



CONCEPT-BASED • CONCRETE • INTERACTIVE

Social and Environmental Contexts of Science: Case Study of the EMEND Research Project Near Peace River

Developed by Fuse Consulting Ltd.

TABLE OF CONTENTS

INTRODUCTION	1
--------------	---

GUIDING QUESTION #1: STUDYING A NATURAL LANDSCAPE – WHAT IMPACTS DO YOU OBSERVE?

Context, Vocabulary, Materials	2
● ENGAGE: Comic— The boreal forest is a busy place	2
● INTRODUCE	3
● EXPERIENCE: Aerial Landscape Video	3
● EXPLORE: Interactive Tour #1— What does a recent fire look like?	3
● DEMONSTRATE UNDERSTANDING: What impacts do you see on the landscape?	3

GUIDING QUESTION #2: HOW DO SCIENTISTS CONDUCT LANDSCAPE SCALE STUDIES?

Context, Vocabulary, Materials	4
● ENGAGE: Comic: The Challenges of Field Research	5
● INTRODUCE: What kind of research goes on at EMEND?	5
● EXPERIENCE: Research Sites 360 Video	5
● DEMONSTRATE UNDERSTANDING: Designing Your Own Study	6
● EXPLORE: Interactive Tour #2— Research at EMEND	7
● DEMONSTRATE UNDERSTANDING: What innovative technology or creative technique could you use to overcome a challenge in your study?	7

GUIDING QUESTION #3: HOW ARE THE SCIENTIFIC FINDINGS ABOUT NATURAL DISTURBANCE HELPING TRANSFORM FORESTRY PRACTICES?

Context, Vocabulary, Materials	8
● ENGAGE: What does a harvest block designed to emulate a forest fire look like?	9
● INTRODUCE	9
● EXPERIENCE: Helping Harvested Forests Grow Back Faster 360 Video	9
● EXPLORE: Interactive Tour #3: Harvest Block Emulating a Wildfire Pattern	9
● DEMONSTRATE UNDERSTANDING: Understanding how scientific findings evolve into forest harvest best practice?	10

CONCLUSION AND ACKNOWLEDGEMENTS	11
---------------------------------	----

INTRODUCTION

The immersive video experiences on this webpage, <https://emend.ualberta.ca/>, provide concrete examples and interactive investigation that teachers can use to teach the following essential understandings:

1. Investigating the interactions of the physical world facilitates understandings that can be a basis for discovery and innovation.
2. Examining the nature of science and scientific inquiry can help us appreciate the development of knowledge about the natural world.
3. How can engaging in scientific inquiry enable us to produce evidence to support explanations of scientific phenomena?

What to expect with 360 technology?

- Click and drag to look (pan) around.
- Test your speakers and turn up the volume as each virtual tour includes audio from the forest.
- For the second and third sections students will have an opportunity to explore independently or in small groups from within the 360 tours. Providing tablets or smartphones will enhance your class experience but, if not available, all tours can be explored together at the front of the class using your SMARTboard.
- Note: Only tablets with a gyroscope will automatically pan around as students move. For other devices, click or touch and drag to pan around.
- Click the back button to exit a hotspot when inside an interactive tour.

Preparing for this class presentation:

- If time allows introduce your students to the new terminology in the Vocabulary List at the beginning of each section.
- Check out the EMEND website at <https://emend.ualberta.ca/> to better understand the boreal forest and the research happening there. This will help you guide student discussion on the questions about the social and environmental contexts of science. EMEND is an excellent concrete example to help your students understand these abstract concepts!

Using the Student Workbooks

- Before you begin, pass out the Student Workbooks and let them look over the Tour Map and the the Icons they can be watching for in the videos.
- Your students will Demonstrate Understanding of the new ideas and concepts using their student workbooks.

Competencies Covered In This Resource



DID YOU KNOW?

EMEND stands for
*Ecosystem-based
Management
Emulating
Natural
Disturbance*

Guiding Question #1: Studying a natural landscape – what impacts do you observe?

