Forests in Crisis

Strands	Suggested time
Algebra Data Social-Emotional Learning (SEL) Skills in Mathematics and the Mathematical Processes Geography - Natural Resources Around the World: Use and Sustainability	Over several days
Topic	**Grade**
Mathematical Modelling and our forests	7

Algebra
- C4. apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations

Data
- D1. manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life
  - D1.2 collect qualitative data and discrete and continuous quantitative data to answer questions of interest, and organize the sets of data as appropriate, including using percentages

Social-Emotional Learning Skills in Mathematics and the Mathematical Processes
- A1. Throughout this grade, in order to promote a positive identity as a math learn, to foster well-being and the ability to learn, build resilience, and thrive, students will apply, to the best of their ability, a variety of social-emotional learning

skills to support their use of the mathematical processes and their learning in connection with the expectations in the other five strands of the mathematics curriculum.

In this lesson, to the best of their ability, students will learn to **maintain positive motivation and perseverance** and **think creatively and critically** as they apply the mathematical processes **reasoning and proving** (develop and apply reasoning skills to justify thinking, make and investigate conjectures, and construct and defend arguments), **reflecting** (demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their results are reasonable, by recording their thinking in a math journal)) and **representing** (select from and create a variety of representations of mathematical ideas (e.g., representations involving physical models, pictures, numbers, variables, graphs) and apply them to solve problems) so they can recognize that testing out different approaches to problems and learning from mistakes is an important part of the learning process, and is aided by a sense of optimism and hope, and so they can make connections between math and everyday contexts to help them make informed judgements and decisions.

Geography - Natural Resources Around the World: Use and Sustainability
- B1. analyse aspects of the extraction/ harvesting and use of natural resources in different regions of the world, and assess ways of preserving these resources
    - B1.1 analyse interrelationships between the location/accessibility, mode of extraction/harvesting, and use of various natural resources.
- B2. use the geographic inquiry process to investigate issues related to the impact of the extraction/ harvesting and/or use of natural resources around the world from a geographic perspective
    - B2.1 formulate questions to guide investigations into issues related to the impact of the extraction/harvesting and/or use of natural resources around the world from a geographic perspective

Learning Goals	Success Criteria
We are learning… • to apply the process of mathematical modelling to analyse data and make decisions. • to create a model that can be used to predict the point at which we will no longer have enough forestry	I can.. ❏ make and evaluate assumptions in order to create a list of useful research questions for my model. ❏ collect and organize data related to the impact of the use of forestry products.

products to meet our needs.	❏ use my model to identify a point in time when the demand for forestry products will overtake the available supply. ❏ reflect on the effectiveness of my model by comparing it to other models. ❏ reflect on the impact my assumptions made on my model. 🖱 By adding these success criteria to your virtual learning platform (Google Classroom, D2L, …), you can share these success criteria with students who are in virtual classrooms so they can refer to them and assess their progress.
Prior Learning	**Resources and Materials**
As part of their learning in grade 7 geography, students will understand the ways in which people extract and use natural resources, and some of the potential social, economic, political and environmental consequences.	Laptops / chromebooks in order to conduct their research [Canadian Forest Service Statistical Data](#) [Canadian Forest Products](#) 🖱 Share these resources with students who are learning remotely as slides of pdfs by posting them to your virtual learning platform

Learning and Teaching Activities

Understand the Situation		**Understand the Situation Opportunities for Differentiation** ● Complete in pairs rather than small groups.
Within the context of their learning in geography about natural resources and the ways in which people extract and use	**Teacher Moves** The teacher circulates to observe the students and address any	

forestry products, the teacher will pose the following problem:
At the current rate of deforestation in Canada, at what point will we no longer have enough forestry products to meet our needs?

Students will be placed in small flexible groups and given the task of trying to figure out what they need to know in order to solve this problem.

The teacher consolidates the students' ideas into a larger list of what they might need to know in order to solve this problem. Anticipated responses include:
- How many hectares of trees do we have?
- How much lumber do we harvest per year?
- Is the amount of lumber we harvest increasing or holding steady?
- Are there places in Canada where we cannot harvest trees?
- How many hectares of trees are lost each year due to forest fires?
- What is the reforestation rate?

misconceptions about the problem. In order to facilitate their problem solving, the teacher can ask:
-How do we know deforestation is a concern?
-How could we prove that deforestation is a concern?
-Why might some people (e.g. governments, everyday citizens) not be concerned at this time?
-What kinds of information will you need in order to solve this problem?

