

LEARNING EXPERIENCE SIX

Guiding Question: What's needed for agriculture to meet the needs of a growing population?

This Learning Source provides starting points and information to investigate: • Sustainability goals • Population growth • Social and economic sustainability • Family farms	Build Competencies: Global food security Students create if-then statements about the relationship between population and food and analyze solutions for sustainability. This handout includes activities that support competencies, and weblinks to online resources that can support student learning. 	  Assess Look for evidence of understanding of the following concepts: • Human population growth • Energy use • Capacity • Impact on environmental For a formative assessment, have students make predictions about the potential that ecosystems approaches to food production have in meeting food needs of a growing population. Use a Cause and Effect Chart to make these predictions in the form of actions that students recommend. Have them focus their predictions on the question, What agricultural practices should we strive toward and how should we get there?
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Additional Research or Background Sources

Consult teacher or student background sources such as the examples that follow to further explore, enrich or expand activities for this guiding question.



The video *7 Billion: How did we get so big so fast?* was produced in 2011 but provides a clear explanation of population growth. Watch it at www.youtube.com/watch?v=VcSX4ytEfcE.

Read the Standing Senate Committee on Agriculture and Forestry's report, *Innovation in Agriculture: The Key to Feeding a Growing Population*, at <https://sencanada.ca/content/sen/committee/412/agfo/rms/01jun14/Home-e.htm>.

Journey 2050 takes students on a virtual farm simulation that explores world food sustainability. The program resources can be found at www.journey2050.com.

Read about the Canadian Agri-Food Sustainability Initiative at www.agrifoodsustainability.ca/, which focuses on the food supply chain and sustainability. Find background on sustainability related to the food system on their FAQ page at www.agrifoodsustainability.ca/faq-1.

The Food and Agriculture Organization of the United Nations provides the article *2050: A third more mouths to feed* at www.fao.org/news/story/en/item/35571/icode/.



Additional information and discussion questions are provided in the carousel slide for this guiding question in the **sustainability MATTERS** section of the **LEARN** webpage.

Click on the carousel slide to open and explore the following content.

- Alberta's **population facts** and a video about 150 years of population growth from the 2016 Canada Census
- An opinion that urbanization is **more than just population growth**
- Circle graphs and stats about **food production in Alberta**
- An opinion excerpt about **family farms and feeding the future**



Find **Science 9**, **Science 20** and **Biology 20** learning outcomes supported by this learning experience on the following pages.

Use this activity to have students focus on strategies that farmers use to mitigate risks to the environment and increase the efficiency of food production. How do consumer food demands and trends put pressure on environments? How does the concept of a sustainable diet affect these food trends?

Have students explore trends in the demand for protein sources and the effect of these trends on the environment and energy cycles as well as on food production. What are the challenges these trends pose for the environment and growing populations?

Challenge students to assess the impact of food waste on the food supply and the capacity of the earth's resources.

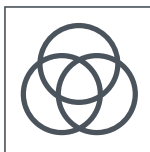
After completing activities in this learning experience, have students reflect on the importance of local farms and farmers to food production in a global context.

The World Resources Institute provides a global perspective on food production that addresses waste and discusses food production and consumption issues. Find this webpage at www.wri.org/our-work/topics/food.

Find an article that discusses myths associated with sustainable agriculture and food production, based on a study carried out in eleven countries globally by Enough Movement. *Separating myths from facts: Understanding food labels and innovation in food production* can be accessed at www.bizcommunity.com/Article/196/358/168914.html. Some of the issues identified are similar to those faced by Canadians.

> EXTEND LEARNING

Ask students to connect what they have learned about agroecosystems and food security to the ability to meet the global demand for food from an increasing population. Focus on the question, How can agroecosystems support human communities?



Have students use a **Triple Venn** to identify ecological, social and economic compromises that should be balanced to support humans and the environment. Find this graphic organizer in **sustainability MATTERS Project Tools**.



