LEARNING EXPERIENCE THREE

Guiding Question: How is plant diversity affected by agricultural landscapes?

This **Learning Source** and accompanying **Build Competencies** activities encourage students to make connections between crop plant characteristics and environmental factors and conditions, including the influence of growing seasons and climate as well as soil types, zones and their features. Students are asked to consider how crop needs are met through the growing conditions in different areas of Alberta.

This **Learning Source** provides starting points and information to investigate:

- Diverse landscapes
- Influences on land use
- Focus on seasons
- Focus on climate and soil connections
- Finding growing conditions

Organize a **"sponge model" demonstratio**n to spark thinking about the factors that affect soil and water conditions.

A series of simple demonstrations using sponges, along with accompanying explanations, that can be used to introduce and explore concepts related to soil moisture, saturation, runoff, porosity, water holding capacity and drainage can be found at www.doctordirt.org/teachingresources/sponge/. As students observe the demonstrations you select, pose questions such as the following:

- What factors affect the moisture in soil in areas that are susceptible to drought?
- What types of soil do you think would hold the most moisture?
- How does seeding and harvesting crops affect soil infiltration and water runoff? What adaptations do you think farmers could use to minimize runoff?
- What possible effects do you think water runoff from crop fields might have on soil and water sources? What adaptations do you think farmers could use to protect natural water sources?

Build Competencies: Finding Crop Locations

Students create a map that matches soil types across western Canada to the range of crops grown; and complete labs to investigate the physical properties of soil and how it influences decisions about what crops to grow.

This handout includes activities that support competencies, literacy and numeracy, and weblinks to online resources that can support student learning.

Assess

Look for evidence of understanding of the following concepts:

- Crops
- Growing conditions
- Climate
- Soil zones
- Soil properties: texture, structure, porosity, water infiltration
- Salinity

For a formative assessment, look for evidence of understanding of how texture, structure, porosity and water infiltration affects plant growth, as well as students' ability to analyze qualitative and quantitative data and develop explanations in the **soil properties lab** they complete in the **Build Competencies** lab activities.

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

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

- Soil origins in Alberta
- Soil influences
- Impact of climate change on Canadian agriculture

Lab Preparation

This learning source provides instructions for a lab that investigates soil texture, structure, porosity and water infiltration.

Preview the labs and gather the following lab supplies.

- 1000 ml beaker, clear cup or wide-mouth glass jar
- Wire mesh or sieve to fit on top of the beaker, cup or jar
- Water
- 2 soil samples from any two of the following sources, about the size of an egg:
  - Ground soil (from a lawn, garden or field)
  - Potting soil
  - Sandy soil (can make your own soil mixture)

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.

An overview of regional land use planning as it relates to agriculture in Alberta is provided on the Land Use Planning Hub at https://landusehub.ca/urban-agriculture/.

An online, map-based soil information viewer from Alberta can be accessed at www.alberta.ca/alberta-soil-information-viewer.aspx. Additional information on using this online resource is provided on the Land Use Planning Hub at https://landusehub.ca/datasets/alberta-soil-information-centre/. This resource may be more suitable for teacher-led demonstrations.

A PDF map of soil zones in Alberta from Alberta Agriculture and Forestry can be found at https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex3896/$FILE/soil_zones_map.pdf.

The Prairies Regional Adaptation Collaborative, a cost-shared initiative of Natural Resources Canada and the governments of Manitoba, Saskatchewan and Alberta, provides a discussion of the Impacts of Climate Change on the Canadian Prairies at www.prairiesrac.com/climate-impacts/#impacts-of-climate-change-on-the-canadian-prairies.

An example of a map-based exploration of climate change in the prairies, including its influence on agriculture, has been created using ArcGS StoryMaps app at www.arcgis.com/apps/MapJournal/index.html?appid=97dec6313b7147a481516ab6aeb71da3.

Agriculture and Agri-Food Canada provides detailed information on Greenhouse Gases and Agriculture at https://agriculture.canada.ca/en/agriculture-and-environment/climate-change-and-air-quality/greenhouse-gases-and-agriculture.

Explore the use of water in more depth with the Alberta Water Nexus, Energy, Food and People project. This website includes a case study that focuses on water sources for agriculture at http://albertawater.com/nexus-food/case-study-agriculture. It provides a range of resources that can be used to investigate and consider the connections between water, soil health and agriculture.

The Alberta Irrigation Districts Association website at www.albertairrigation.ca also provides information about irrigated agriculture that can help provide some background.

