/indigenous>

COASTIE Canada: The COASTIE program is a collaboration between Parks Canada and the University of Windsor that developed from the global CoastSnap Community Beach Monitoring movement … Verified and anonymized photographs taken at COASTIE stations are uploaded to the global database to capture changing coastlines. <https://coastiecanada.ca/>

Earth Science Literacy Principles (National Science Foundation 2010): Big ideas of Earth science that all citizens should know, determined by the Earth science research and education communities, it has undergone an extensive period of public review. This document, representing the current scientific knowledge in Earth science, is helping to shape decisions by government and industry and helping to guide the direction of educational curricula. It is a work in progress because the scientific process continues to improve our understanding of Earth. Teachers and school boards are using it to shape class instruction ranging from individual lessons to whole curricula. <http://www.earthscienceliteracy.org/>

Exploring Geoscience Across the Globe (King 2019): The book has been produced to support teachers across the world in teaching the International Geoscience Syllabus. The syllabus covers the geoscience that all 16-year-old students should know and understand, as recommended by the international geoscience education community. The textbook has been approved by the International Geoscience Education Organisation, the International Union of Geological Sciences through its Commission on Geoscience Education and Technology Transfer, and the European Geosciences Union. < http://www.igeoscied.org/download/exploring-geoscience-across-the-globe-english-original-version/>

EdGEO: EdGEO, initiated in the early 1970s, supports local workshops on earth science for Canadian teachers. It is coordinated by the Canadian Geoscience Education Network of the Canadian Federation of Earth Sciences (CFES). <https://www.edgeo.org/en_CA/>

Four Billion Years and Counting: Canada's Geological Heritage (Canadian Federation of Earth Sciences, 2014): *Four Billion Years and Counting* covers basic concepts about rocks and minerals, plate tectonics, geological time, and fossils. It also explores resources and social issues related to geology, many of which are today's pressing concern. <https://science.gc.ca/eic/site/063.nsf/eng/97357.html>

Geographical Names in Canada: Access the Canadian Geographical Names Database, find guidelines for proposing a geographical name, and learn about geographical terms and the origins of Canadian place names. <https://www.nrcan.gc.ca/maps-tools-and-publications/maps/geographical-names-canada/10786>

Geoscience Habits of Mind (InTeGrate: Interdisciplinary Teaching about Earth for a Sustainable Future): The geoscience habits of mind are a set of perspectives and skills that are deeply engrained in the ways that geoscientists work. No matter what your field, developing your own understanding of what constitutes expert thinking in your own discipline can help you teach it better. Developing an understanding of the perspectives of your colleagues in other disciplines, including their expert thinking strategies, can help foster a culture of collaboration and facilitate interdisciplinary research and teaching. <https://serc.carleton.edu/integrate/teaching_materials/themes/expert_thinking/habits.html>

GeoNB: GeoNB is the Province of New Brunswick's gateway to geographic information and related value-added applications. Providing all users with easy access to geographic data, value-added applications and maps; reducing duplication and costs through collaboration and the sharing of geographic data and infrastructure; promoting and increasing the use of geographic data and maps. <http://www.snb.ca/geonb1/e/index-E.asp>

Google Earth: Google Earth Pro on desktop is free for users with advanced feature needs. Import and export GIS data, and go back in time with historical imagery. Available on PC, Mac, or Linux. <https://www.google.com/earth/versions/>

Google Earth Engine: Earth Engine is a platform for scientific analysis and visualization of geospatial datasets, for academic, non-profit, business and government users. Earth Engine hosts satellite imagery and stores it in a public data archive that includes historical earth images going back more than forty years. The images, ingested on a daily basis, are then made available for global-scale data mining. Earth Engine also provides APIs and other tools to enable the analysis of large datasets. <https://earthengine.google.com/>

Institute for Integrative Science and Health: The Institute for Integrative Science & Health (IISH) provides an organizational home for the people engaged in efforts to realize the vision we hold for Integrative Science … Numerous and diverse people have contributed to Integrative Science and helped develop its guiding principles and themes, as well as its numerous knowledge products such as articles and presentations and multimedia items. < http://www.integrativescience.ca/>

Mi'Kmawey Debert Cultural Centre: The Mi'kmawey Debert Cultural Centre (MDCC) project is a charitable, not-for-profit First Nations organization, mandated by all thirteen Nova Scotia Mi'kmaw Chiefs. The project is administered through The Confederacy of Mainland Mi'kmaq, a First Nation tribal council. The *Mi'kmawe'l Tan Teli-kina'muemk: Teaching about the Mi'kmaq* resource was designed for anyone who teaches Mi'kmaw history, culture and knowledge. Through the stories and knowledge of Mi'kmaw Elders, educators, and other experts, this volume will share content and teaching strategies for three subject areas for grades primary to nine: <https://www.mikmaweydebert.ca/>

Mi'kmaw Place Names: The digital atlas … forms the basis for Ta'n Weji-sqalia'tiek Mi'kmaw Place Names Website. We envision this website will become a multimedia, interactive, educational website that will be accessible throughout the world. The digital atlas and website will directly support other Mi'kmaw activities including the development of educational products for schools, enhance Mi'kmaw tourism and promote cultural awareness about Mi'kmaw people. <https://placenames.mapdev.ca/>

