




## LEARNING EXPERIENCE ONE

### Guiding Question: Is food production sustainable in the 21st century?

<p>This <b>Learning Source</b> provides starting points and information to investigate:</p> <ul style="list-style-type: none"> <li>Food systems</li> <li>Biological diversity and production</li> <li>Bioeconomies</li> <li>Organic food production</li> <li>Hormone use in food production</li> <li>Antibiotic use in food production</li> <li>Climate resilience</li> <li>Animal welfare monitoring</li> </ul>	<p><b>Build Competencies: Food production technologies</b></p> <p>Students define smart agriculture, research organic practices, investigate how food production facts affect food choices and make predict.</p> <p>This handout includes activities that support competencies and weblinks to online resources that students can explore.</p> 	 <p><b>Assess</b></p>  <p>Look for evidence of understanding of the following concepts:</p> <ul style="list-style-type: none"> <li>Impact of modern technologies in food production</li> <li>Technologies for climate resilience</li> <li>Management of farming ecosystem</li> </ul> <p>For a formative assessment, have students create a <b>Triple Venn</b> that explores the intersection between human activities, technologies and food production.</p>
--	--	---



### 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. Student research sources are also provided in **Build Competencies** handouts.

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/](http://www.fao.org/news/story/en/item/35571/icode/).

Agriculture and Agri-Food Canada provides websites that can provide students with perspectives on the range of agricultural products produced in Canada. Find connections to a variety of sources of information on the Eat Canadian webpage at [www.agr.gc.ca/eng/?id=1538141990966](http://www.agr.gc.ca/eng/?id=1538141990966). Find links to products grown across Canada on the Discover Agriculture webpage at [www.agr.gc.ca/eng/about-us/publications/discover-agriculture/?id=1411999466585](http://www.agr.gc.ca/eng/about-us/publications/discover-agriculture/?id=1411999466585).

Advertising can promote food with descriptive words that highlight trends, such as “no antibiotics, organic, made in Canada, additive-free, fair trade or locally produced.” Students may be interested in exploring some of these terms. *The Pendulum Swings 2016 Food Trends for Industry Processors*, at <http://westerngrocer.com/the-pendulum-swings-2016-food-trends-for-industry-processors/>, provides some insights into food-specific trends and is suitable as teacher background information.



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

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

- A discussion of **smart food production**
- Examples of **emerging agriculture technologies**
- A description of **precision egg farming**
- An overview of the **“rise” of the robots and parlour styles** in dairy farming
- A description and research-based article about **chicken technologies**



Find **Science 9, Science 10** and **Science 14** learning outcomes supported by this learning experience on the following page.

Use this activity to have students focus on concepts of biodiversity, environmental impacts of farming, climate change and modern technologies through the lens of food sustainability in the 21<sup>st</sup> century. Have students reflect on the science behind food trends, such as organic farming, sustainable food production and buying local. Have students identify examples of these food trends reflected in the information in the learning source.

After completing activities in this learning experience, have students write or discuss their thinking about the extent to which they think the food available to them is influenced by the increasing use of technologies in agriculture.



Look on the **VIEW** webpage for video interviews with Alberta farmers about technologies and food trends. As students watch the video, ask them to identify perspectives shared by farmers.

The Alberta government also provides a number of articles in their series, *Consumer Corner*. These articles are designed to share consumer related information with Alberta's agriculture and food industry, department staff and the public. The articles in this series include information about what consumers are buying and why they are buying it. A full listing can be accessed at <https://open.alberta.ca/publications/consumer-corner>.

Find a series of fact sheets about organic farming from the Agriculture in the Classroom Canada website at <https://aitc-canada.ca/en-ca/learn-about-agriculture/category/organics>.

