

Challenge BEEF



SUSTAINABILITY

How does sustainability affect my food choices?



Activity-Based Challenges for
Learning about Farming,
the Food System and the
Environment in
Alberta Junior and Senior High
Science and Social Studies



The **Challenge BEEF** teaching resources provide curriculum-based activities and supports for a mini-unit that focuses on the contributions and vitality of agriculture in Alberta. Activities encourage students to explore cattle farming and ranching in Alberta. From family farms and ranches, passed down through generations, to new, state-of-the-art feeding and breeding operations, Alberta's farmers and ranchers are proud of their industry.

The many authentic photos and stories used in these learning resources share the land, resources, experiences and stewardship that are part of Alberta cattle farming and ranching families.

It is our hope that students develop understandings of the ways of life involved in raising cattle and contributing to Alberta's and Canada's food system while respecting the different choices that people make about their food. Alberta Beef Producers is proud to support education and provide the **Challenge BEEF** resources for teachers and students in junior and senior high Social Studies and Science programs, with potential support for other areas of Alberta curriculum as well.

The **Challenge BEEF** resources were conceptualized and developed for Alberta Beef Producers by the education experts and design team at **InPraxis Learning**:

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Alberta Beef thanks our teacher reviewers, who provided valuable suggestions and feedback during the development of the **Challenge BEEF** program resources.

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Alberta Beef Producers also thanks the cattle farmers and ranchers who have shared stories and photos that are used in these resources.

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Readers should be aware that Internet websites offered as citations and/or sources for further information may have changed or disappeared between the time this was written and when it is read. Teachers are cautioned that all websites listed in this resource should be checked for appropriateness and suitability before being provided to, or used with, students.

Every effort has been made to acknowledge sources used in the **Challenge BEEF** resources. In the event of questions arising as to the use of any material, we will be pleased to make the necessary corrections in future versions.



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TOPIC: SUSTAINABILITY

How does sustainability affect my food options?



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The **Challenge BEEF** resources provide activities that encourage students to translate their learning into experiences that are personally meaningful and that can make a difference to their own understandings and decision-making.



The Challenge BEEF Series

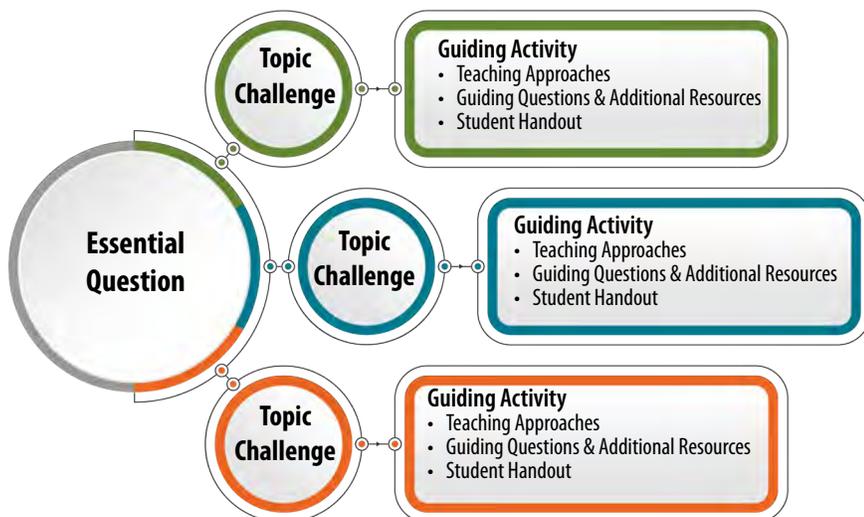
The **Challenge BEEF** resources provided by Alberta Beef Producers are organized around a series of challenges for student learning. These challenge resources provide activities that are structured so they can be implemented in **one to three** junior or senior high classes, and support Alberta Science and Social Studies curriculum. Suggestions are also provided for possible integration into other subject areas, including English Language Arts and Career and Technology Studies AGR courses.

Three Challenge BEEF resources encourage students to explore agriculture through current issues connected to three big idea topics. Each of the three resources are organized around an essential question:

- This **SUSTAINABILITY** resource is focused on the essential question: **How does sustainability affect my food choices?**
- The **RESILIENCE** resource is focused on the essential question: **How does globalization affect the resilience of our food system?**
- The **MEDIA MESSAGES** resource is focused on the essential question: **How can media messages contribute to misinformation about food choices?**

The essential question provides a focus for student research and for building understandings. However, you and your students are also encouraged to adapt, revise or develop your own essential question for a topic.

Each resource topic is focused on an **essential question** and includes a **culminating topic challenge**. The topic challenge turns the essential question into a call to action by asking students to create a solution or response applicable to local and/or personal contexts. The topic challenge can provide a focus for a student project or simply for the implementation of any or all of the guiding activities.



Adapting Challenge Based Learning to Activity-Centred Learning



“Challenge Based Learning mirrors the 21st century workplace. Students work in collaborative groups and use technology to tackle real-world issues in the context of their school, family, or local community. For teachers, the task is to work with students to take multidisciplinary standards-based content, connect it to what is happening in the world today, and translate it into an experience in which students make a difference in their community.”

SOURCE: Apple Inc. (2010). Challenge-Based Learning: A Classroom Guide. https://images.apple.com/education/docs/CBL_Classroom_Guide_Jan_2011.pdf

This approach mirrors and supports the development of Alberta Education’s competencies. “Competencies are combinations of attitudes, skills and knowledge that students develop and apply for successful learning, living and working.”

SOURCE: Alberta Education online. What are competencies? <https://education.alberta.ca/competencies/student-competencies/>

EACH TOPIC RESOURCE INCLUDES THE SAME ELEMENTS, AS ILLUSTRATED IN THE ORGANIZATION FLOWCHART ON THIS PAGE.



The **Challenge BEEF** resources are designed so they can be implemented as a series of lessons that culminate in a challenge **OR** so that each guiding activity could be implemented as a single, discrete lesson and integrated into existing units.

Although the three topics are targeted at specific curricular areas, there are many opportunities to mix and match the activities found in each and integrate them into other grade levels and subject areas. Tips for making additional curriculum links are provided in the teaching suggestions for each activity.

PREVIEW THE THREE Challenge BEEF TOPICS ON THE FOLLOWING PAGES.

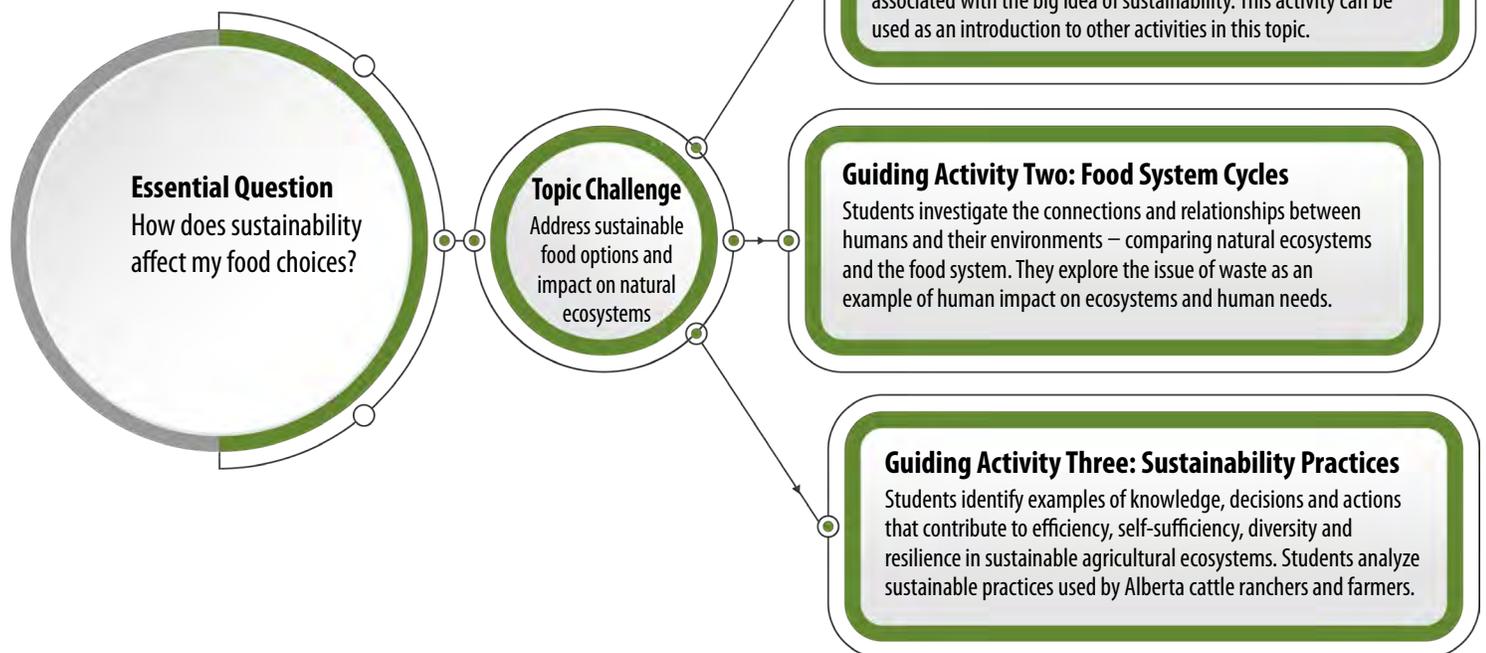
Topics – and the essential question – are developed through **guiding activities**. The guiding activities in each topic can be selected, broadened and/or expanded to be implemented as a single-class activity or as a whole challenge-based mini-unit. The guiding activities include suggestions for **guiding questions** and **guiding resources**, which can provide support for the essential question.

Guiding questions are questions that are posed to students. They can be shared in writing, as part of class discussions or posted on an online bulletin board. Guiding questions support students’ work on their learning tasks by calling their attention to concepts and details that will help them complete a task. Guiding questions should encourage students to move to higher levels of thinking. **Guiding resources** include the student handouts as well as suggestions for other online sources, including websites and videos.

The guiding activities also include **mini challenge activities** to facilitate implementation choices and flexibility – if you choose to implement only one or two of the guiding activities in this topic, the mini challenge in each can reinforce application of students’ learning to local and/or personal contexts. Mini challenges are tasks that students can complete for formative or summative assessment.

Each guiding activity also includes suggestions for implementation in in-class, remote learning, individual, paired or small group contexts. All student handouts provide **fillable fields**, which can facilitate independent, online and remote learning.

This flowchart provides an overview of the organization of the **SUSTAINABILITY** topic.



TOPIC: SUSTAINABILITY

ESSENTIAL QUESTION: How does sustainability affect my food options?



Challenge BEEF: SUSTAINABILITY centres on the concept of sustainability. It asks students to consider messages that affect understandings of sustainability and shares examples of agricultural practices implemented by cattle ranchers and farmers in Alberta. The **three** guiding activities in this topic encourage students to consider how they can practice sustainability in their personal environments.

This topic's cumulative challenge asks students to design, create and/or develop a project that addresses the extent to which the food system provides sustainable food options, considering the impact of food production on natural ecosystems. Mini challenges are also included with each guiding activity.

Challenge BEEF: SUSTAINABILITY supports specific learning outcomes in **Grade 7 Science Topic A: Interactions and Ecosystems**.

Suggestions for linking learning to **Grade 8 Science Unit E: Freshwater and Saltwater Systems**; **Grade 9 Science Topic C: Environmental Chemistry** and **Career and Technology Studies AGR 2010: Introduction to Agriculture** are also provided.

TOPIC: RESILIENCE

ESSENTIAL QUESTION: How does globalization affect the resilience of our food system?

Challenge BEEF: RESILIENCE focuses on the implications of globalization on the food system, in the face of an unforeseen disturbance like the COVID-19 pandemic. It encourages students to explore the balance between global markets and local sourcing in the food supply chain, using examples from the beef production industry. The **two** guiding activities in this topic encourages students to consider how their food choices are affected by both globalization and local responses to issues in the food supply chain.

This topic's cumulative challenge asks students to design, create and/or develop a project that supports a resilient food system, either at a local level – personal, school, community – and/or in response to a globalized food supply. Mini challenges are also included with each guiding activity.

Challenge BEEF: RESILIENCE supports specific learning outcomes in **Grade 10 Social Studies: Related Issues 3 and 4. To what extent does globalization contribute to sustainable prosperity for all people? and To what extent should I, as a citizen, respond to globalization?**

Suggestions for linking learning to **Social Studies 9.2 Issues for Canadians: Economic Systems in the United States and Canada**, **Science 24 Unit C: Disease Defence and Human Health** and **Career and Technology Studies AGR 2010: Introduction to Agriculture** are also provided.

TOPIC: MEDIA MESSAGES

ESSENTIAL QUESTION: How can media messages contribute to misinformation about food choices?

Challenge BEEF: MEDIA MESSAGES centres on examples of media messages that can intentionally and/or unintentionally promote misinformation, myths and misconceptions about the food system. The **three** guiding activities in this topic encourage students to apply evidence and critically assess the credibility of messages found in social and news media about climate change and consumer food trends.

This topic's cumulative challenge asks students to design, create and/or develop a project that fact checks misconceptions and misinformation about an aspect of the food system. Mini challenges are also included with each guiding activity.

Challenge BEEF: MEDIA MESSAGES supports specific learning outcomes in **Science 10 Unit D: Energy Flow in Global Systems** and **Social Studies 9.2 Issues for Canadians: Economic Systems in the United States and Canada**.

Suggestions for linking learning to **Grade 10 Social Studies: To what extent should we embrace globalization?** and **Grade 9 Language Arts and English 10-1 or 10-2** as well as **Grade 9 Math** and **Math 10C** are also provided.

