



# THE DIRT ON SOIL

A HANDS-ON SERIES DESIGNED FOR  
GRADE 7 CLASSES AND THEIR TEACHERS

TEACHERS' GUIDE

THE DIRT ON SOIL SERIES IS PRESENTED BY ALBERTA AGRICULTURE AND FOOD & AGRIUM INC.

# THE DIRT ON SOIL

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Bring the Dirt on Soil Series into your class and explore learning outcomes like these\*:

- Trace and interpret the flow of energy and materials in an ecosystem starting with its foundation - the soil.
- Learn how soil is formed and why so many types of soil exist.
- Explore the essential role of plants, identifying links to human needs, technologies, products and impacts as well as insect and animal habitat.
- Review soil basics by learning how scientists classify soils into different types. Students will be taken through the importance of soil colour, texture and structure.
- Investigate and describe relationships between humans and their environments. Explore dependencies and impact using science, debate and discussion.
- Understand the demand on our soils and the finite space available to grow crops for healthy food and products. Explore the need for land used for recreation and development.

### PLEASE NOTE:

\*These learning outcomes highlight some of the curriculum covered in a Grade 7 unit, however, can be used in other grades. The tools provide teachers and instructors with background for classroom learning, discussion and activity. When students are working in isolation these tools will not be as effective.

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### TEACHER AND INSTRUCTION GUIDE FOR THE 'DIRT ON SOIL' SERIES

#### WHAT IS THE DIRT ON SOIL SERIES?

Alberta Agriculture and Rural Development developed 'The Dirt on Soil' series in collaboration with Agrium Inc. The video and worksheet series is designed to connect with the Grade 7 science and social studies curriculum.

Through this series Alberta Agriculture and Agrium hope to:

- raise awareness of the importance of healthy soils on earth;
- tell students that soil science and agriculture hold essential keys to a sustainable future;
- encourage critical thinking and debate about human impact on soil and habitat.

The videos and worksheets promote thought about soil and encourage students to debate its use in an informed manner. The suggested classroom activities help students discover the complexity of soil for themselves. When you believe your students have the proper foundation to discuss soil, they are ready to use SoilQuest. SoilQuest is a guided web activity that takes teachers and students through a land use debate. There are no right or wrong answers in this exercise, as it is entirely inquiry based.

#### WHAT IS IN THE SERIES?

The Dirt on Soil series will continue to grow in the future with additional topics being explored using this format. As of the Spring 2008, it consists of the following components:

- Teacher's Guide for the series
- The Dirt on Soil - Video & Worksheet 1
- The Soil Beneath our Feet - Video & Worksheet 2
- Soil Basics - Video & Worksheet 3
- Banking on Soil - Video & Worksheet 4
- SoilQuest Land Debate website - [www.SoilQuest.ca](http://www.SoilQuest.ca)
- Games, animations and additional tools for youth - [www.growingthenextgeneration.com](http://www.growingthenextgeneration.com)

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### VIDEO DESCRIPTIONS

The Dirt on Soil - Video Overview (approx. 4 minutes)

Kacey, a young adult involved in agriculture, talks to students about soil and why it deserves more thought. She reminds students of all the things we enjoy today because of the soil and takes them back to early civilization to show its importance to the very first settlers.

The Soil Beneath Our Feet - Video Overview (approx. 7 minutes)

A young rancher named Ryan takes students on a journey to take a closer look at soil. Ryan speaks about what you will find in the soil, why we study it and how it is formed. This video concentrates on the 5 soil forming factors. It provides a good foundation to talk about land formations as well as soil types, textures and colours.

Soil Basics - Video Overview (approx. 5 minutes)

Sarah is a soil scientist tasked with assessing the proper use for a section of land. She takes students through the clues in the soil that help her assign the proper use for it. To do this, she takes learning into the kitchen to review the texture and properties of sand, silt and clay.

Banking on Soil - Video Overview (approx. 5 minutes)

Scott is a land developer who gets lost on a hike in Drumheller. When we find him, he's starting to think about how he would survive in the Badlands without food, water or shelter. He talks about the importance of soil for food production and explains how healthy soil is like a savings account at the bank.