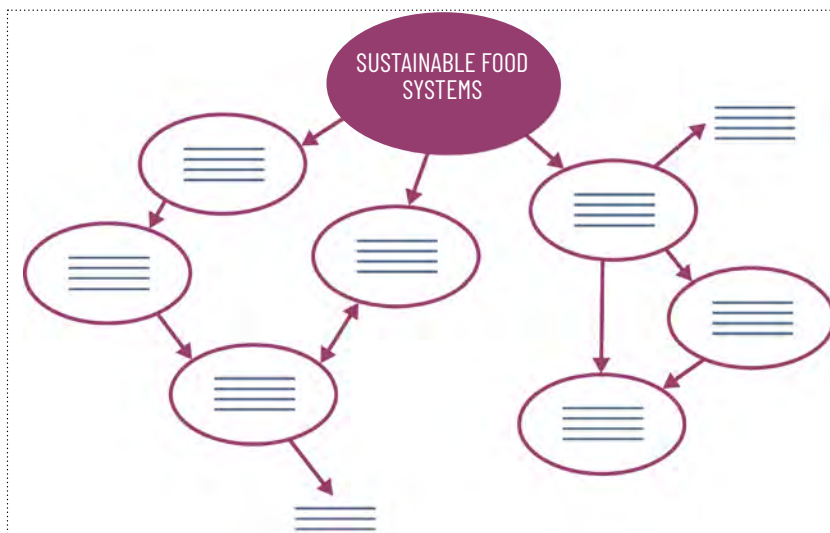
Find a white paper *Characterization and Management of Food Loss and Waste in North America* prepared for the Commission for Environmental Cooperation Canada at [www3.cec.org/islandora/en/item/11772-characterization-and-management-food-loss-and-waste-in-north-america-en.pdf](http://www3.cec.org/islandora/en/item/11772-characterization-and-management-food-loss-and-waste-in-north-america-en.pdf).

### > EXTEND LEARNING

Create a concept wall based on concepts in the learning source and smart agriculture that is centred on the concept of "sustainable food systems." Start, for example, with terms such as organics, hormones, antibiotics, climate resilience, animal welfare, waste, technology.



Have students work in groups to place these concepts in a hierarchy, using a **Mind Map**. Find this thinking map in **smart AGRICULTURE Project Tools**. These concepts may not all belong in the first "level" of the pyramid – challenge students to come up with their own hierarchies. Have the students use connectors, arrows, and descriptions to show the relationships between these concepts. As a class, discuss each group's ideas and the reasons for their choices.





## LEARNING EXPERIENCE ONE: LEARNING OUTCOMES AND COMPETENCY MAP

project AGRICULTURE Activity	GRADE 9 SCIENCE	SCIENCE 10	SCIENCE 14
	CONCEPTUAL KNOWLEDGE	CONCEPTUAL KNOWLEDGE	CONCEPTUAL KNOWLEDGE
<b>LEARNING SOURCE</b>  Is food production sustainable in the 21st century?	<b>Unit A Biological Diversity</b> 1. Investigate and interpret diversity among species and within species, and describe how diversity contributes to species survival <ul style="list-style-type: none"> <li>Identify the role of variation in species survival under changing environmental conditions (e.g., resistance to disease, ability to survive in severe environments)</li> </ul> 4. Identify impacts of human action on species survival and variation within species, and analyze related issues for personal and public decision making <ul style="list-style-type: none"> <li>Evaluate the success and limitations of various local and global strategies for minimizing loss of species diversity (e.g., breeding of endangered populations in zoos, development of seed banks, designating protected areas, development of international treaties regulating trade of protected species and animal parts)</li> <li>Investigate and describe the use of biotechnology in environmental, agricultural or forest management; and identify potential impacts and issues (e.g., investigate issues related to the development of patented crop varieties and varieties that require extensive chemical treatments; identify issues related to selective breeding in game farming and in the rearing of fish stocks)</li> </ul> Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show awareness that the scientific study of changing animal and plant populations can arise from a variety of global needs, involving many individuals and organizations)  Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., strive to assess a problem accurately by careful analysis of evidence gathered; critically consider ideas and perceptions, recognizing that the obvious is not always right)	<b>Unit D: Energy Flow in Global Systems</b> 4. Investigate and interpret the role of environmental factors on global energy transfer and climate change <ul style="list-style-type: none"> <li>Assess, from a variety of perspectives, the risks and benefits of human activity, and its impact on the biosphere and the climate (e.g., compare the Gaia hypothesis with traditional Aboriginal perspectives on the natural world; identify and analyze various perspectives on reducing the impact of human activity on the global climate)</li> </ul> Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., appreciate Aboriginal clothing and home designs of the past and present that use locally-available materials to adapt to climate; recognize that science and technology develop in response to global concerns, as well as to local needs; consider more than one factor or perspective when making decisions on Science, Technology and Society [STS] issues)  Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., view a situation from different perspectives, propose options and compare them when making decisions or taking action; evaluate inferences and conclusions with a critical mind and without bias, being cognizant of the many factors involved in experimentation)	<b>Unit D: Investigating Matter and Energy in the Environment</b> 1. Describe how the flow of matter in the biosphere is cyclical along characteristic pathways and can be disrupted by human activity <ul style="list-style-type: none"> <li>Explain how biodegradable materials reduce the impact of human-made products on the environment</li> <li>Compare the recycling of matter by society with the natural cycling of matter through ecosystems</li> <li>Assess the impact of modern agricultural technology on the natural pathways of recycling matter</li> </ul> 2. Analyze a local ecosystem in terms of its biotic and abiotic components, and describe factors of the equilibrium <ul style="list-style-type: none"> <li>Describe the relationship between land use practices and altering ecosystems (e.g., swamp drainage, slash and burn forestry, agriculture)</li> </ul> Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., consider scientific, technological, economic, cultural, political and environmental factors when formulating conclusions, solving problems or making decisions on a Science, Technology and Society issue)  Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., insist on evidence before accepting a new idea or explanation for waste reduction; insist that the critical assumptions behind any line of reasoning be made explicit, so that the validity of the position taken can be judged)