FOCUS ON SUSTAINABILITY



Introduction to the SUSTAINABILITY Topic

How do we want to produce the food that we eat? What kinds of food should we produce, and which factors should be considered when producing it? Agriculture involves processes, inputs and outputs, but it is also a reflection of society's preferences and values.

Sustainability is an important consideration in agriculture and food production. This challenge guide uses examples from agriculture, and specifically the beef production system in Alberta, to explore questions and issues related to sustainability. Students can also be encouraged to broaden their investigations to other areas of agriculture with their investigations.



Sustainability is commonly described as “meeting the needs of the present without compromising the ability of future generations to meet their needs while ensuring long-term ecological, social, and economic health.” This well-known definition of sustainability comes from the Brundtland Report, a product of a 1989 United Nations commission on development.

Challenge BEEF: SUSTAINABILITY builds understandings of the importance and application of sustainability practices in our food system, including the impact of sustainability initiatives on natural ecosystems and agriculture.

Implementing a Mini-Unit or Selecting Individual Activities

This topic is developed through three guiding activities, all focused on the essential question: **How does sustainability affect my food choices?** An overview and curriculum correlation for each guiding activity is provided on pages 12 to 15.

Guiding Activity 1: Message Cloud (pages 16 to 19)

Guiding Activity 2: Food System Cycles (pages 20 to 26)

Guiding Activity 3: Sustainability Practices (pages 27 to 32)

- Additional definitions of the concept of sustainability are shared in **STUDENT RESOURCE 1**, provided on pages 37 to 40.

- These three guiding activities can be implemented in sequence as a mini-unit, focused on the big idea of sustainability.
- Alternatively, individual guiding activities can be selected and implemented in one-to-two class settings to supplement and enrich existing lessons. Students may also have ideas for additional investigations that connect to other areas of their learning.



Teaching approaches and strategies in each guiding activity support the development of the essential question with suggestions for strategies, sequencing and levelled alternatives. Look for additional curriculum links and guiding resource weblinks that can supplement learning tasks in the student handouts.

The topic challenge responds to the essential question by asking students to create a personal response; a storyboard or video message, public service announcement, social media post or other products that communicate their findings and conclusions.

Each guiding activity includes:

- Teaching approaches and strategies
- Scaffolding and assessment tips
- Guiding questions and guiding resource suggestions for inquiry and research
- A student learning resource handout
- A mini-challenge

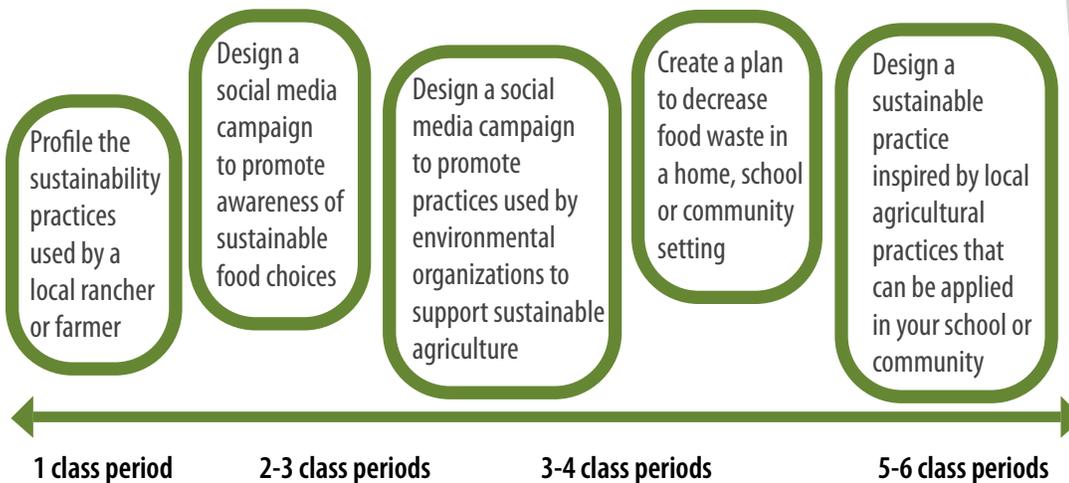
The following guiding questions are provided in the guiding activities and are supported with suggestions for additional guiding resources that can be used for student inquiry and research. These questions include the following:

- How do farmers address sustainability?
- How do farm and ranch environments affect or interact with natural ecosystems?
- What examples of sustainability might we see on a beef cattle ranch or farm?
- Where does sustainability fit with food options we find at home, on a ranch or farm or in stores?
- What does sustainability look like in Alberta's food system?
- How can sustainability practices be promoted?
- What challenges do farmers and ranchers face with sustainability?
- Why could the food system be considered an energy source?
- What makes a food system sustainable?
- How are sustainable ranches and farms like natural ecosystems?
- How can natural ecosystems provide a model for a sustainable food system?
- What does sustainability look like on local ranches and farms?
- How do sustainable practices on ranches and farms benefit natural ecosystems and the food system?
- How might unsustainable practices threaten natural ecosystems and the food system?
- How does innovation affect sustainability practices?

The Cumulative Topic Challenge

The cumulative topic challenge asks students to design, create and/or develop a project that addresses the extent to which the food system provides sustainable food options, considering the impact of food production on natural ecosystems.

Sample project formats and choices can be provided to students, depending on the time that is appropriate for a challenge task. Consider examples such as the following, that may vary from one class or day to a weeklong task.



- Encourage students to brainstorm issues connected to the concept of sustainability – and specifically resilience in our food system – that they could be interested in tackling in personal, school or the broader community level.
- Initial brainstorming might involve a whole class discussion, partner or small group brainstorm, or individual home assignments.



The **Challenge Based Learning (CBL)** website provides a number of resources that can support teaching and learning in a challenge based learning format at www.challengebasedlearning.org/toolkit/. The **CBL rubric** provides a starting point to develop personalized resources to guide the learning experience. This rubric can be accessed at www.challengebasedlearning.org/wp-content/uploads/2019/03/CBL_Rubric.pdf.

- Students can be provided with the **CHALLENGE CANVAS**, a template that allows them to track the big idea, essential question, guiding questions on which they are focusing, guiding activities and resources they complete and use as well as a synthesis of their learning and their challenge project idea. This fillable template is found on pages 66 to 67.

Guiding Activity Overview and Curriculum Support

Challenge BEEF: Sustainability addresses selected learning outcomes in **Grade 7 Science Topic A: Interactions and Ecosystems**. Additional curriculum connections may be identified in some of the guiding activities.



Guiding Activity	Focus	Curriculum Links This guiding activity supports the following outcomes from Grade 7 Science Topic A: Interactions and Ecosystems :
<p>1 Message Cloud</p>	<p>In this activity, students explore the concept of sustainability, based on what they know, have heard or have experienced. They create a group or class word cloud, looking critically at terms and concepts that are most associated with the big idea of sustainability. This activity can be used as an introduction to other activities in this topic.</p>	<p>1. Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions</p> <ul style="list-style-type: none"> <input type="checkbox"/> identify examples of human impacts on ecosystems, and investigate and analyze the link between these impacts and the human wants and needs that give rise to them (e.g., identify impacts of the use of plants and animals as sources of food, fibre and other materials; identify potential impacts of waste products on environments) <input type="checkbox"/> analyze personal and public decisions that involve consideration of environmental impacts, and identify needs for scientific knowledge that can inform those decisions <p>Ask questions about the relationships between and among observable variables, and plan investigations to address those questions</p> <ul style="list-style-type: none"> <input type="checkbox"/> identify science-related issues (e.g., identify a specific issue regarding human impacts on environments) <input type="checkbox"/> identify questions to investigate arising from practical problems and issues (e.g., identify questions, such as: “What effects would an urban or industrial development have on a nearby forest or farming community?”)
<p>2 Food System Cycles</p>	<p>In this activity, students investigate the connections and relationships between humans and their environments – comparing natural ecosystems and the food system. They explore the issue of waste as an example of human impact on ecosystems and human needs.</p>	<p>1. Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions</p> <ul style="list-style-type: none"> <input type="checkbox"/> illustrate how life-supporting environments meet the needs of living things for nutrients, energy sources, moisture, suitable habitat, and exchange of gases <input type="checkbox"/> identify examples of human impacts on ecosystems, and investigate and analyze the link between these impacts and the human wants and needs that give rise to them (e.g., identify impacts of the use of plants and animals as sources of food, fibre and other materials; identify potential impacts of waste products on environments)

This guiding activity could be adapted to reinforce the concept of sustainability and explore how it relates to environmental monitoring in **Grade 9 Science Unit C: Environmental Chemistry**.

It may also help meet specific learning outcomes relating to sustainability in **CTS: AGR 1010 Introduction to Agriculture**.

Guiding Activity	Focus	Curriculum Links This guiding activity supports the following outcomes from Grade 7 Science Topic A: Interactions and Ecosystems:
2 Food System Cycles (continued)		<p>4. Describe the relationships among knowledge, decisions and actions in maintaining life-supporting environments</p> <ul style="list-style-type: none"> <input type="checkbox"/> identify intended and unintended consequences of human activities within local and global environments (e.g., changes resulting from habitat loss, pest control or from introduction of new species; changes leading to species extinction) <input type="checkbox"/> describe and interpret examples of scientific investigations that serve to inform environmental decision making <p>Ask questions about the relationships between and among observable variables, and plan investigations to address those questions</p> <ul style="list-style-type: none"> <input type="checkbox"/> identify science-related issues (e.g., identify a specific issue regarding human impacts on environments) <input type="checkbox"/> identify questions to investigate arising from practical problems and issues (e.g., identify questions, such as: “What effects would an urban or industrial development have on a nearby forest or farming community?”) <p>Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data</p> <ul style="list-style-type: none"> <input type="checkbox"/> research information relevant to a given problem or issue <input type="checkbox"/> select and integrate information from various print and electronic sources or from several parts of the same source (e.g., compile information on a global environmental issue from books, magazines, pamphlets and Internet sites, as well as from conversations with experts) <p>Analyze qualitative and quantitative data, and develop and assess possible explanations</p> <ul style="list-style-type: none"> <input type="checkbox"/> 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., illustrate a food web, based on observations made within a given environment)

This guiding activity could be adapted to focus on the impact of human activity on water quality and sources in **Grade 8 Science Unit E: Freshwater and Saltwater Systems**.

It may also help meet specific learning outcomes relating to sustainable agricultural production, including a sustainable food supply and waste management in **CTS: AGR 1010 Introduction to Agriculture**.

Guiding Activity

Focus

Curriculum Links

This guiding activity supports the following outcomes from **Grade 7 Science Topic A: Interactions and Ecosystems**:

3 Sustainability Practices

In this activity, students identify examples of knowledge, decisions and actions that contribute to efficiency, self-sufficiency, diversity and resilience in sustainable agricultural ecosystems. Students analyze sustainable practices used by Alberta cattle ranchers and farmers.

1. Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions

- analyze personal and public decisions that involve consideration of environmental impacts, and identify needs for scientific knowledge that can inform those decisions

3. Monitor a local environment, and assess the impacts of environmental factors on the growth, health and reproduction of organisms in that environment

- investigate a variety of habitats, and describe and interpret distribution patterns of living things found in those habitats (e.g., describe and compare two areas within the school grounds—a relatively undisturbed site and a site that has been affected by heavy use; describe and compare a wetland and a dryland area in a local parkland)
- investigate and interpret evidence of interaction and change (e.g., population fluctuations, changes in weather, availability of food or introduction of new species into an ecosystem)

4. Describe the relationships among knowledge, decisions and actions in maintaining life-supporting environments

- identify intended and unintended consequences of human activities within local and global environments (e.g., changes resulting from habitat loss, pest control or from introduction of new species; changes leading to species extinction)
- describe and interpret examples of scientific investigations that serve to inform environmental decision making
- analyze a local environmental issue or problem based on evidence from a variety of sources, and identify possible actions and consequences (e.g., analyze a local issue on the control of the beaver population in a nearby wetland, and identify possible consequences)

Guiding Activity	Focus	Curriculum Links This guiding activity supports the following outcomes from Grade 7 Science Topic A: Interactions and Ecosystems:
3 Sustainability Practices (continued)		<p>Ask questions about the relationships between and among observable variables, and plan investigations to address those questions</p> <ul style="list-style-type: none"> <input type="checkbox"/> identify science-related issues (e.g., identify a specific issue regarding human impacts on environments) <input type="checkbox"/> identify questions to investigate arising from practical problems and issues (e.g., identify questions, such as: “What effects would an urban or industrial development have on a nearby forest or farming community?”) <p>Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data</p> <ul style="list-style-type: none"> <input type="checkbox"/> research information relevant to a given problem or issue <input type="checkbox"/> select and integrate information from various print and electronic sources or from several parts of the same source (e.g., compile information on a global environmental issue from books, magazines, pamphlets and Internet sites, as well as from conversations with experts) <p>Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results</p> <ul style="list-style-type: none"> <input type="checkbox"/> 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., present findings from an analysis of a local issue, such as the control of the beaver population in a nearby wetland) <input type="checkbox"/> defend a given position on an issue, based on their findings (e.g., make a case for or against on an issue, such as: “Should a natural gas plant be located near a farming community?”) <p>Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., assume personal responsibility for their impact on the environment; predict consequences of proposed personal actions on the environment; consider both immediate and long-term consequences of group actions; identify, objectively, potential conflicts between responding to human wants and needs and protecting the environment)</p>

This guiding activity could be adapted to focus on practices that farmers and ranchers use to protect water sources and support learning in **Grade 8 Science Unit E: Freshwater and Saltwater Systems**.

Students can also focus on the extent to which biological diversity is affected by sustainable practices that farmers and ranchers implement, supporting learning outcomes in **Grade 9 Science Unit A: Biological Diversity**.