Learning Objectives

Students will:

- Experience the physical characteristics of the northern boreal forest.
- Demonstrate **Critical Thinking** in carefully observing the 360 aerial video of a boreal forest landscape, pulling out evidence of different human and natural disturbance.
- **Manage Information** when considering the patterns of wildfires and the pattern of a harvest block.

Competencies covered in this section



Critical Thinking



Managing Information

Vocabulary List:¹

Boreal Forest: The forest growing in northern Alberta, made up mostly of coniferous trees like spruce and deciduous trees like aspen.

Landscape: All the visible features of a large area of land.

Cutblock AKA Harvest Block: A specific area with defined boundaries and a thoughtful design/shape authorized for harvest.

Retention: Live, standing trees left within a harvest block to retain seed sources, shelter and habitat connectivity for living organisms.

Materials:

- Projector/Smartboard equipped with speakers
- 1 Workbook for each student
- Comic 1 on the screen
- Video 1: Aerial Landscape Introductory Video (2:27 minutes)
- Interactive Tour #1: Inside a Recent Fire



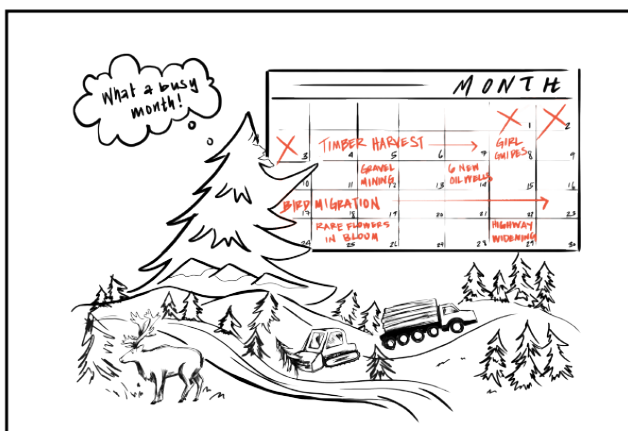
30 MINUTES

ENGAGE

Show the comic on the screen at the front of the class to prepare and hook students.

Comic 1: The Boreal Forest is a Busy Place

THE BOREAL FOREST IS A BUSY PLACE



INTRODUCE

Provide students with context for the upcoming video using the script below or material that connects to the classes prior knowledge.

"Some scientific research takes place in a laboratory and some research takes place outside, in fields and forests and lakes. There are also research studies that are looking for more than new pieces of information to add to a textbook, they are looking for information that can affect and improve real world practices and plans. This research is taking place in the context of social issues like economic development and environmental issues like conservation.

Today we will have a chance to be the researchers that conduct these field studies. So let's imagine we are scientists that observe entire forests and pull out important observations and questions.

We are about to take a video tour of a forest 90 minutes northwest of Peace River, Alberta. This forest has been the topic of study of a team of researchers since 1998. This study will go on for 80-100 years and includes a forest about 7 km wide by 10 km long. The study is called EMEND, and it is the largest scale research experiment of its kind in the world. The learnings (research results) from EMEND inform how we can better manage forests in Alberta and beyond.

Have a look on the front of your student work book to see the map of our journey and get familiar with the icons you'll see in the videos."

EXPERIENCE

Turn your speakers on and view Video 1: Aerial Landscape Introductory Video.

What impacts do you observe on the boreal landscape?

Class discussion, fill in Question 1 and 2 of the worksheet.

EXPLORE

Now let's go inside a recent forest fire.

View [Interactive Tour #1: Inside a Recent Fire](#)

All together as a class view and pan around the Interactive 360 photo taken inside a recent wild fire.

What do you notice?

Trees are standing, green shrubs growing back, woodpeckers are using the habitat

How long ago do you think this forest fire happened?

Answer: This footage was taken 3 years after this forest was burned.

If it were later, you would see more trees fallen down and new trees growing.

DEMONSTRATE UNDERSTANDING

Answer Question 2 in the Workbook – How might one of these impacts affect the organisms that live in the forest?

Guiding Question #2: How do scientists conduct landscape scale studies?