## LEARNING EXPERIENCE ONE: LEARNING OUTCOMES AND COMPETENCY MAP

project AGRICULTURE Activity	GRADE 9 SCIENCE	SCIENCE 10	SCIENCE 14
	PROCEDURAL KNOWLEDGE	PROCEDURAL KNOWLEDGE	PROCEDURAL KNOWLEDGE
<b>BUILD COMPETENCIES</b>  Food production technologies     	<b>Unit A Biological Diversity</b> Ask questions about the relationships between and among observable variables, and plan investigations to address those questions <ul style="list-style-type: none"> <li>Identify science-related issues (e.g., identify issues related to loss of species diversity)</li> </ul> Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data <ul style="list-style-type: none"> <li>Observe and record data, and prepare simple line drawings (e.g., compare two related plants by measuring, describing and drawing them)</li> <li>Research information related to a given issue (e.g., conduct an electronic search for information on factors that affect the reproduction and survival of wood frogs)</li> </ul> Analyze qualitative and quantitative data, and develop and assess possible explanations <ul style="list-style-type: none"> <li>Interpret patterns and trends in data, and infer and explain relationships among the variables (e.g., interpret data on changing animal populations, and infer possible causes)</li> </ul>	<b>Unit D: Energy Flow in Global Systems</b> Ask questions about observed relationships, and plan investigations of questions, ideas, problems and issues <ul style="list-style-type: none"> <li>Identify questions to investigate that arise from practical problems and issues (e.g., develop questions related to climate change, such as “How will global warming affect Canada’s northern biomes?”; “How will a species be affected by an increase or decrease in average temperature?”)</li> </ul> Conduct investigations into relationships between and among observable variables, and use a broad range of tools and techniques to gather and record data and information <ul style="list-style-type: none"> <li>Compile and organize data, using appropriate formats and data treatments to facilitate interpretation of the data (e.g., organize data to prepare climatographs for comparing biomes)</li> <li>Use library and electronic research tools to collect information on a given topic (e.g., research sources of greenhouse gases; research protocols to control human sources of greenhouse gases)</li> </ul> Analyze data and apply mathematical and conceptual models to develop and assess possible solutions <ul style="list-style-type: none"> <li>Compile and display, by hand or computer, evidence and information in a variety of formats, including diagrams, flow charts, tables, graphs and scatterplots</li> </ul>	<b>Unit D: Investigating Matter and Energy in the Environment</b> Ask questions about relationships between and among observable variables, and plan investigations to address those questions <ul style="list-style-type: none"> <li>Identify questions to investigate arising from practical problems and issues (e.g., develop questions related to recycling, ozone depletion or introduction of exotic species)</li> <li>Define questions and problems to facilitate investigation (e.g., develop questions to guide investigations on composting, recycling, impact of farming practices on local ecosystems)</li> </ul> Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data <ul style="list-style-type: none"> <li>Select and integrate information from various print and electronic sources (e.g., research the influence of a specific living organism—nitrogen bacteria, sulfur bacteria, sea birds, mollusks—on the cycling of matter through the biosphere, and communicate information in the form of a clearly written report; create a database or use spreadsheets to convey information on populations)</li> </ul> Analyze qualitative and quantitative data, and develop and assess possible explanations <ul style="list-style-type: none"> <li>Compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs, line graphs and scatterplots (e.g., analyze population growth curve graphs; communicate information on the flow of energy through the biosphere, using a diagram or flow chart)</li> <li>Identify new questions and problems that arise from what was learned (e.g., “Should there be more controls on bringing live animals and plants to Canada from the United States and other countries?”; “How can we reduce the amount of household wastes?”)</li> </ul>