Some learning tasks can be adapted to focus on processes used by farmers and ranchers to monitor substances in the environment and protect water systems to support learning in **Grade 9 Science Unit C: Environmental Chemistry**.

It may also help meet specific learning outcomes relating to the environmental impact of agriculture in **CTS: AGR 1010 Introduction to Agriculture**.

Challenge BEEF: SUSTAINABILITY

How does sustainability affect my food options?



MESSAGE CLOUD



Grade 7 Science
Topic A: Interactions
and Ecosystems

In this guiding activity, students explore the concept of sustainability, based on what they know, have heard or have experienced. They create a group or class word cloud, looking critically at terms and concepts that are most associated with the big idea of sustainability. This activity can be used as an introduction to other activities in this topic.

ASSESSMENT

Formative assessment can focus on the extent to which students demonstrate understandings of the concept of sustainability and connect it to the impact of human activities, such as agriculture, on natural environments and ecosystems.

- Track questions for further research and inquiry that students pose, having them identify how science-related issues and practical problems and issues are reflected in their questions.
- Collect examples of student definitions of the term “sustainability” and use them to reinforce different perspectives about messages related to sustainability.
- Assess students’ definitions and examples of environmental, economic and social aspects of sustainability, including the significance of sustainability to natural ecosystems.
- Assess for a range of perspectives related to the concept of sustainability described and compared in the Venn graphic organizer completed in HANDOUT 1: MESSAGES ABOUT SUSTAINABILITY.

ADDITIONAL CURRICULUM LINKS

- Grade 9 Science Unit C: Environmental Chemistry
- Career and Technology Studies: AGR 1010 Introduction to Agriculture

KEY CONCEPTS

- Sustainability
- Sustainable
- Environment
- Interactions
- Ecosystems

TIMING

- 30 minutes to 2 hours

GUIDING ACTIVITY 1: Message Cloud

THIS GUIDING ACTIVITY INTRODUCES CONCEPTS RELATED TO SUSTAINABILITY. IT CAN BE USED TO INTRODUCE A CHALLENGE OR IMPLEMENTED AS A SINGLE CLASS ACTIVITY. HIGHLIGHT CONNECTIONS THAT STUDENTS MAKE BETWEEN HUMAN ACTIVITIES AND NATURAL ECOSYSTEMS.

Start the activity by sharing or writing the term *SUSTAINABILITY* on a classroom or digital board.

Provide students with **HANDOUT 1: MESSAGES OF SUSTAINABILITY**. This handout provides some “thought-starters” to help students brainstorm what comes to mind when they think about sustainability.

Invite students to record words, phrases or descriptions either directly on the first page of the handout or by using one of the strategies below. Students can brainstorm individually, with a partner or with a small group.



Alternatively, have students brainstorm individually, using strips of paper or sticky notes. Then, use an affinity mapping process to have them come to the board in pairs or groups of three and combine their brainstormed words and phrases as appropriate.

Identify and discuss those words that occurred most frequently.

- Use a **discussion board strategy** to have students share their ideas. Have students brainstorm on sticky notes and post them on a classroom whiteboard. Alternatively, use a digital board like Google Jamboard or Padlet to share virtual sticky notes.
- Use a live word cloud generator with students, using an app such as Mentimeter. Post brainstorming focus questions like *WHAT IS SUSTAINABILITY?* and/or *WHAT IS THE OPPOSITE OF SUSTAINABILITY?* in the app and have students use their devices to respond.

Watch as the word cloud is created and changes with student responses. Discuss those words that are highlighted the most in the word cloud.

Digital and Remote Brainstorming



Google Jamboard is Google’s cloud-based interactive whiteboard that works on Chromebooks as well as on the web. It can be used for interactive remote lessons. It can be used for both synchronous and asynchronous learning. Find information from Google at https://edu.google.com/products/jamboard/?modal_active=none.

Padlet at <https://padlet.com> is a web app that lets users post notes on a digital wall. Students can post text, videos and images from a mobile device or a desktop. Use Padlet also for reflection boards that encourage students to post comments and thoughts about their learning.

Flipgrid at <https://info.flipgrid.com/> is a website that allows teachers to create “grids” to facilitate video discussions. Each grid is like a message board where teachers can pose questions, called “topics,” and their students can post video responses that appear in a tiled grid display. Teachers set up an account and create grids, which act as communities for students to work in. Within each grid, you can create prompts called topics, and students can post video responses to the prompts and replies to each other’s videos.

Mentimeter is an online tool that lets you interact with your students in real time. The app allows you to create and share live polls, quizzes, word clouds and Q&As. Find more information at www.mentimeter.com.



Additional Curriculum Links

Adapt this activity to **Grade 9 Science Unit C: Environmental Chemistry** by emphasizing the concept of balance between substances and environmental needs associated with agriculture and those that are part of natural cycles and changes in the environment. Discuss the role of different substances in the environment in supporting the human activity of agriculture. Encourage students to make connections between the concept of sustainability and decisions that are made about the impacts of different substances on local and global environments.

This activity could also be adapted to explore understandings of the concept of sustainability in **CTS AGR 1010** and reinforce how economic, environmental and social factors apply to sustainable agriculture.

- Student engagement can often be enhanced with the use of visual cues and starters. Use the images and videos listed below once students have posted and shared their brainstorming.

Watch **Journey 2050: Introduction** at www.youtube.com/watch?v=zYecU_gJdxA and **Sustainability Barrel – Journey 2050** at <https://youtu.be/nTAXPO-YDF8> for a quick overview of elements that influence sustainability.

Preview the video **What is Sustainability?** from Christian Weisser (Bedford Spotlight) at www.youtube.com/watch?v=rmQby7adocM&feature=emb_logo as an option to share with students.

This video provides an excellent overview of the evolution of definitions of sustainability and addresses its relevance to natural environments, ecosystems and human activities. Grade 7 students may need support as they watch and listen to this video. Plan to play sections of the video, identify and discuss vocabulary and guide students in making connections to their learning.

Another video called **What is Sustainability?** is provided by The Lexicon and can be accessed at www.youtube.com/watch?v=QptExNJCgEU.

This video explores the different meanings of sustainability, its connection to values and principles and direct examples of agricultural perspectives. This video makes excellent references to the responsibility of individuals to participate with their communities.

Note that both of these videos are from American sources. Connections should be made to Canadian and Alberta contexts.

Ask students to compare their combined brainstorming to the study that identified concepts associated with sustainability referenced in **HANDOUT 1: MESSAGES OF SUSTAINABILITY**, using the **Venn graphic organizer**. Review and discuss the definitions provided in the handout and then, revisit understandings of sustainability.

Have students use their understanding to identify guiding questions that can help build understandings of ways that sustainability has an impact on their daily lives – through the food options that are available to them. These guiding questions can form a focus for the subsequent two activities and the cumulative challenge in this topic.

- How do farmers address sustainability?
- How do farm and ranch environments affect or interact with natural ecosystems?
- What examples of sustainability might we see on a beef cattle ranch or farm?

- Where does sustainability fit with food options we find at home, on a ranch or farm or in stores?
- What does sustainability look like in Alberta's food system?
- How can sustainability practices be promoted?
- What challenges do farmers and ranchers face with sustainability?
- Why could the food system be considered an energy source?



SOME BACKGROUND RESOURCES

The **Journey 2050** program provides a focus on sustainable agriculture and can be accessed at www.journey2050.com. An introductory video to the program includes a discussion of sustainable agriculture at www.youtube.com/watch?v=gePneYLv5to&feature=youtu.be.

The **Food Insight** website provides a section focused on sustainability which includes articles and research studies that come from peer-reviewed science and the work of authoritative bodies, including the U.S. Food and Drug Administration, the U.S. Department of Agriculture, the National Academies of Sciences, Engineering, and Medicine, the European Food Safety Authority and others. Food Insight is an information hub created and curated by nutrition and food safety experts at the International Food Information Council (IFIC). Find this section at <https://foodinsight.org/category/sustainability/>.

Find a discussion of consumer trends and interest in sustainability in **Intuitive Eating and the "Un-Diet"; Sustainability (Finally!) Takes Shape; New Food Tech Gathers Momentum** at <https://foodinsight.org/2020-trends/> - this article may provide additional insights into definitions and understandings of the concept of sustainability that can enhance class discussions in this activity.

Other articles can provide background information on various issues related to sustainability that can be discussed with students.

The **Best Food Facts** website also provides a section on sustainability at www.bestfoodfacts.org/category/sustainability/. The article **Weighing Pros & Cons to Make Sustainable Choices** provides an initial discussion and a graphic that illustrates the idea that a change in one area can have a positive or negative impact in another.



MINI CHALLENGE

Implement this activity as a mini challenge that asks students to apply the concept of sustainability to decisions they make on a daily basis, such as.

- Food choices
- Favourite products
- Daily routines
- Activities

Challenge BEEF: SUSTAINABILITY

How does sustainability affect my food options?

FOOD SYSTEM CYCLES



Grade 7 Science
Topic A: Interactions
and Ecosystems

In this guiding activity, students investigate the connections and relationships between humans and their environments – comparing natural ecosystems and the food system. They explore the issue of waste as an example of human impact on ecosystems and human needs.

ASSESSMENT

Formative assessment can be centred on the graphic organizers and thinking maps that students use to compare and analyze interactions and interdependencies that are part of agriculture.

- Collect examples of data researched and organized by students into the Triple T-Chart in **HANDOUT 2: FOOD SYSTEMS AND ECOSYSTEMS**. Have students identify how they analyzed and integrated information from different sources of information.
- Look for evidence of how connections between agriculture and natural ecosystems represent interactions and interdependencies between humans and their environments.
- Focus on examples of decisions and actions about food waste in the Mind Maps completed as part of **HANDOUT 2: FOOD SYSTEMS AND ECOSYSTEMS**. Assess the extent to which multiple perspectives on this issue are represented by students.

ADDITIONAL CURRICULUM LINKS

- Grade 8 Science Unit E: Freshwater and Saltwater Systems
- Grade 9 Science Unit C: Environmental Chemistry
- Career and Technology Studies: AGR 1010

KEY CONCEPTS

- Ecosystems
- Agriculture
- Food system
- Cycles
- Inputs
- Outputs
- Waste

TIMING

- 1 to 3 hours

GUIDING ACTIVITY 2: Food System Cycles

THIS GUIDING ACTIVITY ASKS STUDENTS TO INVESTIGATE THE IMPACT OF AGRICULTURE ON ECOSYSTEMS AND ANALYZE THE LINK BETWEEN THE FOOD SYSTEM AND THE ENVIRONMENT, FOCUSING ON INPUTS AND OUTPUTS INVOLVED. STUDENTS ALSO ANALYZE THE IMPACT OF WASTE ON FOOD SYSTEMS AND ECOSYSTEMS.

Revisit the flow of energy in an ecosystem from previous learning about ecosystems, identifying producers, consumers and decomposers. Encourage students to provide examples of each. Tell students that farms and ranches are examples of agricultural ecosystems and challenge them to hypothesize how and why.

Introduce guiding questions that explore the connection of sustainability to the food system, such as:

- What makes a food system sustainable?
- How are sustainable ranches and farms like natural ecosystems?
- How can natural ecosystems provide a model for a sustainable food system?

Display and share the food system infographic with students in the class, as a group, or individually. This infographic is provided on a full page at the end of this activity, as well as in **HANDOUT 2: FOOD SYSTEMS AND ECOSYSTEMS**. Provide students with this handout.

Students are provided with two resource references – the **Raising Canadian Beef** website at www.raisingcdnbeef.ca and a podcast about how an Alberta beef cattle ranch works from **Agriculture for Life** at www.agricultureforlife.ca/podcast/episode/e5001db9/episode-1-an-inside-look-at-a-ranch. Have students use these resources and the **Triple T-Chart graphic organizer** to analyze the inputs and outputs in a food system.

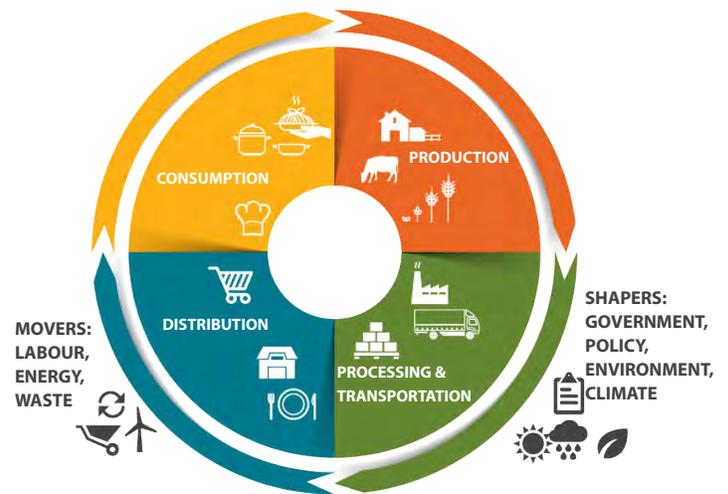


Other resource references can be provided to students on an online bulletin board or posted in the classroom to accommodate varying learning needs of students.

- **Farm and Food Care** provides a video tour and information points about beef farms and ranches in Canada at www.farmfood360.ca/#beef-tile. Additional farm tours can also be accessed.



Food systems require many steps, each with a variety of inputs and outputs. This infographic identifies the four main stages of production, processing, distribution and consumption. Students can be encouraged to identify the inputs and outputs involved in each stage, as well as the factors that influence each stage, identified as “movers” and “shapers.”





Additional Curriculum Links

Parts of this activity can be used in **Grade 8 Science Unit E: Freshwater and Saltwater Systems**. Have students focus on the significance of water supply and quality to the food system and, more directly, to agriculture and farming. Identify human impact on water quality that results from the issue of food waste.

This activity may also be adapted to support **Grade 9 Science Unit C: Environmental Chemistry** by focusing on the impact of human activities on air and water quality and how these environmental conditions, in turn, influence the food system.