Learning Objectives

Students will:

- Consider their **Personal Growth** in thinking about something they would like to study.
- Demonstrate **Critical Thinking** and **Managing Information** in thinking about where and how they would study their selected topic.
- Demonstrate **Creativity & Innovation** in solving the biggest challenge their imaginary study would have. They will see examples of creative study designs and innovative equipment being used at EMEND.

Competencies covered in this section



Personal Growth



Critical Thinking



Managing Information



Creativity and Innovation

Vocabulary List:

Observation: Use of the senses or scientific instruments to notice qualitative (descriptive) or quantitative (numerical measurements) aspects of a phenomenon or living thing.

Ecosystem: A community made up of living organisms and nonliving components such as air, water, and mineral soil.

Hypothesis: A proposed explanation for a phenomenon based on previous observation and that can be tested.

Variable: A logical set of attributes. A condition or a group of conditions that influences an outcome or condition.

Ecosystem Processes: Ecosystem processes such as primary production, soil formation, and nutrient cycling regulate the movement of energy and matter through an environment.

Materials:

- Tablets and Projector/Smartboard
- 1 Workbook for each student
- Comic 2 Onscreen
- Introductory Video 2: Intro to EMEND Research Video Slideshow
- Video 2: Research Sites 360 Video (3:49 minutes)
- Interactive Tour #2: Research at EMEND

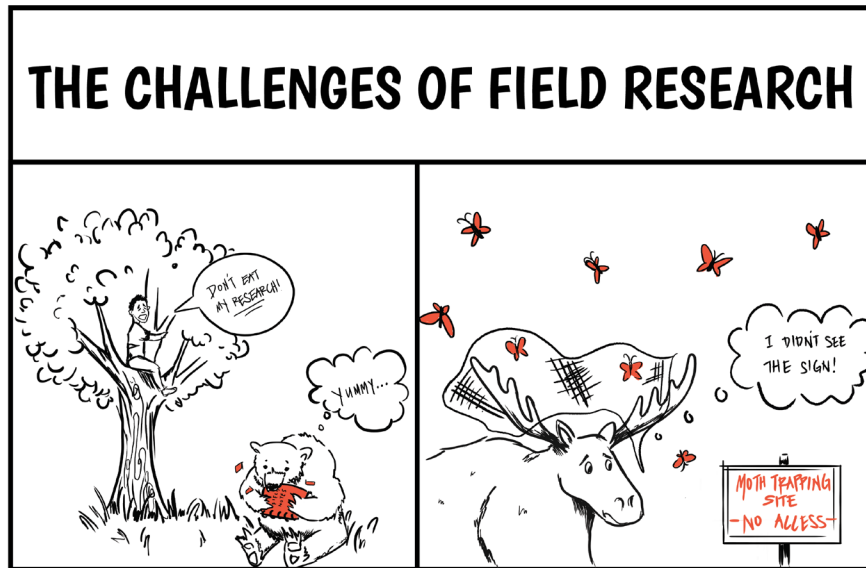


30 MINUTES

ENGAGE

Show the comic on the screen at the front of the class to prepare and hook students.

Comic #2: The Challenges of Field Research



INTRODUCE

View *Introductory Video 2: Intro to EMEND Research Video Slideshow* at the front of the class.

Provide students with context for the upcoming video using the script below or material that connects to the classes prior knowledge:

There are many active research studies and innovative harvest techniques going on at EMEND. We will immerse you in the field with a team of researchers setting up studies and collecting data.

Look for these activities:

- Digging a hole and inserting a plastic trap in the ground to catch ground dwelling insects
- Checking on an owl box by tapping the tree to scare the curious owl out
- Uploading photos from a camera trap
- Measuring tree diameter
- Listening for bird songs to identify the types of birds in the area

EXPERIENCE

Allow individual or groups of students to explore *Video 2: Research Sites* 360 Video on tablets.

Provide the class with the following information:

The EMEND research study is very creative and innovative because it is being used to study ecosystem processes over a very long time AND it is studying a wide range of organisms, from tiny mites in the soil to birds flying in the sky.