- Provide students with some of the questions that might need to be answered to solve the problem to help get them started.
- Provide students with the sources for conducting their research.
- Provide students with graphic organizers for recording and organizing their research.
- Scaffold the research process using the gradual release of responsibility.
- Assist students in differentiating between relevant and extraneous information.

Opportunities for Assessment
Assessment for Learning - Observations and Conversations
- Ability to make assumptions in order to create a list of useful research questions.
- Ability to reflect on and prioritize their questions.
- Ability to research in order to collect and organize relevant data.

Opportunity for Assessment and Differentiation

At any point in this lesson during which in-school students are collaborating, at-home students can be placed in small groups by assigning them to break out rooms. Provide a sharing option so that students can capture their thinking and share it with the in-school class and the teacher (ex.: Google slides, Padlet, Jamboard, or voice recording).

Pop into the breakout rooms to listen for any misconceptions that may be surfacing. Make note of any interesting ideas that you might hear that can be shared with the in-school students to support the remote students to feel part of the discussion.

Analyse the Situation		
Students return to their small groups with the list generated by the whole class and are given the following task: a) Determine which of the questions can be researched. b) Identify which of the questions would be most useful in helping to solve the problem. c) Order your list of questions according to their usefulness in solving the problem, in order to allow for focused and timely research.	**Teacher Moves** The teacher moves about the room to support each small group in identifying which questions are the most useful for solving the problem. The teacher might ask: -Which of these questions do you need answered in order to find the point at which our supply of forestry products will not be able to meet our demand? -Which of these answers would be the most helpful in solving this problem? -Which of these questions will best help you determine how our needs of	**Analyse the Situation** **Opportunities for Differentiation** ● Differentiate by interest by grouping students according to the criteria they find most important in solving the problem. Groups share back their findings with the whole class. **Opportunities for Assessment**

Once each group has generated and prioritized their list of questions, they are given multiple periods, either during math or geography, or both, to research and gather the data to answer their questions.

[Canadian Forest Service Statistical Data](#)

[Canadian Forest Products](#)

Once each group has completed their research, the students work in their groups to reflect on their data.

forestry products might change over time?
-Which questions might be most effective in helping you determine how accessible forestry products will be over time?

The teacher will also help students determine how they could research to find the required data.

The teacher might ask:
-Where could you find the answers to these questions?
-How will you know your information is reliable?

During the research periods, it is important that the teacher is conferencing with and checking-in on each group frequently in order to ensure that their research is focused and that the data they are gathering is relevant and reliable.

The teacher circulates to observe the groups and guide them in reflecting on their data for the purpose of determining which data they are going to use to

Assessment for Learning - Observations and Conversations
● Ability to reflect on the relevance and usefulness of their data.

A student working from home might benefit from creating a record/journal of what they did, using words, sketches, photographs, screen captures, and numbers to help them describe their process.

make their model. The teacher helps the students identify which data is not helpful for solving the problem and guides them in removing extraneous information in order to make their model more manageable.

The teacher might ask:
-Which information does not help us determine when our need for forestry products will overtake our supply?
-Which information can help us answer this question?
-What quantities or measurements are remaining constant? Which quantities are changing? What is the rate at which they are changing? How do these quantities or rates of change help us determine a point at which our supply of forestry products will be overtaken by our need for these products?

Ultimately, the teacher poses the following question to each group:
-How can we use mathematics and the data you have gathered to find the point at which we will no longer have enough forestry products in Canada to meet our needs?

	-How can we use a graphic to determine when the demand will overtake the supply?	
Create a Mathematical Model		
The students work in their groups to create a model using their data that will determine when the demand for Canadian forestry products will overtake the available supply. Students' choice of graphic representations may include: -a number line -a double-bar graph -a double-line graph -an equation	**Teacher Moves** The teacher moves about the room to observe and guide small group discussions through questioning: -Which graphic representation have you selected for your model? -How could you visually represent any equations you have created? -Have you accounted for any rates that may change over time? (e.g. an increasing population would account for an increase in the demand for forestry products; increasing wildfire rates would have an impact on the available supply). The teacher identifies any groups or individual students who are still struggling with understanding the problem or who are struggling with creating a model to determine the point at which we will no longer have enough forestry products to meet our needs. The teacher addresses misconceptions and provides clarification as needed.	**Create a Mathematical Model Opportunities for Differentiation** ● Complete in pairs rather than small groups. ● The teacher could direct the prioritization of the data or provide the data to be used to develop the model. **Opportunities for Assessment** Assessment for Learning - Observations and Conversations ● Use of representations to solve the problem. ● Ability to reflect on the impact of their assumptions and the usefulness of their data. ● Ability to test out different approaches to solving the problem. ● Understanding of the impact of various rates on the point at