This activity could also be adapted to explore understandings of the concept of sustainability in **CTS AGR 1010** and the inputs and outputs involved in the food system.

- The **It's GOOD, Canada** website provides video profiles of Canadians involved in agriculture at <http://itsgoodcanada.ca/our-people/>. It's Good, Canada is a national campaign to connect consumers to the Canadian food system. The campaign features personal stories of Canadians working in the food system from coast to coast on both the front and back lines of the food supply chain – from farming, transportation, retail, processing and production. This website represents an initiative of the **Canadian Centre for Food Integrity**.

Some of these videos could be previewed and identified for more in-depth student research in **HANDOUT 2**. Identify the parts of the food system that some videos represent and apply them to inputs and outputs in the food system.

HANDOUT 2: FOOD SYSTEMS AND ECOSYSTEMS also provides students with the opportunity to consider the impact of waste on both the food system and on ecosystems.



Spark thinking about the issue of food waste by sharing the following videos with students.

- Use the **Food Waste** video from **PBS** and the **Lexicon of Sustainability**, found at www.pbs.org/food/features/lexicon-of-sustainability-food-waste/, as an introduction.

Note that this video presents an American perspective, but does provide ideas applicable to Canadian and Alberta contexts. Highlight the idea of learning to eat from head to tail to eliminate waste. Then, show the two videos from beef cattle groups.

- More than Bunnies Eat Carrots** and **How Beef Cattle Help Reduce Food Waste** from **Canada Beef** and the **Canadian Cattlemen's Association** profile how an Alberta farms apply the principle of upcycling to reduce food waste and promote sustainability.

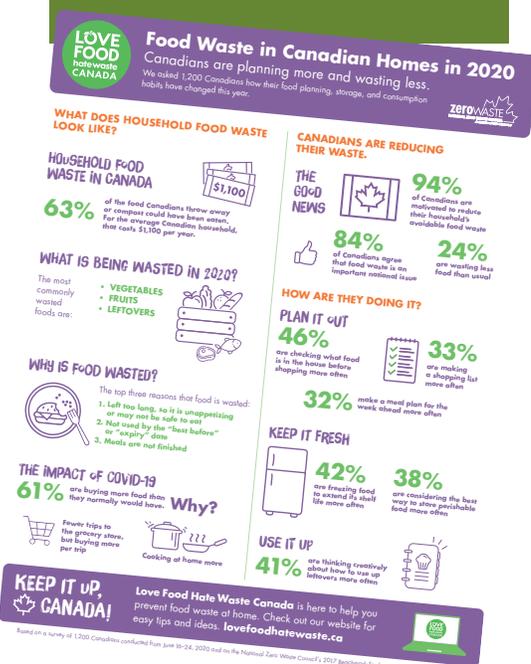
Access **More than Bunnies Eat Carrots** on YouTube at <https://bit.ly/3bvfgQI>.

Access **How Beef Cattle Help Reduce Food Waste** on YouTube at <https://bit.ly/3pOMLSA>.



Encourage students to explore further with **Food Waste in Canadian Homes in 2020** on the **LoveFoodHateWaste** website at <https://lovefoodhatewaste.ca/get-inspired/food-waste-in-2020/>. Have students build numeracy skills by analyzing the statistics in the infographic on this webpage. The infographic can be downloaded as a PDF document.

Challenge students to consider why and how food waste affects both natural ecosystems and the food system.



Have students apply food waste to the elements of the food system. Use the **Mind Map thinking map** in **HANDOUT 2: FOOD SYSTEMS AND ECOSYSTEMS** to generate examples of actions that people involved in the food system could implement to reduce food waste.

- Actions that producers can take
- Actions that consumers can take
- Actions that distributors can take
- Actions that processors can take



Encourage students to draw out connections between the impact of food waste on the food system and the impact on natural ecosystems.

Have students refocus on, reflect and discuss the guiding question, *WHAT MAKES A FOOD SYSTEM SUSTAINABLE?* Students can be asked to find and use additional sources to address this question. Work with students to differentiate between facts and points of view presented in sources of information.

- What other information, articles, research can you find that address this guiding question?
- What opposing or supporting facts do they present? What supporting or opposing points of view do they present?



Students can also apply these questions to other guiding questions they have identified or developed.



SOME BACKGROUND INFO

What goes into and out of a food system? A food system includes all of the processes and infrastructure involved in food production: growing, raising animals, harvesting, processing, packaging, transporting, marketing, distribution, consumption and disposal of food.

A food system also involves inputs and outputs that are needed for production or result from activities. It can be viewed as a route, a journey or a cycle.

The processes, inputs and outputs involved in a food system cycle are similar to the flow of energy and materials in an ecosystem, and are also interrelated with the natural ecosystems on which the food system depends.

Connecting Challenge Topics



Food waste is an issue that affects climate change – according to the **Food and Agriculture Organization of the United Nations**, food wastage's carbon footprint is estimated at 3.3 billion tonnes of CO₂ equivalent of GHG released into the atmosphere per year.

SOURCE: FAO online (2013): Food Wastage Footprints: Impacts on natural environments. www.fao.org/news/story/en/item/196402/icode/

Food waste has also been affected by the COVID-19 pandemic, with restrictions on distribution of foods and changing requirements to access food suppliers, like stores and markets.

This activity can be connected with these ideas to the **Challenge BEEF: Resilience** topic activities.



MINI CHALLENGE

Implement this activity as a mini challenge that asks students to focus on personal actions they can take to reduce food waste.

Identify two to three actions that they and their families can practice or currently practice.

Assess how these personal actions can have an impact on the food system as well as on natural and agricultural ecosystems.



Additional Information

All food must be processed, stored or packaged in some way and at some level. Vegetables can be rinsed before packing them, wheat is transformed into cereal and packaged, and meat is butchered and packaged before it is sold in stores.

Meat that is consumed in Canada, such as beef, is processed at meatpacking plants. Issues that have resulted from COVID-19 have exposed potential disruptions to the food system cycle. Some believe that local and small-scale meat processors can help make the food system more resilient. If one or a few have to close, it is less disruptive to the food system.



Connecting Challenge Topics

Food consumption is the part of the food system that everyone is involved with. The COVID-19 pandemic has affected the balance between eating out and eating at home.

SOURCE: Jones, Alexandra Mae (May, 2020) CTV online: [Making more of less: How COVID-19 is impacting food production in Canada.](http://www.ctvnews.ca/canada/making-more-of-less-how-COVID-19-is-impacting-food-production-in-canada-1.4886097) www.ctvnews.ca/canada/making-more-of-less-how-COVID-19-is-impacting-food-production-in-canada-1.4886097

The sustainability of the food system can be connected to **Challenge BEEF: Resilience** topic activities. The concept of resilience is also explored in **Activity 3: SUSTAINABILITY PRACTICES** in this topic.

The following summary provides an overview of the inputs and outputs involved in the food system and support the details provided in the food system infographic. Students are asked to identify examples such as these in **HANDOUT 2: FOOD SYSTEMS AND ECOSYSTEMS**. Classroom textbooks for **Science 8 Topic A: Interactions and Ecosystems** can also be used to explore the connections between natural ecosystems and the food system cycle, inputs and outputs.

STEP 1: PRODUCTION

- What goes in: Knowledge of how to raise crops and livestock, sun, soil, water, air, seeds, livestock, access to land, tools, farm equipment
- What comes out: Food ready for processing (also feed for animals, fiber for textiles, and biofuel)

STEP 2: PROCESSING

- What goes in: Harvesting, packaging, storage and food processing facilities
- What comes out: Food products ready for distribution

STEP 3: DISTRIBUTION

- What goes in: Food products, stores, marketing and advertising
- What comes out: Food ready for consumption

STEP 4: CONSUMPTION

- What goes in: Food that is ready to prepare, food preparation techniques, recipes, cooking tools
- What comes out: Ready to eat food (traditions, cultural heritage, time, dietary needs, budget and personal preferences influence eating choices)

WHAT MOVES FOOD THROUGH THE FOOD SYSTEM?

In addition to the inputs and outputs listed for each step, elements that are needed to move food through the food system include:

- **Labour** – including farm families, farm workers, food processing facility workers, market and grocery store workers, restaurant staff and distribution workers, like transportation operators.
- **Energy** – there is a lot of energy required to keep the food system working, including the fuel and electricity needed to power equipment, factories, transport methods, grocery stores, restaurants and home food preparation appliances and tools.
- **Waste** – food is processed and packaged as it moves through the food system and there can be waste at every step. Changing packaging materials, recycling, reusing and composting can reduce the amount of waste that results.

WHAT SHAPES THE FOOD SYSTEM?

A number of factors shape the food system.

Agriculture and food policy can be set by governments at the federal, provincial and local levels. Canada has a national food policy, established in 2019. **Agriculture and Agri-Food Canada** describes the context of the food policy as it relates to food systems and the wellbeing of Canadians as well as the environment.

Food systems, including the way food is produced, processed, distributed, consumed, and disposed of, have direct impacts on the lives of Canadians. Food systems are interconnected and are integral to the wellbeing of communities, including northern and Indigenous communities, public health, environmental sustainability, and the strength of the economy.

All orders of government, including many federal departments, have taken actions to address food system issues, for example through:

- Income support programs that reduce poverty, that can also reduce food insecurity
- Policies to improve food environments and support healthier food choices
- Initiatives to reduce greenhouse gas emissions, including in the agriculture and food sector
- Investments in innovation to increase the agriculture and food sector's capacity to produce high-quality food

Despite this wide range of actions being taken, issues still exist in the Canadian food system. For example, around one million Canadian households are not able to access healthy food, almost two in three Canadian adults are overweight or obese, and about one third of food produced in Canada is wasted. These important societal challenges require multi-faceted solutions.

The social, health, environmental, and economic components of food systems are interdependent; however, they are often addressed in isolation. To tackle complex food issues, coordinated and coherent approaches are needed.

As decisions about food are made by individuals, organizations, and as a country, broader linkages across food systems need to be considered to ensure effective actions are taken. Collaborating across government and across society to work toward mutually reinforcing goals can increase the collective capacity of all actors in the food system to build a healthier and more sustainable food system that supports communities and the economy.

Climate and weather patterns also have a large impact on farming and ranching. Changing weather patterns and extreme events like floods and drought can add more uncertainty to the food system.

Some Background Resources



The **Oxford Martin Programme on the Future of Food** website, from the University of Oxford UK, provides an overview and video that discusses sustainable intensification that is suitable for teacher background and may provide some context for discussions with students. Access this website and video at www.futureoffood.ox.ac.uk/producing-sustainable-nutritious-food.

Canada's national food policy can be accessed on the **Government of Canada** website at www.canada.ca/en/campaign/food-policy/the-food-policy.html. The policy addresses sustainable food practices that reduce environmental impact and improve the climate resilience of the Canadian food system. Connections can also be made to learning about the impact of climate change in the **Challenge BEEF: Resilience** topic activities.

SOURCE: Government of Canada: The Food Policy for Canada. Online. www.agr.gc.ca/eng/about-our-department/key-departmental-initiatives/food-policy/the-food-policy-for-canada/?id=1597863791042



Challenge BEEF: SUSTAINABILITY

How does sustainability affect my food options?

Guiding
Activity

3

SUSTAINABILITY PRACTICES



Grade 7 Science
Topic A: Interactions
and Ecosystems

In this guiding activity, students identify examples of knowledge, decisions and actions that contribute to efficiency, self-sufficiency, diversity and resilience in sustainable agricultural ecosystems. Students analyze sustainable practices used by Alberta cattle ranchers and farmers.

ASSESSMENT

Formative assessment can be centred on students' ability to apply knowledge of natural ecosystems to the principles of sustainable agricultural practices.

- Collect examples of student inquiry and research questions generated in discussions about what is involved in sustainable practices in agriculture. Assess the range and reliability of sources that they identify.
- Look for evidence of their research and organizational skills in the information they select and integrate into the expert group posters they create using HANDOUT 3: SUSTAINABILITY PRACTICES. Monitor collaborative problem solving and their ability to share in their groups.
- Look for evidence of their ability to assess the impact of environmental factors and relationships between knowledge, decisions and actions that affect these environmental factors on Alberta ranches and farms.
- Assess the synthesis of their learning in the illustrations students are asked to create to show what sustainability looks like in a grassland ranch ecosystem.

ADDITIONAL CURRICULUM LINKS

- Grade 8 Science Unit E: Freshwater and Saltwater Systems
- Grade 9 Science Unit A: Biological Diversity
- Grade 9 Science Unit C: Environmental Chemistry
- Career and Technology Studies: AGR 1010

KEY CONCEPTS

- Ecosystems
- Endangered
- Sustainability
- Efficiency
- Self-sufficiency
- Diversity
- Resilience

TIMING

- 2 to 4 hours



Additional Curriculum Links

This introduction can also be adapted for a discussion of the biodiversity in prairie ecosystems for **Grade 9 Science Unit A: Biological Diversity**. Students can be asked to focus on the diversity of species found in these environments and assess the extent to which grazing activities protect the land and natural species.

Some Background Resources

Information about the history and place of bison as a “keystone” species to the prairie ecosystem can also be shared with students, as – like beef cattle – they directly affect plant composition and maintain grasslands and meadows through grazing. The **Alberta Wilderness Association** provides a comprehensive discussion of bison in the prairie ecosystem, history, concerns and biology at <https://albertawilderness.ca/issues/wildlife/bison/>.

Find the research that addresses grassland loss in the **2020 Plowprint Report** from the **World Wildlife Fund** at www.worldwildlife.org/projects/plowprint-report. Find other articles related to grassland ecosystems and the actions that cattle ranchers and organizations like **Ducks Unlimited** are taking to conserve them at <https://guardiansofthegrasslands.ca/guardians-at-work/>.