At EMEND, researchers are studying all these things:

- Mites
- Spiders
- Songbirds
- Mushrooms
- Fur-bearing animals that trappers depend on for their livelihood (Wolverine, Pine Marten, Fox, Fisher)
- Beetles and other ground insects
- Moths and Butterflies
- Plants and mosses
- Soils
- Hydrology

DEMONSTRATE UNDERSTANDING

Go to your workbooks.

What other things could scientists at EMEND be studying?

If you were a scientist what would you like to study?

Would you study that in a lab or in the forest? What would be the biggest challenge in studying what you chose?

EXPLORE

Allow students, individually or in groups, to explore Interactive Tour #2: Research at EMEND.

Share the following information with the students:

“Over the past 20 years there have been over 70 University students doing research at EMEND. With the help of a Professor, students choose a research topic that needs to be answered and design an experiment. They have to think about making their equipment tough in case mice chew it, deer or moose scrape it, bears rub on it or a hard wind blows it down. Their equipment needs to be waterproof, stand up to very hot and very cold temperatures, and needs to be efficient on batteries because they can’t return to change them very often.”

DEMONSTRATE UNDERSTANDING

Looking back at your answer to what you would like to study, what innovative technology or creative technique could you use to overcome the challenge (or a different challenge) you identified?

Complete Question 6 in your Workbook.

Guiding Question #3: How are scientific findings about natural disturbance helping transform forestry practices?

Learning Objectives:

Students will:

- Explore the concepts of **Cultural and Global Citizenship** by learning about changes to industry practice and government policy that balance current resource development with future resource sustainability (for development and environmental values).
- **Communicate** orally with partners and in writing on their worksheets using new vocabulary and synthesizing the new concept of retention.
- **Manage Information** and **Problem Solve** to determine which industry practices evolved from which scientific findings.

Competencies covered in this section



Cultural and Global Citizenship



Communication



Managing Information



Problem Solving

Vocabulary List:ⁱⁱ

Policy: A deliberate system of principles to guide decisions and achieve planned outcomes.

Forest Harvest: Cutting and removing merchantable timber from a planned and defined area (one harvest block).

Cutblock AKA Harvest Block: A specific area with defined boundaries and a thoughtful design/shape authorized for harvest.

Retention: Live, standing trees left within a harvest block to retain seed sources, shelter and habitat connectivity for living organisms.

Sustainability: Preservation and protection of diverse ecosystems—the soil, plants, animals, insects and fungi—while maintaining the forest’s productivity.

Habitat Connectivity: Corridors, stepping stones and islands of small wild areas that allow animals to travel between larger pieces of high quality habitat within their territory.

Seed Source: Any source of seeds, from living or dead plants or from healthy soil, that provides the seeds necessary for regeneration.

Materials:

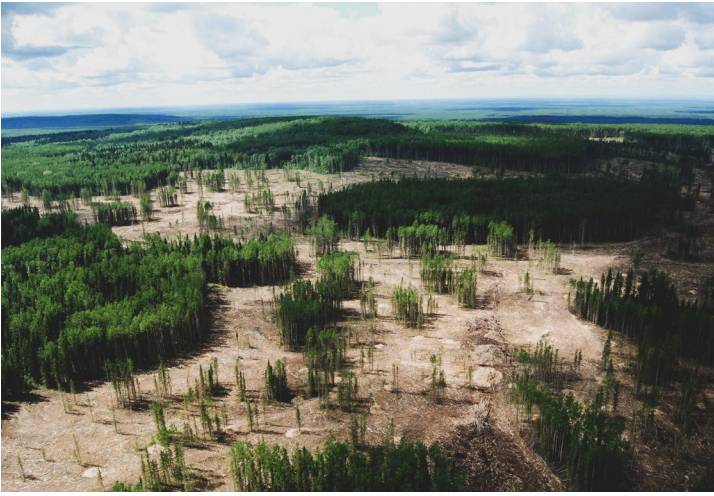
- Tablets and Projector/Smartboard
- 1 Student Workbook for each student
- Fire and Harvest Block Aerial Photos
- Interactive Tour #3: Harvest Block Emulating a Wildfire pattern
- Video 3 in 360: Helping Harvested Forests Grow Back Faster (3:35 minutes)



30 MINUTES

ENGAGE

Aerial Photos of Recent Harvest vs. Burned Forest



INTRODUCE

Provide students with context for the upcoming video using the script below or material that connects to the classes prior knowledge.