LEARNING EXPERIENCE SIX: LEARNING OUTCOMES AND COMPETENCY MAP

project AGRICULTURE Activity	GRADE 9 SCIENCE	SCIENCE 20	BIOLOGY 20
	CONCEPTUAL KNOWLEDGE	CONCEPTUAL KNOWLEDGE	CONCEPTUAL KNOWLEDGE
LEARNING SOURCE What's needed for agriculture to meet the needs of a growing population?	Unit C: Environmental Chemistry 3. Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment Investigate and evaluate potential risks resulting from consumer practices and industrial processes, and identify processes used in providing information and setting standards to manage these risks (e.g., interpret and explain the significance of manufacturer's information on how wood preservatives can be safely applied; recognize that some individuals may have greater sensitivity to particular chemical substances than do others in the general population) Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., consider more than one perspective when formulating conclusions, solving problems or making decisions on environmental quality issues) Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., consider observations and ideas from a number of sources during investigations and before drawing conclusions; strive to assess a problem or situation accurately, by careful analysis of evidence gathered) Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., show respect for all forms of life; modify their behaviour in light of an issue related to conservation and protection of the environment; recognize that the materials people use may have environmental consequences when people dispose of them)	Unit D: Changes in Living Systems 20-D1.2sts Explain that society and technology have both intended and unintended consequences for humans and the environment (SEC3) [ICT F2-4.8, F3-4.1] - Assess habitat loss and the responsibility of society to protect the environment for future generations 20-D2.2sts Explain that science and technology are developed to meet societal needs and expand human capabilities (SEC1) [ICT F2-4.8] - Contrast the diet of people in developing countries and that of people in developed countries in terms of energy efficiency and environmental impact, and describe ways to address potential food shortages in the future 20-D3.5k Describe how factors including space, accumulation of wastes (e.g., salinization of soil), competition, technological innovations, irrigation practices (e.g., Hohokam farmers) and the availability of food impact the size of populations	Unit A: Energy and Matter Exchange in the Biosphere 20-A1.1sts Explain that the process of scientific investigation includes analyzing evidence and providing explanations based upon scientific theories and concepts (NS5f) [ICT C6-4.2] - Explain, in terms of energy flow, the advantage of vegetarianism in densely populated countries. 20-A2.1sts Explain that science and technology have both intended and unintended consequences for humans and the environment (SEC3) [ICT F3-4.1] - Discuss the use of water by society, the impact such use has on water quality and quantity in ecosystems, and the need for water purification and conservation: – agricultural systems 20-A3.2sts Explain that science and technology have both intended and unintended consequences for humans and the environment (SEC3) [ICT F3-4.1] - Describe how human activities can have a disrupting influence on the balance in the biosphere of photosynthetic and cellular respiratory activities: – fossil fuel combustion – depletion of stratospheric ozone – forest destruction



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project AGRICULTURE Activity	GRADE 9 SCIENCE	SCIENCE 20	BIOLOGY 20
	PROCEDURAL KNOWLEDGE	PROCEDURAL KNOWLEDGE	PROCEDURAL KNOWLEDGE
BUILD COMPETENCIES Innovative science       	Unit C: Environmental Chemistry Ask questions about the relationships between and among observable variables, and plan investigations to address those questions - Identify science-related issues (e.g., identify issues regarding the use of soil fertilizers) - Identify questions arising from practical problems and issues (e.g., ask questions about the needs of different living things for nutrients and about the mechanisms by which these nutrients are obtained) Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results - Work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise - Receive, understand and act on the ideas of others (e.g., seek and achieve group consensus on procedures to be used in an investigative activity, and act on that consensus) - Defend a given position on an issue or problem, based on their findings (e.g., provide a clear rationale for a choice between alternative chemical products in a consumer application)	Unit D: Changes in Living Systems 20-D1.2s Conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information - Use library and electronic research tools to collect information on a given topic, such as: – protection of the environment as a priority over economic interest – sustainable development initiatives (PR-NS4) [ICT C1-4.1, C3-4.2] 20-D1.4s Work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results - Elicit feedback from others on an environmental issue (CT-NS1) - Prepare a visual display that explains initiatives undertaken by industry to protect the environment (CT-NS2) [ICT P4-4.2] 20-D3.3s Analyze data and apply mathematical and conceptual models to develop and assess possible solutions - Demonstrate and assess the effect of environmental factors on population growth curves (AI-NS2, AI-NS6) [ICT C7-4.2] - Apply the growth curve for open populations to identify the long-term impact on Earth's carrying capacity and the demands on natural resources for a growing human population (AI-NS2, AI-NS4, AI-NS6) 20-D3.4s Work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results	Unit D: Investigating Matter and Energy in the Environment 20-A3.4s Work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results Work cooperatively as a group to investigate, synthesize and present information on the effects of changes to stratospheric ozone levels on society, agriculture, plants and animals (CT-SEC1, CT-SEC2, CT-SEC3) [ICT C1-4.4, C7-4.2, F2-4.7]