GUIDING ACTIVITY 3: Sustainability Practices

THIS GUIDING ACTIVITY ASKS STUDENTS TO INVESTIGATE EXAMPLES OF AGRICULTURAL PRACTICES TO BUILD UNDERSTANDINGS OF FACTORS OF NATURAL ECOSYSTEMS THAT ARE APPLIED TO AND MAKE AGRICULTURAL ECOSYSTEMS SUSTAINABLE.

Introduce this activity by asking students to identify what they think is the most endangered ecosystem. If students need additional background, explore the meaning of the concept of *ENDANGERED*.



You may choose to show the preview video clip of the documentary film **Guardians of the Grasslands** at <https://guardiansofthegrasslands.ca>. The film explores the current state of one of the world’s most endangered ecosystems, the Great Plains grasslands and the role that cattle play in its survival.



SOME BACKGROUND INFO

The **Guardians of the Grasslands** website provides the article, **Why Canada’s prairies are the world’s most endangered ecosystem**, at <https://guardiansofthegrasslands.ca/2019/09/25/why-canadas-prairies-are-the-worlds-most-endangered-ecosystem/>. The article can provide some ideas that can be used to introduce this activity with students.

Ask any Canadian kid to name the world’s most endangered ecosystem, and chances are you’ll hear one of the following answers: 1) rainforests; 2) coral reefs; 3) leave me alone.

Ignoring the last answer, there’s a good reason why kids, and most other people, think that rainforests and coral reefs are the most endangered ecosystems; the planet’s most critical and urgent habitats in need of conservation. Tropical rainforests and coral reefs are incredibly important for protecting the planet’s biodiversity. They are a cornucopia of millions of species and display the incredible and beautiful forces of life that create diversity. We are continuing to lose tropical rainforests, and coral reefs are at increasing risk from pollution, rising water temperatures and ocean acidification (the latter two a consequence of climate change). There is no question that both of these are endangered. . .

Now, what if I told you the world's most endangered ecosystem isn't tropical rainforests or coral reefs? It's a different habitat. And one that is much closer to home than you might think.

Recent studies have found that the Great Plains of the U.S. and Canada have lost a greater proportion of intact grassland than the Brazilian Amazon has lost rainforest.

Provide students with the opportunity to identify guiding questions that can focus their investigations into sustainable practices, such as:

- What does sustainability look like on local ranches and farms?
- How do sustainable practices on ranches and farms benefit natural ecosystems and the food system?
- How might unsustainable practices threaten natural ecosystems and the food system?
- How does innovation affect sustainability practices?

Organize students into expert groups and provide them with **HANDOUT 3: SUSTAINABILITY PRACTICES**. Revisit and discuss the qualities of natural ecosystems introduced at the beginning of the handout. Ask students to use their prior learning to suggest ways that natural ecosystems are:

- Efficient
- Self-sufficient
- Diverse
- Resilient

Tell students they will explore practices that ranchers and farmers use to build these qualities into sustainable ranching and farming.



This task could be introduced by watching a video provided by the **Beef Cattle Research Council – What Beef Producers Need to Know about Environmental Footprint** at <https://bit.ly/3dC4E4N>.

Students may need some support with vocabulary in the video. Ask them to listen and watch with questions such as the following in mind:

- What references are made to the relationship between sustainability and efficiency, self-sufficiency, diversity and resilience?
- Why is research and evidence-based decision making important to beef cattle farmers and ranchers?
- What examples can you identify of the three aspects of sustainability - environmental, economic and social?

Digital and Remote Group Work



Google Jamboard at https://edu.google.com/products/jamboard/?modal_active=none and Padlet at <https://padlet.com> can be used as a group response board. Set up one area of a Padlet board for each group and have students add their responses. Add additional guiding resources that students can use in their research.

Flipgrid "grids" at <https://info.flipgrid.com/> can be used to pose questions for each topic and students can be asked to post video responses to the questions and replies to each other's videos.



Connecting Challenge Topics

The connection between sustainability and resilience may be explored in more depth by selecting and adapting any of the **Challenge BEEF: Resilience** topic activities.



Additional Curriculum Links

Adapt this activity to **Grade 8 Science Topic E: Freshwater and Saltwater Systems** by focusing on the relationship between cattle ranching and farming and wetland conservation initiatives in Alberta.

Some Background Resources

Cows and Fish at <https://cowsandfish.org> works to foster a better understanding of how improvements in grazing and other management of riparian areas can enhance landscape health and productivity, for the benefit of landowners, agricultural producers, communities and others who use and value riparian areas. The **Cows and Fish** website provides producer and consumer stories at <https://cowsandfish.org/product-category/communityandproducerstories/>.

Ducks Unlimited Canada provides a focus on wetland conservation at www.ducks.ca/our-work/wetlands/ and www.ducks.ca/places/alberta/. Many Alberta cattle ranchers and farmers are involved with **Ducks Unlimited** initiatives. For example, an overview of their initiatives in Alberta can be found at www.ducks.ca/news/provincial/alberta/conservation-finds-a-home-on-the-range-duc-supports-beef-industry-for-environmental-sustainability-with-abp/.



Additional sources, research-based fact sheets and general information can also be found on the **Beef Cattle Research Council** website, including numerous links and references on www.beefresearch.ca/research-topic.cfm/environmental-footprint-of-beef-production-6.

Divide students into groups, asking each group to focus on **one** of these qualities and the questions provided in **HANDOUT 3: SUSTAINABILITY PRACTICES**. Use the snapshots and articles provided in the handout to respond to the questions included with their quality. Many of the snapshots include links to videos.

Ask students to record the questions and their responses and findings on **poster paper** to facilitate large group sharing after they have completed this task.



If time permits, provide groups with the opportunity to complete additional research, identifying other types of agriculture or human activities that connect to the food system. There are a number of additional resources that can provide perspectives from science as well as from the beef cattle industry. Preview these additional sources and select those that may be appropriate for learning in your classroom to share with students on a classroom or an online bulletin board, such as **Padlet**.

- **Agriculture and Agri-Food Canada** provides content that highlights recent scientific discoveries and initiatives in agriculture at www.agr.gc.ca/eng/news-from-agriculture-and-agri-food-canada/scientific-achievements-in-agriculture/?id=1379013177194. Scroll to the bottom of the webpage and select **Agro-ecosystem productivity and health** from the drop-down “Science Sector” menu. You can also filter for articles or research notes.
- For example, an article about research at the **Lacombe Research and Development Centre** can be shared with students. **Frozen Dinners for Cattle** can be accessed at <https://www.agr.gc.ca/eng/news-from-agriculture-and-agri-food-canada/scientific-achievements-in-agriculture/frozen-dinners-for-cattle-swath-grazing-saves-time-and-money/?id=1450194753308>.
- Investigate initiatives such as the **Canadian Roundtable for Sustainable Beef** and **McDonald’s** restaurant that emphasize the principles of sustainability in agriculture and the food system.

The **Canadian Roundtable for Sustainable Beef** can be accessed at www.crsbcertified.ca and provides an overview of the core principles of sustainable beef:

Natural resources

- People & Community
- Animal Health & Welfare
- Food
- Efficiency & Innovation

These principles are based on international standards from the **Global Roundtable for Sustainable Beef**. The **Global Roundtable for Sustainable Beef** can be found at <https://grsbeef.org/>.

- Explore the actions that are being implemented by **McDonald's** in their sustainability initiatives at www.mcdonalds.com/ca/en-ca/about-our-food/sustainability.html. There are several videos that provide perspectives on sustainability. One video that helps make the connection between natural and agricultural ecosystems can be found in **Mini Amazon Rainforest** at www.youtube.com/watch?v=UpVnMZ9HNOA&feature=emb_logo.
- A 2018 article that provides some context for the **McDonald's** sustainability initiative – McDonald's rollout of 'certified sustainable' beef considered win for western ranchers – from the **Calgary Herald** and accessed at <https://calgaryherald.com/business/local-business/mcdonalds-rollout-of-certified-sustainable-beef-a-win-for-agriculture-industry>.
- Watch **Our Sustainable Beef Journey**, which features some Alberta ranchers, at www.youtube.com/watch?v=KO901ivGatQ.
- **Beef Sustainability** provides an overview of what beef sustainability means. Find it at www.youtube.com/watch?v=LPRc5xmdFX4.
- **Canada Beef** provides an overview of the relationship between beef cattle and Canada's pasture and prairie environments, including grasslands and climate. Find a summary and links to infographics and articles at <https://canadabeef.ca/whycanadianbeef/>.

Links on this website also include two articles featured by them.

Opening Eyes through the Lens: How Agriculture Protects Canada's Grasslands can be accessed at <https://canadabeef.ca/wp-content/uploads/2020/06/Canada-Beef-Opening-Eyes-Through-the-Lens.pdf>.

Cattle and Conservationists on the Same Side of the Fence can be accessed at https://canadabeef.ca/wp-content/uploads/2019/04/AgriculturalInnovation_NP_p4_r2FINAL.pdf.

Connecting Challenge Topics



The COVID-19 pandemic resulted in some interruptions to supplies of food products in the food chain. The McDonald's 100 percent Canadian beef initiative was affected, with a temporary sourcing adjustment announced so they could supplement with imported beef from pre-approved McDonald's suppliers. A return to sourcing 100 percent Canadian Beef was announced in September 2020.

Sustainability practices and initiatives and climate change are also closely connected.

There are opportunities to integrate this activity with the **Challenge BEEF: Resilience** topic activities.



Students can be encouraged to compare information and perspectives from these sources to other trusted sources in the classroom. How do perspectives on sustainability differ? How do they support each other?



As an alternative learning structure, and if students are working individually, assign a snapshot or article to individual students and have them respond to the questions for all four ecosystem qualities. Post additional research sources on a classroom Jamboard or Padlet board for students to use and/or add to their research.

Have each group share their poster responses. This can be done through **carousel sharing** or by simply asking students to **'stand and share'**. If appropriate to use carousel sharing, have students display their poster responses in one area of the classroom and have groups rotate through each poster. Students can be encouraged to add comments or questions to a response form displayed with each poster.

Challenge students to synthesize their learning by creating an illustration that shows what sustainability looks like in a grassland ranch ecosystem.



Alternatively, have students create an illustration, blog post, op ed or use another format to respond to the question: *HOW MIGHT UNSUSTAINABLE FOOD PRODUCTION THREATEN THE FOOD SYSTEM AND THREATEN NATURAL ECOSYSTEMS?*

Extend learning by having students compare sustainability in a natural ecosystem with sustainability in an agricultural ecosystem. Illustrate how natural and agricultural ecosystems meet the needs of living things for nutrients, energy sources, moisture, suitable habitat and exchange of gases.



MINI CHALLENGE

Implement this activity as a mini challenge that asks students to highlight sustainability in their own contexts. Challenge them to consider how they practice sustainability.

Create a chart or mind map that compares their own sustainability practices to those used by ranchers and farmers. How are they:

- Efficient?
- Self-sufficient?
- Diverse?
- Resilient?

Reflect on the meaning of sustainability in personal and societal contexts.

Challenge BEEF: SUSTAINABILITY

How does sustainability affect my food options?

CHALLENGE

TOPIC CHALLENGE



Grade 7 Science
Topic A: Interactions
and Ecosystems

The culminating topic challenge asks students to assess the extent to which the food system provides sustainable food options, considering the impact of food production on natural ecosystems. Have students work individually, with a partner or in a group to promote and/or highlight sustainability in the food system. Their challenge solution can focus on:

- The issue of waste and its impact on food choices, food availability, sustainable food practices and local environments
- The availability of foods that are sustainably produced
- Sustainable relationships between agriculture and natural ecosystems
- Other related topics that students are interested in

Students can organize and format their solution response to the challenge in a variety of formats, including as a personal response; a storyboard or video message, public service announcement, social media post or other product idea that they have.

For the product that students create, have them contextualize the challenge, addressing:

- The big idea
- The essential question
- A statement that discusses the significance and importance of the topic
- Local and/or personalized examples of the significance and importance
- An engaging statement that summarizes the challenge

As students develop their product, ask them to include:

- The challenge that they are tackling
- A summary of how the challenge was explored
- Their conclusions or solution
- How the conclusion or solution could be implemented or was implemented
- Authentic, local and/or personalized examples
- Lessons learned



Student HANDOUTS

SUSTAINABILITY

How does sustainability affect my food choices?



Messages about Sustainability



When you hear the word sustainability, what comes to your mind? A small study conducted in 2020 tried to understand how people think of sustainability, the concepts they evoke when they talk of sustainability and the images and symbols they use to explain these concepts. **What do you think?**



What words, terms and/or concepts do you most associate with sustainability?

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What is the opposite of sustainability?

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What image or images could you use to represent sustainability?

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What symbol or symbols do you think could be used to show what sustainability means?