A discussion focused on contemporary Indigenous agriculture and land management can be found in Sowing a way towards revitalizing Indigenous agriculture: creating meaning from a forum discussion in Saskatchewan, Canada at www.facetsjournal.com/doi/10.1139/facets-2020-0004.

Canadian Geographic provides a teacher resource focused on Canada in a Changing Climate at www.canadiangeographic.com/educational_products/activities/climate_change_lesson_plans/EN/Living_World%20_Activities/Climate-Change-Lesson-Plan_Living_World_Teachers_Guide.pdf.

Find **Science 7** learning outcomes supported by this learning experience on the following page.

Use this activity to investigate the relationships between natural environments, soil and climate and the growth of crop plants, including the modifications that farmers and scientists apply to grow more food while using fewer resources. Ask students to consider the practices farmers use to increase sustainability.

> ACCOMMODATE AND/OR EXTEND LEARNING

Have students explore the map they created as part of the **Build Competencies** activities to look for patterns between land use, physical characteristics and where food crops are grown. Ask students to work with a partner or in a small group to transfer this information to an infographic focused on where and what crops are grown in Alberta.

Look on the **MEET A FARMER** webpage for video interviews with Alberta farmers on irrigation practices used on their farms.

Learning Experience Three: Learning Outcomes and Competency Map

project AGRICULTURE Activity	GRADE 7 SCIENCE	
	CONCEPTUAL KNOWLEDGE	**PROCEDURAL KNOWLEDGE**
LEARNING SOURCES How is plant diversity affected by agricultural landscapes? **BUILD COMPETENCIES** Finding Crop Locations	**Grade 7 Unit B: Plants for Food and Fibre** 1. Investigate plant uses; and identify links among needs, technologies, products and impacts • investigate trends in land use from natural environments (e.g., forests, grasslands) to managed environments (e.g., farms, gardens, greenhouses) and describe changes 2. Investigate life processes and structures of plants, and interpret related characteristics and needs of plants in a local environment • investigate and interpret variations in plant structure, and relate these to different ways that plants are adapted to their environment (e.g., distinguish between plants with shallow spreading roots and those with deep taproots; describe and interpret differences in flower form and in the timing of flower production) • describe the processes of diffusion, osmosis, conduction of fluids, transpiration, photosynthesis and gas exchange in plants [Note: This item requires a general understanding of the processes; it does not require knowledge of the specific biochemistry of these processes.] 3. Analyze plant environments, and identify impacts of specific factors and control • describe methods used to increase yields, through modifying the environment and by creating artificial environments (e.g., describe processes used in raising bedding plants or in vegetable production through hydroponics) • investigate and describe characteristics of different soils and their major component (e.g., distinguish among clayey soils, sandy soils and soils rich in organic content; investigate and describe particle sizes, compaction and moisture content of soil samples) • identify practices that may enhance or degrade soils in particular applications 4. Identify and interpret relationships among human needs, technologies, environments, and the culture and use of living things as sources of food and fibre • identify the effects of different practices on the sustainability of agriculture and environmental resources (e.g., identify positive and negative effects of using chemical fertilizers and pesticides and of using organic farming practices)	**Grade 7 Unit B: Plants for Food and Fibre** Ask questions about the relationships between and among observable variables, and plan investigations to address those questions • define practical problems (e.g., identify problems in growing plants under dry conditions) • identify questions to investigate arising from practical problems and issues (e.g., What methods will help limit moisture loss from plants and soil? What reduction in the loss of soil moisture can be achieved through the use of a plastic ground sheet or through the use of a plastic canopy?) Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data • research information relevant to a given problem • state a prediction and a hypothesis based on background information or an observed pattern of events (e.g., predict the effect of a particular plant treatment) • observe and record data, and create simple line drawings (e.g., describe plant growth, using qualitative and quantitative observations; draw and describe plant changes resulting from an experimental procedure) Analyze qualitative and quantitative data, and develop and assess possible explanations • compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs and line graphs (e.g., prepare a record of a plant's growth that charts its development in terms of height, leaf development, flowering and seed production) • identify new questions and problems that arise from what was learned Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results • communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means (e.g., show the growth of a group of plants over time through a data table and diagrams) Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., consider the nutrient content of food they eat and the potential presence of residues; consider observations and ideas from a number of sources, during investigations and before drawing conclusions) Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., assume responsibility for their share of work in preparing for investigations and in gathering and recording evidence; consider alternative ideas and approaches suggested by members of the group; share the responsibility for difficulties encountered in an activity)