Native Land Digital: Native Land Digital is a registered Canadian not-for-profit organization … We strive to map Indigenous lands in a way that changes, challenges, and improves the way people see history and the present day. We hope to strengthen the spiritual bonds that people have with the land, its people, and its meaning. <https://native-land.ca/>

iNaturalist: One of the world's most popular nature apps, iNaturalist helps you identify the plants and animals around you. In 2014 iNaturalist became an initiative of the California Academy of Sciences and a joint initiative with National Geographic Society in 2017. Internationally, iNaturalist is supported by several different organizations through the iNaturalist Network. Projects let you pool your observations with other people on iNaturalist. <https://www.inaturalist.org/>

National Geographic: Teaching with Google Earth: The National Geographic Society and Google Earth are teaming up to empower students to think about the world beyond their classrooms. The educational resources […] are designed for the new web-based Google Earth and highlight a range of geographical concepts as well as some of National Geographic's most exciting initiatives. <https://www.nationalgeographic.org/education/google-earth/>

Open Geography Education: This website is dedicated to providing free, open curriculum and resources to anybody who is interested in our geographic world. Using the world as our contributors and content experts, we will strive to make the most engaging, dynamic, and relevant information possible. The spirit behind this movement is community. It is in that spirit that I invite you to provide anything that you find useful to help advance the Open Geography Education and Open Education movement forward. < https://www.opengeography.org/>

Pan Inuit Trails: The Atlas provides a synoptic view (although certainly incomplete) of Inuit mobility and occupancy of Arctic waters, coasts and lands, including its icescapes, as documented in written historical records (maps of trails and place names). <http://www.paninuittrails.org/index.html>

Pepamuteiati nitassinat – Innu Place Names : Explore Innu place names. Find out how to pronounce them and where they are located. See photos and video clips taken at some of the named places, and listen to stories set there. <https://www.innuplaces.ca/aboutPlaceNames.php?lang=en>

Physical Geography and Natural Disasters (Dastrup, 2020): The intent of this textbook is to update and build upon the body of knowledge that exists within the geographic discipline. Unless otherwise noted within each chapter of the textbook, this body of work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. < https://slcc.pressbooks.pub/physicalgeography/>

Inuit Heritage Trust Place Names Program – Place Names in Nunavut: The land has always been alive with names for all places of any significance to Inuit who have called this environment home for centuries … In an effort to capture and enable this source of knowledge to be shared across generations, maps are essential. The Inuit Heritage Trust has two main goals: The distribution of traditional place names knowledge on topographic, thematic maps in IHT's Nunavut Map Series. In addition, place names can now be viewed using Google's interactive MyMaps; Ensuring the traditional names are made official through a process involving the Government of Nunavut's Geographic Names Policy. <

Project Everyone: Project Everyone seeks to put the power of great communications behind The Global Goals, accelerating the creation of a fairer world by 2030, where extreme poverty has been eradicated, climate change is properly addressed and injustice and inequality are unacceptable. Our mission is to ensure that everyone on the planet knows what the Global Goals are, so that they stand the greatest chance of being achieved. We are a not-for-profit agency, available to work on campaigns, content and events which ladder up to the achievement of the Goals. < https://www.globalgoals.org/>

Science Rendezvous: Science Rendezvous serves as a public platform to promote science awareness and increase science literacy in Canada. The events of the day work to engage and transform the general public from passive supporters of science and engineering to active, passionate champions with an understanding of the important role science plays in our rapidly changing world. The open-lab concept of Science Rendezvous brings science and world-leading scientists face-to-face with the public. <https://www.sciencerendezvous.ca/>

Stories From the Land – Indigenous Place Names in Canada: In Canada close to 30,000 official place names are, or may be, of Indigenous origin. This map offers a small sample of official geographical names selected by the federal, provincial and territorial naming authorities of the Geographical Names Board of Canada. < https://maps.canada.ca/journal/content-en.html?lang=en&appid=0e585399e9474ccf932104a239d90652&appidalt=11756f2e3c454acdb214f950cf1e2f7d>

Teaching Geographical Thinking: Revised and Expanded Edition (Sharpe, Bahbahani, Huynh, 2016): This series introduces the core tools needed to inquire critically within a specific discipline and offers multiple strategies and exemplary lessons to support teachers in embedding thinking into teaching the subject matter. *Teaching Geographical Thinking* is intended for teachers who want to engage their students in geographical thinking through critical inquiry. This resource provides a framework for understanding and applying critical thinking in geography. < https://tc2.ca/shop/teaching-geographical-thinking-revised-expanded-edition-p-27>

United Nations Sustainable Development Goals: The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests. <https://sdgs.un.org/goals>

Youth Science/Smarter Science: Youth Science Canada exists so Canadian youth are engaged through science in inquiry and critical thinking. Youth Science Canada provides or partners in programs to increase awareness and involvement of youth in science, engineering and technology, to engage, mentor and recognize Canada's young scientists, to set standards for scientific experimentation by young people, to promote the creation and support of science and technology fairs, and to engage scientists, engineers, educators, parents and leading public and private sector organizations in the development of a national science, engineering and technology network of Canadian youth. Smarter Science is an open-source framework for teaching and learning K-12 science and developing the skills of inquiry, creativity and innovation in a meaningful and engaging manner. < https://youthscience.ca/for-educators/>

Zooniverse: The Zooniverse is the world's largest and most popular platform for people-powered research. This research is made possible by volunteers — more than a million people around the world who come together to assist professional researchers. Our goal is to enable research that would not be possible, or practical, otherwise. Zooniverse research results in new discoveries, datasets useful to the wider research community, and many publications. <https://www.zooniverse.org/>