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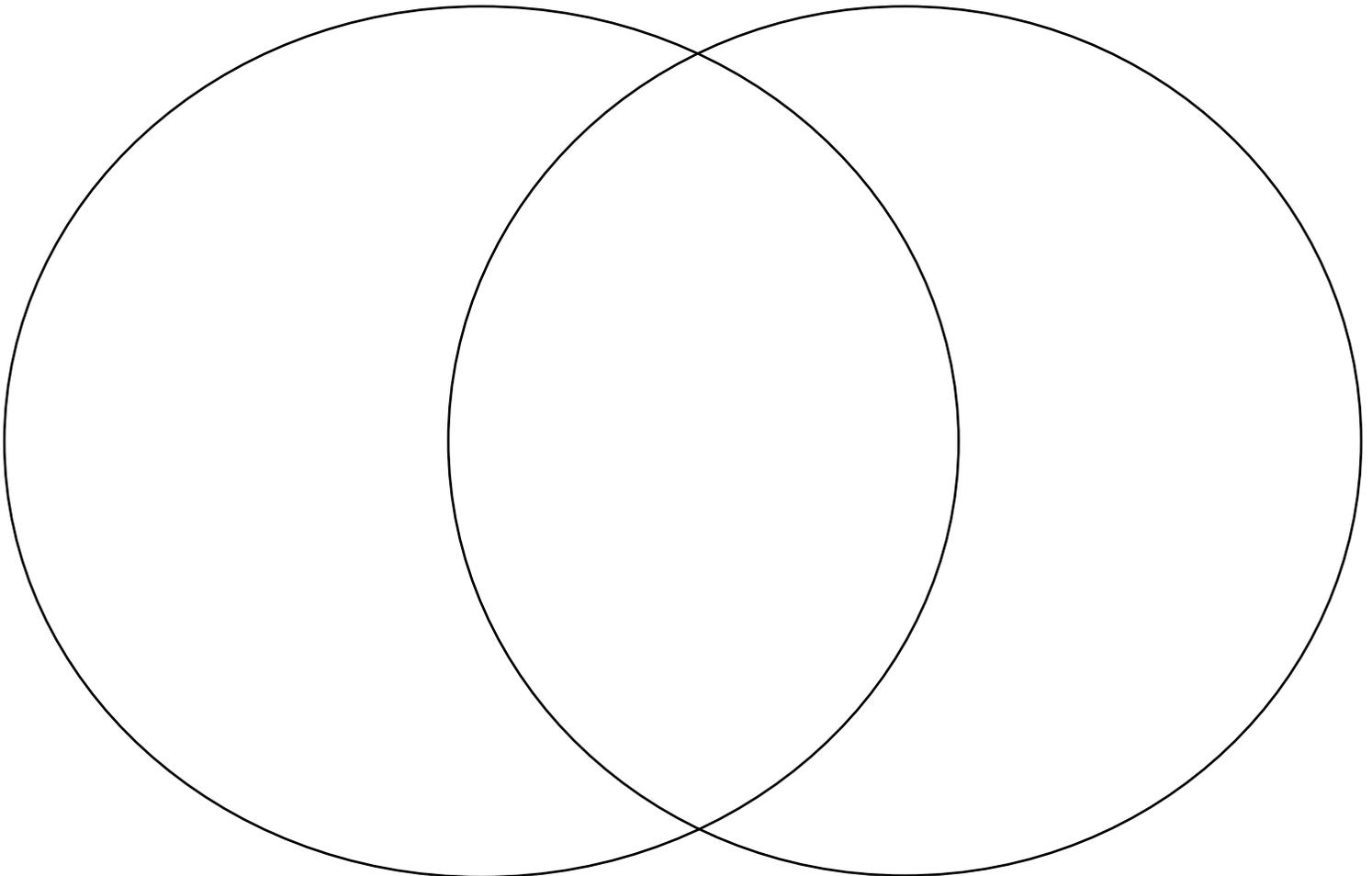
SOURCE: Mauri, C. (2020): What comes to mind when you think of sustainability? Qualitative research with ZMET. Worldwide Hospitality and Tourism Themes. www.emerald.com/insight/content/doi/10.1108/WHATT-05-2020-0021/full/html

Exploring Sustainability

The ten people interviewed in the 2020 study identified ten main ideas that they related to sustainability. Although the study had a limited audience of participants, how do you think the ideas that these ten people shared compare to your own ideas about sustainability? **Use the Venn below to compare your words, images and symbols with these ideas. Find ideas that are similar to yours and describe them in the middle of the Venn. Find ideas that are different and describe them on either or both of the outside circles of the Venn.**



1. Sustainability is about problems and solutions
2. Sustainability involves individual behavior
3. Sustainability is about the environment and ecosystems
4. Sustainability involves technologies and innovations
5. Sustainability considers social fairness (equity and justice for people and the environment)
6. Sustainability considers food and nutrition
7. Sustainability supports the movement of goods and people
8. Sustainability needs education and mindfulness
9. Sustainability involves sustainable development
10. Sustainability will result in "utopia" or an ideal world



Definitions of Sustainability

Consider more widely read sources that define the concept of sustainability.

Sustainability is commonly described as “meeting the needs of the present without compromising the ability of future generations to meet their needs while ensuring long-term ecological, social, and economic health.”

This well-known definition of sustainability comes from the **Brundtland Report**, a product of a 1989 United Nations (UN) commission on development.

Sustainability is also connected to the study of ecosystems. When the term sustainability is used to describe an ecosystem, it refers to that ecosystem’s ability to remain healthy, diverse and productive over time. For example, forests and wetlands that have been around for a long time are examples of sustainable ecosystems.

The UN definition of sustainability focuses more on the idea of development by humans. It emphasizes the need to make decisions about resources and environments when developing them for human use.

The **University of Alberta** expanded on the United Nations definition of sustainability to consider how people make a living and can build a good quality of life. This includes ideas like protecting jobs, making jobs and a good quality of life accessible to everyone, providing quality products to meet people’s needs and making policies that protect the environment while using resources.

Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. In addition to natural resources, we also need social and economic resources. Sustainability is not just environmentalism. Embedded in most definitions of sustainability we also find concerns for social equity and economic development.



SOURCE: University of Alberta: Office of Sustainability. (2013): What is sustainability? Online. www.mcgill.ca/sustainability/files/sustainability/what-is-sustainability.pdf

What about Agriculture?

People involved in agriculture have focused more and more on sustainability over time. Sustainable agriculture is designed to preserve the environment while using the earth’s natural resources while creating a good quality of life for people and animals.

Sustainable agriculture meets peoples' need for food and textiles without damaging the earth's ability to continue to provide natural resources for future generations. It also focuses on practices that maintain soil quality, reduce erosion and preserve water. Sustainable agriculture also pays attention to the ability of farmers and ranchers to make a living and build a good quality of life.

The **Canadian Roundtable for Sustainable Beef** focuses on the environmental, social and economic performance of the Canadian beef industry. They emphasize the following definition.

SOURCE: Canadian Roundtable for Sustainable Beef website. www.crsb.ca

We define sustainable beef as a socially responsible, economically viable and environmentally sound product that prioritizes the Planet, People, Animals and Progress.

Defining Sustainability

Environmentally Sound. Socially Responsible. Economically Viable.

We define sustainable beef as a socially responsible, economically viable and environmentally sound product that prioritizes the **Planet, People, Animals and Progress**.

The CRSB has adopted the same five guiding principles as set by the [Global Roundtable for Sustainable Beef](#) for its work in Canada.



Natural Resources



People & the Community



Animal Health & Welfare



Food



Efficiency & Innovation



What message does the definition and image from the Canadian Roundtable for Sustainable Beef communicate about sustainability? How does this compare to your own sustainability definition?

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Food Systems and Ecosystems

A food system works in much the same way as an ecosystem works. It involves producers and consumers. It is based on the interactions between them. A farm is an example of an ecosystem.

Food systems rely on natural resources – land, water, minerals, fossil fuels as well as on the diversity of plants and animals in natural ecosystems. A food system needs these resources for agriculture, but also to process, package, distribute and consume food.

Almost all food system activities require energy. This energy comes from fuels, animals and human labour. Energy flows through a food system, similar to how it flows through a natural ecosystem.

Many of the resources used in a food system are renewable, which means they are naturally replenished. Land, water and the plants and animals in natural ecosystems renew themselves naturally. However, this does not mean that they cannot be damaged, their capacity reduced or made extinct if they are not properly managed.

Other resources are non-renewable, which means that they cannot be regenerated and are gone once they are used. Important non-renewable resources include fossil fuels and minerals. For example, a mineral like phosphorus is not actually completely removed from a food system. However, it can be severely reduced in a food production system if it is not captured and recycled.

This is where sustainability comes in. A sustainable food system is a food system that ensures safe and nutritious food is available to all in such a way that the environment, people's ability to make a living and quality of life is not put at risk.





An organization called the Sustainable Food Lab provides another definition. How does this definition expand on the definition from the FAO?

We define a sustainable food and agriculture system as one in which the fertility of our soil is maintained and improved; the availability and quality of water are protected and enhanced; our biodiversity is protected; farmers, farm workers, and all other actors in value chains have livable incomes; the food we eat is affordable and promotes our health; sustainable businesses can thrive; and the flow of energy and the discharge of waste, including greenhouse gas emissions, are within the capacity of the earth to absorb forever.

SOURCE:
Sustainable
Food Lab
website. [https://
sustainablefoodlab.
org/](https://sustainablefoodlab.org/)

Movers and Shapers in a Food System

A food system identifies what it takes to move food from the farm to your plate. It starts on the farm.

Food moves from the farm to your plate because of people who work in the system. This **movement** needs energy sources. It also produces waste.

The food system is **shaped** by environmental factors, like the characteristics of the land and climate. It is also shaped by the decisions of businesses, scientists, governments, researchers and consumers.



What Goes into a Food System

There are many different activities involved in a food system, including farming systems, water systems, energy systems and market systems. These activities use different – and varying amounts of – natural resources.

Farming is most closely connected to resources. It needs land to grow crops or graze animals, water for irrigation and other substances like minerals for fertilizer. Farming depends on natural ecosystems for processes such as pollination.

However, land is also used for food processing plants, food storage, stores and landfills for food waste. Energy sources are used across all types of food system activities – to power farm machinery, cool or heat barns, process food, refrigerate, transport, cook and collect waste.



What does the beef food system look like? Visit www.raisingcdnbeef.ca and explore the links on this website to complete the Triple T-Chart that follows. Make sure you watch the video available by clicking on the “Beef Supply Chain” link.



Listen to a podcast to supplement your research and gain an Alberta perspective. Go to www.agricultureforlife.ca/podcast/episode/e5001db9/episode-1-an-inside-look-at-a-ranch.

FOOD SYSTEM COMPONENT	WHAT COMES INTO THE FOOD SYSTEM	WHAT GOES OUT OF THE FOOD SYSTEM
PRODUCTION		
PROCESSING		
DISTRIBUTION		
ACCESS		
CONSUMPTION		

What About Waste

Waste that is produced in a natural ecosystem cycles back through the system. However, human waste – including agriculture waste and food waste – can affect the balance across natural ecosystems. Almost all human activities produce some type of waste. Some waste is biodegradable, which means it can be broken down by naturally occurring decomposers. Other waste cannot be naturally broken down and must be managed.

Food waste is becoming an increasing problem. Over 1.5 billion tons of food is thrown away every year. This waste threatens ecosystems across the world. Landfills that hold decomposing food waste produce methane; a greenhouse gas that contributes to global warming. Waste that is dumped in oceans or other bodies of water are a risk to local fish and other species, which can take an ecosystem out of its natural balance. Litter can attract scavenging animals and also larger wildlife that prey on them. Even the smallest changes to the food chain in an ecosystem can have ripple effects and reduce biodiversity.



What are the implications of waste for the food system? Use the sources that follow to challenge your thinking. Use the Triple T-Chart that follows the sources to identify one action that was taken to increase sustainability from each example. Explain why you identified this action.

The need for sustainable food systems and reduced waste is driving the development of innovative solutions that benefit both the environment and the economy. Sustainable livestock farmers use a variety of innovative practices to manage waste on their ranches and farms.

The article excerpted on the next page estimates that there were 1 billion cattle and 767 million pigs worldwide in 2019. And there were 996 million chickens in 2018. The number of chickens alone is three times larger than the global human population. The article also makes the point that animal source foods like meat, eggs, milk, yogurt and cheese comprise an important part of daily diets, and this consumption is expected to continue to grow.

Farmers and ranchers – across Canada and around the world – work to minimize their impact on the environment by following ongoing research, innovation and best practices. For example, efficient and innovative management of manure produced on Canadian farms and ranches provides a valuable source of nutrients, organic matter and carbon to pastures and cropland.

28 Innovative Livestock Farmers Who are Shaping the Future of Protein

To celebrate their work, Food Tank highlights 28 innovative livestock farmers who are shaping the future of livestock production.

Aloha House (Philippines): Keith Mikkelson

Keith Mikkelson is the Executive Director of Aloha House, a ranch and an organic farm in Puerto Princesa on the island of Palawan in the Philippines. The food produced on the farm caters to the local community and Aloha Orphanage housed on the farm. Mikkelson raises cattle, goats, hogs, and chickens on his small-scale, diverse farm in the tropics, and these animals are part of the natural farming process. Mikkelson makes use of animal power, manure and other animal byproducts to grow vegetables, make fertilizers and turn other wastes like forage crop residues into useful materials.

Centre Songhai (Benin): Godfrey Nzamujo

Centre Songhai was founded by Godfrey Nzamujo in 1985 in Proto-Novo, Benin. It is a zero-waste farm which integrates plant, animal, and fish production components. The farm recycles all by-products or wastes produced from one production component to use it in another component. For example, livestock manure is converted into compost for plant production and biogas for cooking and lighting.

Chew's Agriculture (Singapore): Edvin Lim

Edvin Lim is the director of Chew's Agriculture in Singapore, one of the first Southeast Asian egg producers that joined the Certified Humane program in 2019. In 2014, Chew's started investing in the facility and techniques required to raise laying hens in a more livable environment in which they can express their natural behaviours. To establish a more sustainable farming operation, Chew's will provide poultry waste to an engineering services provider called Acropower for electricity generation. In return, Acropower will provide cheaper electricity to the farm.

Stepney City Farm (United Kingdom)

Stepney City Farm is an urban farm in East London, England. The farm started as a community farm called Stepping Stones Farm in 1979, and a charity has since taken over. One of the past projects implemented on the farm is The Pig Idea, where campaigners gathered unused food waste from London to feed eight pigs to demonstrate that food waste could be used as feed for pigs for environmental and financial sustainability.