Analyse and Assess the Model		
In their small groups or individually in their Math Journal, the students will reflect on their models and the assumptions they made when creating their models. They will reflect on the following questions: -Does their model provide a point at which the demand for Canadian forestry products will no longer meet our needs? -Is the point in time identified by their model reasonable? -Could their model be applied to the issue of extraction / harvesting of other natural resources? Why or why not? The teacher will select certain groups or individual students to share portions of their reflections with the whole group in order to move the learning forward. For instance, the teacher will have different groups present the year that their models generated in order to demonstrate and debrief the impact of different assumptions on the specific years generated by the models. In particular, the teacher will select groups to share their models in order to demonstrate the impact that realistic assumptions, such as	**Teacher Moves** The teacher moves about the room to observe and guide the students' reflections through questioning: -Which of your assumptions were correct? -Which of your assumptions had the biggest impact on your model? -Did you recognize the fact that rates will change over time? (e.g. increasing population will impact the rate at which forestry products are used; as a natural resource becomes more limited, the rate of usage changes as people find alternative sources or the cost of the resource increases, etc.) -What impact did/would these changed rates have on the point in time generated by your model? -What were the most important factors that led to your choice of year?	which the demand for forestry products will overtake the available supply. Capture the students' work so that they can be shared with students who are learning remotely. **Analyse and Assess the Model Opportunities for Differentiation** ● Math Journals or Think/Pair/Share to reflect on the models. ● Guiding questions provided to direct the groups' reflections. **Opportunities for Assessment** Assessment as Learning - Personal Reflections (Math Journal) ● Ability to reflect on the impact their assumptions had on the effectiveness of their model. ● Ability to reflect on the similarities and differences between their model and those of their classmates in order to further improve the effectiveness of their own model. Assessment for Learning - Personal Reflections (Math Journal, Class

the increased rate of wildfires or population growth, would have on the year(s) identified as the point at which the available forestry products would no longer meet the need for such products.		Discussions) ● Ability to reflect on their assumptions and the impact their assumptions had on their model. ● Ability to reflect on the effectiveness of their model.

Consolidation of Learning		
The students present their models and explain how they used mathematics to determine a year in response to the problem. As these models would be generating predictive data, the students would be unable to test them. The teacher would lead a class discussion on what students might see happening in the real world that would lead to the need to readjust their models. For example, if the Canadian government imposed a tax on the use of forestry products or the rate of wildfires increased at an unprecedented rate, the models would have to be adjusted to account for these factors. As a class, the students reflect on which model they think best represents what would actually happen.	**Teacher Moves**: The teacher helps students see the commonalities amongst the various groups' models through questioning: -What similarities did we see between the different models? -What differences did we see between the models? -What impact did different assumptions have on the years that were generated by the models? -Which model do you think most closely represents the modelling that would take place in real life? Why? How can you tell?	**Opportunities for Assessment** Assessment of Learning ● Understanding of the mathematical modelling process, including the impact of assumptions on the effectiveness of a model, as evidenced through the students' individual reflections in their Math Journal and their contributions to the class discussion.

In their small groups or as a whole class, the students reflect on the process of mathematical learning, why we engage in mathematical modelling and what they learned about themselves as mathematicians and about the issue of deforestation.	The teacher helps students reflect on the process of mathematical modelling by posing reflective questions such as: -Why do we use mathematical modelling? How does mathematical modelling help us understand issues or solve problems? -What was the benefit of having each group share their models and their reflections? -What challenges did you face throughout the process? How did you respond to these challenges? -What different approaches did you try throughout the process? Which ones were the most effective? Why? -What did you learn about yourself as a mathematician? (e.g. in terms of solving problems, thinking creatively, representing your thinking, etc.)	

Further Consolidation/Next Steps for students and teachers:

Students may be given the opportunity to revise their mathematical models after the whole class has completed their presentations and feedback has been shared.

Students may repeat the mathematical modelling process in order to address another issue with respect to the extraction or harvesting of natural resources.