Harvest blocks are planned to copy the patterns of natural wildfires. After cutting down and marketing the timber, forestry companies invest in tree planting to help the forest grow back (regenerate). Scientists research and monitor the survival and growth of the planted seedlings and natural regeneration. Their findings help make new recommendations for future harvest, land reclamation and forest regeneration programs.

EXPERIENCE

Allow individual or groups of students to explore the 360 video tour called [Video 3: Helping Harvested Forests Grow Back Faster](#).

EXPLORE

Allow students, individually or in groups, to explore the [Interactive Tour #3: Harvest Block Emulating a Wildfire Pattern](#).

DEMONSTRATE UNDERSTANDING

What shape/pattern is this harvest block?

On the worksheet draw the approximate pattern of the harvest block you saw from the air. Label things like clumped retention and dispersed retention.

How long ago do you think the harvest block you visited was harvested?

Answer: This footage was taken 1-2 years after this forest was harvested.

Have students read in partners or to the class:

The science at EMEND is directly linked to the activities and questions that industry and government have. Planning research projects at EMEND involves attending to the practical and ethical implications of science and technology for the sustainability of local and global communities. Some key findings from the research project that are helping people work together to maintain the health of the boreal forest are:

- By leaving some living trees standing after harvesting (called retention), we can provide key habitat for a range birds, insects and plants and make harvesting more similar to natural disturbance like fire.
- Variation is critical for biodiversity. By creating harvest blocks with a range of shapes, sizes, and levels of retention, we can better conserve the birds, insects and plants that live in this landscape over time.
- By creating small 'mounds' of soil in the forest understory, we can increase the rate at which trees grow and establish on harvested sites.

Discuss as a class:

How could we use science to help harvest timber more sustainably?

Complete Research Findings to Forest Harvest Best Practice matching activity in the workbook.

Social and Environmental Context of Science – this is your opportunity to discuss these questions from curriculum

Discuss as a class how we can (choose one):

1. Use scientific information to identify and address issues in communities.
2. Make decisions informed by relevant and accurate scientific data.
3. Evaluate how the application of science and technology impacts environments and economies.
4. Explain how scientific and technological progress occurs in socio-cultural contexts.

CONCLUSION

Conclude the lesson with these statements:

The EMEND Research site is a local example of landscape scale research that connects industry, science and society. This large area of the boreal forest is being developed by many resource industries at once, and is also being managed for the conservation of wildlife and ecosystem processes.

We can use scientific findings to better protect the and and living organisms while balancing the needs of our economy and society now and in the future.

It takes years of careful study to make a conclusion that can support decision making on our land, and this research is supported financially and physically by forestry companies, governments, and universities who care about sustainable resource development and healthy ecosystems.

Technology and innovation are key components of all scientific research and being a scientist can be an exciting, rewarding career.

ACKNOWLEDGEMENTS



Thank you to: Alberta-Pacific Forest Industries Inc., Alpine Helicopters, Richard Caners, Zoltan Domahidi, Jason Edwards, Caroline Franklin, Seung-Il Lee, Ellen Macdonald, Sonya Odsen, Jaime Pinzon, Matthew Pyper, Jim Witiw and Mike Williamson from the Government of Alberta for their invaluable help capturing and collecting the photos and videos in these tours.

ⁱ Vocabulary terms courtesy of, "Glossary of Forestry Terms", Forestry Canada
<http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/2919.pdf>

ⁱⁱ Vocabulary terms courtesy of Wikipedia
https://en.wikipedia.org/wiki/Main_Page