Tona Farm (India)

Tona Organic Farm in Tona Village in West Bengal, India was established in 2003 as an initiative of Bio-Diverse Farming Pvt. Ltd and is co-owned by farmers from the village. The farm is committed to providing organic food, including meat products free of antibiotics, at affordable prices while creating a healthy farm ecosystem. Zero greenhouse gas emissions and 100 percent waste recycling are among the goals that the farm works to achieve. Animal waste is converted into fertilizer for plants, and medicinal herbs are used to feed the animals.

SOURCE: Maeng, M.H. (March 2020): 28 Innovative Livestock Farmers Who are Shaping the Future of Protein. Adapted from Food Tank: The Think Tank for Food website. <https://foodtank.com/news/2020/03/28-innovative-livestock-farmers-who-are-shaping-the-future-of-protein/>

This excerpt profiles five of the farmers in this article. Find the other 23 farmers on the weblink above.

How do you think these global examples compare to some of the actions that Alberta farmers and ranchers take to increase sustainability in agriculture? Where could you look to find out more?

Check out the profiles of Alberta farmers and ranchers in **HANDOUT 3: Sustainability Profiles**.

Alberta government injects \$750K into agricultural waste recycling pilot

Program aims to recycle grain bags and twine

A new pilot program launched by the province is looking at recycling agricultural plastics that would otherwise go up in flames or sit in a landfill.

Alberta's agriculture and forestry minister, Oneil Carlier, said the three-year program will help the province come up with the best ways to recycle waste like grain bags and twine.

"We've been hearing from the beginning of our term – and I suspect previous governments as well – [from] farmers [who] have been good stewards of their land, have been for generations," he said.

"They [want to] do their part to reduce waste, reduce pollution, reduce greenhouse gas emissions. So here's an opportunity ... to see what exactly we can do on that."

Carlier said the current practice for many farmers is to burn waste on their farms or send it to landfill.

The \$750,000 grant will be managed by Alberta Beef Producers, who will coordinate the recycling programs on behalf of the Agricultural Plastics Recycling Group (APRG). In a release, the APRG said they welcome the province's commitment to the program.

"The APRG will explore an on-the-ground assessment of [agricultural] plastics on the provincial landscape to support the environmentally sound end use of these materials," said APRG chairman, Al Kemmere.

Carlier said the project will determine the financials, logistics and operations of recycling agricultural plastics, which will likely inform future policy to address the problem.

SOURCE: CBC News (January 22, 2019): Alberta government injects \$750K into agricultural waste recycling pilot. Online. www.cbc.ca/news/canada/calgary/ab-gov-750k-agricultural-waste-recycling-pilot-1.4987875
Credit: CBC Licensing



Using Manure

Cattle manure is a valuable resource in agriculture when utilized properly. On an annual basis, approximately 3.4 million hectares of land in Canada receives animal manure as an amendment to improve soil fertility and quality for crop growth.

Manure from cattle contains macronutrients and micronutrients that plants need. It also has considerable amounts of organic matter that can improve soil tilth. Land application of cattle manure is an effective way of recycling nutrients.

As such, cattle manure that is hauled out and applied to farm fields or deposited directly by grazing or overwintered cattle reduces reliance on commercial fertilizers and helps to sustain land productivity.

SOURCE: Information and infographic from Canadian Cattlemen's Association website. www.cattle.ca/cca-resources/environment/



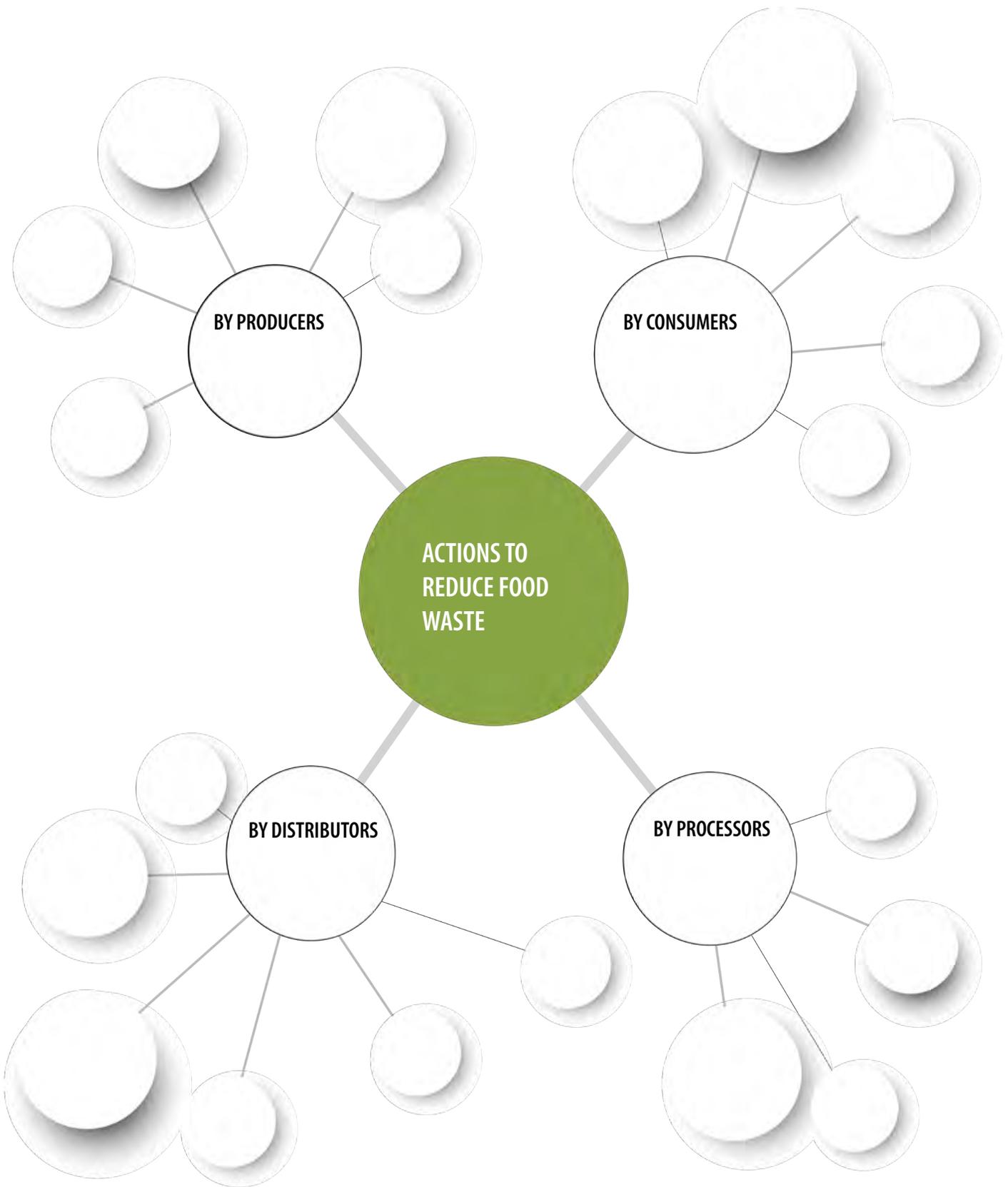
**CHALLENGE
YOUR
THINKING**



Use the **Mind Map** that follows to identify actions that different people involved in the food system could implement to reduce food waste. You can use the examples you identified in the chart as a starting point.

- Actions that producers can take
- Actions that consumers can take
- Actions that distributors can take
- Actions that processors can take

FOOD SYSTEM COMPONENT	AN ACTION THAT INCREASES SUSTAINABILITY	WHY I THINK THIS
Aloha House (Philippines): Keith Mikkelson		
Centre Songhai (Benin): Godfrey Nzamujo		
Chew's Agriculture (Singapore): Edvin Lim		
Stepney City Farm (United Kingdom)		
Tona Farm (India)		
Alberta government and Alberta Beef Producers		
Cattle ranchers		





Sustainability Practices

Sustainable agriculture is farming in sustainable ways. This means meeting people's needs for food and textiles, without compromising the ability for current or future generations to meet their needs.

Some approaches to sustainability focus on integrating the qualities of natural ecosystems into farm ecosystems. This includes ranching and farming practices that manage cattle sustainably and protect natural features of the environment.

Natural ecosystems have qualities that make them sustainable. These qualities address ideas like efficiency, self-sufficiency, diversity and resilience. Many farmers and ranchers use practices that mirror these qualities. Some of these practices are profiled in snapshots of Alberta cattle farmers and ranchers as well as media articles that follow. Explore the explanations of each of these qualities and use the snapshots, media articles and photos – all from Alberta cattle ranches and farms – to reflect on and respond to the questions.

The photos in this handout are all from current Alberta beef cattle ranches and farms. How can they increase your understanding of the environments and activities that are part of agriculture?

Efficiency

Efficiency refers to the ability to produce something with the least waste of time and effort. Natural ecosystems are efficient. Rain and organic matter are continuously recycled. Farmers use practices like composting manure and food waste to use as a natural fertilizer that can improve the quality of the soil.

- How do you think food waste affects the efficiency of the food system?
- What practices can you identify in the following snapshots from Alberta farmers that represent efficiency?
- How do you think the idea of efficiency can be promoted with everyone involved in the food system?





Self-sufficiency

Natural ecosystems and farm ecosystems both require energy from the sun and water from sources like rainfall and bodies of water. Farm ecosystems can become more **self-sufficient** by letting nature do some of the work for them. For example, livestock grazing delivers nutrients back into the soil and reduces the need for pesticides and synthetic fertilizers.

- What indicators of soil quality can you identify in the snapshots?
- How do these ranchers and farmers build self-sufficiency?



Diversity

Farmers who encourage a **diversity** of plant and animal species together can benefit from the relationships between them. For example, cattle and wildlife can thrive together on land that is used for grazing, instead of being cultivated for crops or used for urbanization. Natural plants can provide livestock with food or shelter.

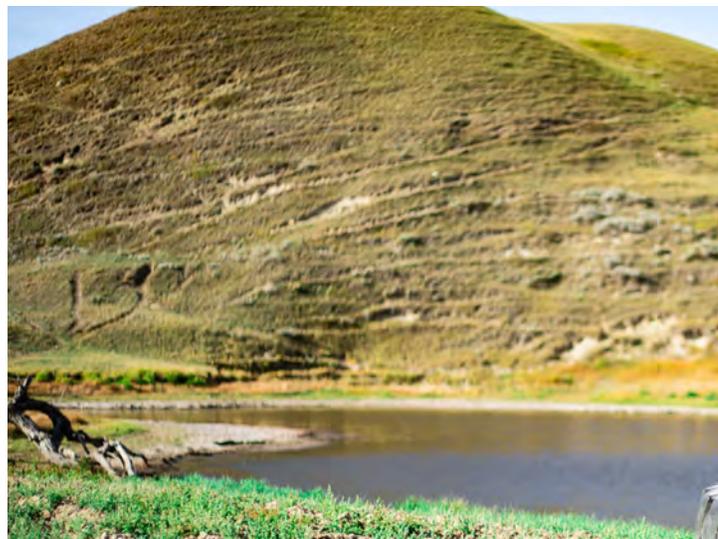
- How do farmers protect the natural diversity of plant and animal species?
- What advantages does a diverse environment have for cattle ranchers and farmers?



Resilience

Resilience refers to the capacity to deal with change and recover quickly from difficulties. Natural ecosystems show resilience when they recover from natural disasters like floods, hurricanes or droughts. Farmers face the same challenges. They build resilience in farm ecosystems by planting trees as shelters, using no till to slow water erosion and managing grazing to protect natural water sources.

- What evidence can you find of practices that build resilience in farm ecosystems?





What can sustainability look like? Ranchers and farmers in Alberta have an ongoing commitment to practices that promote sustainability.

SNAPSHOTS ONE, TWO, THREE AND FOUR PROFILE RANCHES IN ALBERTA THAT HAVE RECEIVED ENVIRONMENTAL STEWARDSHIP AWARDS FROM ALBERTA BEEF PRODUCERS. EACH SNAPSHOT PRESENTS A PERSPECTIVE ON SUSTAINABILITY FROM THESE RANCHERS.

SNAPSHOT 1

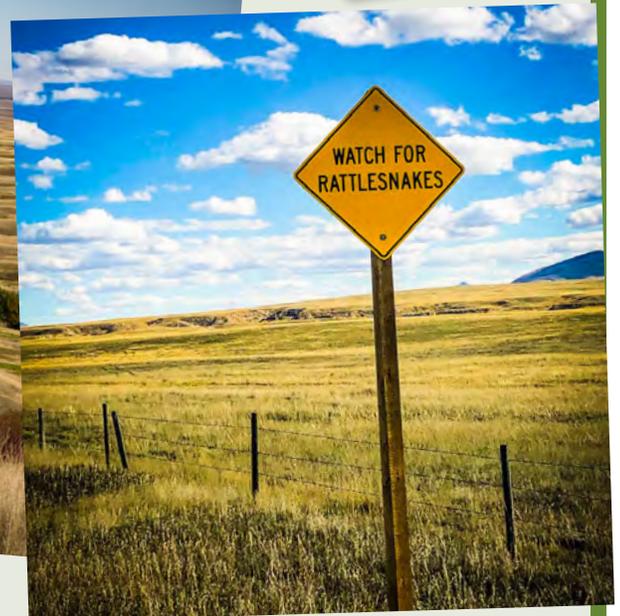
Deer Creek Livestock Co.

Each member of the group that owns Deer Creek Livestock Co., which includes James Bekkering, Richard Visser, Gateway Livestock and the Turner family, bring a different skillset while they work collaboratively to set direction for the ranch and give guidance to the staff. The emphasis on environment is weaved through the fabric of the ranch and ingrained in their values, vision and promise to traditionally raise beef while caring for the land and water.

“We have over 100 different wildlife species on the ranch. We depend on the environment to operate, and with that, our customers depend on us to maintain this environment,” said Smith. “All of us as shareholders, as well as the staff, have the same drive, the same goals, the same vision.”

Hugh Vandersteen joined Deer Creek Livestock as Ranch Manager four years ago and hasn't looked back. “I put my heart into it and I didn't think I would fall in love with it the way I did. I learn something from the cattle pretty well every day,” said Vandersteen.

View a video about Deer Creek Livestock Co. at <https://bit.ly/3br1b6c>.



The ranch works closely with MULTISAR, who partner with landowners to conserve grassland species at risk, to assess soil conditions and monitor range health. They have completed 113 range health assessments and 16 tame pasture health assessments from 2008 to 2014, and implemented the use of hawk poles, converted to 18-inch high smooth bottom wire fence lines and installed solar fencing and watering sites.

Cows and Fish, a group focused on riparian habitat management, has taken inventory of the riparian areas on the ranch in 1999, 2008 and 2014 to measure and benchmark riparian health. Deer Creek Livestock is also a Verified Beef Production Plus certified cattle operation.

Milk River runs directly through the ranch in southeastern Alberta. The solar panel watering systems pump water away from the river to keep cattle off the banks, and solar fencing is used to isolate grasslands and control grazing.

“We’re blessed with water and on dry years we can utilize it for the irrigation potential but that also means we have to protect it. We have to be stewards of the environment no matter what we do. We want to leave the land and where we live in a better place for the next generation,” said Bekkering.



SOURCE: Alberta Beef:
 Environmental Stewardship
 Award 2020: Deer Creek
 Livestock Co. Online.
[www.albertabeef.org/
 producers/environmental-
 stewardship-award](http://www.albertabeef.org/producers/environmental-stewardship-award)

Coulee Crest Farms

Randy Radau and his wife Sandra have been ranching at Coulee Crest Farms in Red Deer County since 1989. They purchased the farm, which was originally homesteaded by the Radau's in 1929, and assumed management of the purebred Hereford herd. They run a purebred and commercial cow/calf operation and background their own calves. Coulee Crest also has an integrated grain operation where they stubble graze cattle and utilize composted manure on cropland.

"The environment is our lifeblood in an agricultural operation. If you don't take care of it your operation will fail. We're constantly motivated to make things better for the environment so it takes care of us. It is a complete coexistence," said Randy Radau.

The farm doubled in size with Randy at the helm when additional neighbouring land was purchased to develop rotational grazing and cross fencing systems, allowing them to triple the herd. The operation currently includes 3,500 acres with 1,500 acres of grain production and 2,000 acres in pasture and hay production. The majority of grazing is done in Spruce Coulee which was designated an Environmentally Significant Area by Red Deer County.

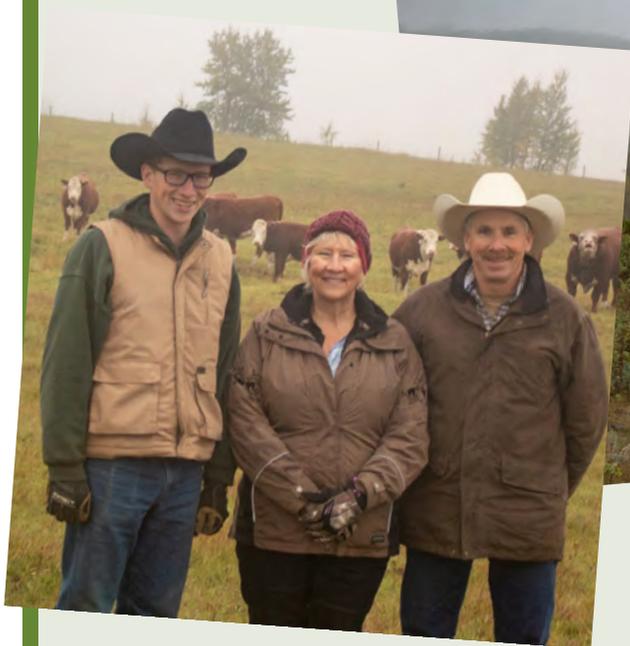


View a video
about Coulee
Crest Farms
at <https://bit.ly/3q07sPk>.



The farm is constantly working on environmental improvements and has completed projects through Growing Forward 2 and Ducks Unlimited. Springs were developed and fenced off to provide a fresh water source for cattle, and wetland restoration was completed. Solar powered watering systems are used to pull water offsite from a fenced dugout, keeping cattle away from the source and preventing runoff.

Coulee Crest Farms is home to many wildlife species including deer, elk, moose, a variety of birds, cougars and most recently a grizzly bear. They have designated and fenced areas with native trees for wildlife habitat, which also provide wind shelter for the cattle.



SOURCE: Alberta Beef: Environmental Stewardship Award 2019: Coulee Crest Farms. Online. www.albertabeef.org/producers/environmental-stewardship-award/2019

Shoestring Ranch

Ian is a fifth-generation Alberta rancher whose family originally homesteaded in 1883, west of Calgary in the Jumping Pound District. In 2007, Ian and Carman moved from north of Cochrane to Shoestring Ranch near Acme, AB. The cow calf and crop operation runs 180 pairs and retains calves for a natural beef program.

“I feel my connection to the land, water, air is really strong and getting stronger as I progress throughout my career,” said Ian.

They began shifting the environmental focus of the ranch through pasture management, but once they switched to focus more on the soil, everything came together. The ranch practices minimum tillage when seeding crops to keep residue anchored in the soil and protect the structure to prevent erosion.

“We try to take an environmental focus on all the decisions that we do here at the ranch, and try to include it in all of our management steps,” said Ian. “We have tried to work with nature as much as we can and we’ve changed the management of our ranch dramatically to do so.”

View a video about Shoestring Ranch at <https://vimeo.com/245440607>.



Dugouts are fenced off with several solar power watering systems to provide better quality water for the cattle and support healthy riparian areas. Shelterbelts are maintained to protect from wind erosion and provide wildlife habitat.

“I’d like to continue to improve upon the utilization of our land, our production, our cattle and pastures. I’d like to continue to improve the health of our soil and the cleanliness of our water,” said Ian.



SOURCE: Alberta Beef: Environmental Stewardship Award 2018: Shoestring Ranch. Online. www.albertabeef.org/producers/environmental-stewardship-award/2018

Winding Creek Ranch

Tom Thompson grew up in farming and agriculture, but it wasn't until the property across from his parents' land became available in 1984 that he decided to build a career and a life in ranching. Today, Winding Creek Ranch is a cow calf operation that rotationally grazes 500 acres, with 700 acres of hay crops.

"Growing up there was something always pulling me into this direction... being a steward of the land. What sustainability means to me is, what you're doing today, will this carry on for generations," said Thompson.

The West-Central Forage Association played a large role in changing the focus and management practices on the ranch. Frustrated with some outcomes, Tom attended a seminar on matching production cycles with grazing cycles and began to make significant improvements to his operation. After incorporating changes to his winter grazing, watering systems and power fencing for rotational grazing, Tom completed an Environmental Farm Plan.

"When the forage and the grass are growing, and the animals are happy... you will be profitable and sustainable. My stewardship goals are to keep the animals and the plants healthy, growing and viable," said Thompson.



View a video
about Winding
Creek Ranch at
<https://vimeo.com/194756179>.

When rotationally grazing his animals, Tom adheres to the adage of eat half, leave half so the grass has plenty of time for rest and regrowth. Cattle bale graze through the winter months to recycle nutrients back into the soil. Riparian areas and dugouts are fenced to keep cattle out, and water is pumped to solar powered watering systems.

“I’m out in the sunshine working with plants and animals. When you have a passion for something it isn’t really work. You want to be out there doing a good job and seeing the changes. We’re just caretakers here... borrowing this land from the next generation,” said Thompson.



SOURCE: Alberta Beef:
 Environmental Stewardship
 Award 2017: Winding
 Creek Ranch. Online.
[www.albertabeef.org/
 producers/environmental-
 stewardship-award/2017](http://www.albertabeef.org/producers/environmental-stewardship-award/2017)



Voices Unite to Protect Alberta's Grasslands

THIS SNAPSHOT PROVIDES EXCERPTS FROM AN ONLINE ARTICLE THAT DISCUSSES THE RISKS THAT NATURAL GRASSLAND ECOSYSTEMS IN ALBERTA FACE AND THE WORK THAT DUCKS UNLIMITED CANADA IS DOING WITH ALBERTA CATTLE RANCHERS.

Grasslands are one of the most threatened terrestrial ecosystems in the world," says Mickenzie Plemel-Stronks, a DUC conservation program specialist whose work concentrates on Alberta's cattle industry.

In a world where much of our native habitat is increasingly put at risk from human activity and development, that alarming claim underscores the vital need for grassland conservation. The importance of Alberta's grasslands is also reinforced when one considers that the Great Plains of North America are recognized as one of the top four grassland biomes on the planet alongside the African savanna, the pampas of Argentina and the steppes of the former Soviet Union.

Fortunately, thanks to the expanding work of DUC and others in the conservation community with Alberta's beef sector, the prospect of maintaining the province's prairie grassland habitat looks more promising...

"The biodiversity of native grassland habitat is amazing," she says. "In a single five-acre plot of prairie, there can be up to 100 different species of plants. Add to that the diversity of insects, birds, mammals, reptiles and more that occupy that small parcel of land for all or part of their life history. It quickly becomes evident that what may appear from a distance to be relatively homogeneous is anything but. Every single species plays an important role in maintaining the health of the complex ecological web of grasslands."



PRAIRIE HABITATS ARE FRAGILE, COMPLEX

“We sometimes don’t think about the impact of losing a single species,” says Plemel-Stronks. “Each species has an important function; if you remove one, it affects the whole web. Wetlands and creeks, grass and shrub lands, fish, birds and other wildlife—they’re all connected.”

ENVIRONMENTAL BENEFITS AND SERVICES ARE ALSO IMPORTANT TO CATTLE PRODUCERS

“The beef industry has become one of the best advocates for grassland conservation,” says Plemel-Stronks. “Wildlife, including waterfowl, need healthy water and grass, just as cattle do. And cattle are good at sharing; they co-exist well with wildlife. As such, DUC has a deep appreciation for Alberta’s cattle industry and a lot of shared interests.”

The alignment of DUC and the cattle industry has led to the development of several DUC programs for beef producers. Conservation easements, for example, provide producers with financial compensation for agreeing to not drain their wetlands or break native prairie. And where native grasslands have already been lost, DUC’s forage program offers producers financial incentives applied to seed costs for land put back into perennial cover.

“Perennial cover like tame grasses used for haying or grazing is preferred to annual crops when it comes to maintaining important ecological functions,” says Plemel-Stronks.

But despite a somewhat dismal past for Alberta’s native grasslands, there’s optimism for the future and she suggests, and all Albertans can play a role.

“When the importance of grasslands was not well understood, people didn’t care about them and didn’t work to conserve them. Fortunately, that’s changing. I would also encourage everyone to make time to explore Alberta’s grasslands—they’ll be surprised at their beauty and diversity.”

SOURCE: Ducks Unlimited Canada (May 2020): *Voices unite to protect Alberta’s grasslands.* Online. www.ducks.ca/stories/grasslands/protecting-albertas-grasslands/

Beefing up biodiversity: investigating the impacts of cattle production in Alberta’s grasslands

THIS SNAPSHOT PROVIDES EXCERPTS FROM AN ONLINE ARTICLE PROVIDED BY THE ALBERTA BIODIVERSITY INSTITUTE.

Posted by: Lindsay Monk

Cattle producers are stewards of 9 million hectares of grassland in Alberta that support biodiversity. However, the relationship between beef production and biodiversity is complex and poorly understood.

We do know that cattle grazing can have both positive and negative effects on wildlife; for example, cows in riparian areas can degrade sensitive vegetation and aquatic life. On the other hand, the endangered Burrowing Owl can benefit from beef production because grazed prairie vegetation can improve the owl’s hunting efficiency.

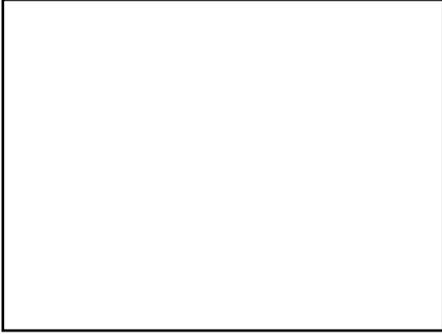
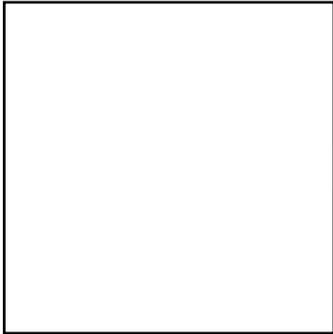
It’s important to understand the relationship between biodiversity and beef production in Alberta, especially considering current efforts to assess the sustainability of beef in Canada (e.g., the Canadian Roundtable for Sustainable Beef; Alberta Beef Producers) and worldwide.

SOURCE: Monk, L. (November 3, 2015): *Beefing up biodiversity: investigating the impacts of cattle production in Alberta’s grasslands.* Alberta Biodiversity Monitoring Institute Blog. <http://blog.abmi.ca/2015/11/03/beefing-up-biodiversity-investigating-the-impacts-of-cattle-production-in-albertas-grasslands/#.X3zIIWhKiUI>



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BIG IDEA ESSENTIAL QUESTION CHALLENGE



GUIDING QUESTIONS (WHAT WE NEED TO LEARN) GUIDING ACTIVITIES AND RESOURCES (WHAT WE DID AND WHAT WE USED TO LEARN)



SYNTHESIS (WHAT WE LEARNED)

SOLUTION (CONCEPT & IDEAS FOR THE CHALLENGE TASK)





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