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### **CURRICULAR CORRELATION:**

'The Dirt on Soil' videos and worksheets match many of the principles set out in Alberta Learning's Program of Studies; the resources are learner centered, collaborative, responsive and innovative. The materials can serve as a wonderful 'real life' resource that help you incorporate learner outcomes into classroom activities. Here are a few examples of potential connections:

#### Science - Grade 7

Unit A: Interactions and Ecosystems (Social and Environmental Emphasis)

Unit B: Plants for Food and Fibre (Science and Technology Emphasis)

#### Social Studies - Grade 7

All six strands of social studies are represented in this series (the land, places and people, time, continuity and change, culture and community, global connections, economics and resources, and power, authority and decision making).

#### Language Arts - Grade 7

SoilQuest.ca will require students use essential language skills as they listen, speak, read, write and represent their thoughts, ideas, feelings and experiences on soil through discussion and integration questions. Students will need to comprehend and respond personally and critically to oral, print and other media texts. Their background on soil will come from viewing the 'The Dirt on Soil' videos and completing the exercises and activities.

Although this program is targeted for grade 7, the material can also be used in grades 4 to 6 to enrich existing activities around growing plants and caring for their environment. The Dirt on Soil series should increase student awareness of soil as an important natural resource by exploring its various roles in society, our economy and natural environment.

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### HOW DO I GET THIS SERIES FOR MY CLASSROOM?

The videos, worksheets and land debate can be downloaded from the SoilQuest website located at [www.SoilQuest.ca](http://www.SoilQuest.ca) and from Agrium's youth site, [www.growingthenextgeneration.com](http://www.growingthenextgeneration.com)

You can order a copy of the videos and sheets on a CD by contacting Agrium Corporate Relations: (403) 225-7000

Ideas on how to bring more hands-on learning on soil and agriculture into your classroom can be obtained by speaking with representatives in The Agriculture Education and Training Branch in Edmonton at (780) 427-4187.

### RECOMMENDED TIME FOR THIS UNIT:

The videos and worksheets cover some complex material about soil and how it connects to our lives. This is the main reason why the videos were separated into specific topics. It is not recommended that you watch all videos in one sitting. Rather, we suggest you watch the first video with your class, complete an activity or worksheet and then watch the second video, and so on. After the fourth video, direct the children's attention to the SoilQuest site ([www.SoilQuest.ca](http://www.SoilQuest.ca)). Be sure to read the Instructor's Guide for useful suggestions on how to use SoilQuest in your classroom.

### BACKGROUND FOR TEACHERS ON SOIL:

Protecting our soil ensures our survival. Humans, plants and animals all depend on soil for food, shelter and clothing.

- ❖ Fewer than 2 out of 1,000 Albertans work in production agriculture (farming). This small group meets the food and fibre needs of Canada as well as many people abroad.

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- ❖ However agriculture, along with its related occupations, is Alberta's second largest industry. It generates billions of dollars every year; one out of every 5 jobs in Alberta depends on agriculture in some way. It has a fundamental impact on the Canadian economy, our Alberta landscape and the environment. It also influences the balance of international trade.

Our citizens must be agriculturally literate in order to make responsible decisions regarding this vital natural resource. Building that literacy through classroom friendly resources is what the 'Dirt on Soil' is all about.

### WHY SOIL IS SO IMPORTANT?

Most life on earth depends on soil for food. Plants are rooted here, and get water and nutrients (nourishing substances) from it. Animals get nutrients from eating the plants that grow in the soil. Soils are home to many organisms like bacteria, insects and worms. We also build our schools, roadways and homes on them. Soils help to filter out pollutants that could contaminate our drinking water. Some are used to contain material like waste. How soil is used depends on its type. There are many different kinds of soil within a given area - like in a field, county or in a province.

Soils form very slowly and are easily depleted of their beneficial properties. That is why it is important for all of us to care for them. This soil education series argues that soil is one of the most important natural resources on earth.

### GLOSSARY

Some of the words in the worksheets may be unfamiliar to your students. Words you might want to pre-teach are:

agriculture, natural and renewable resources, fibre, production, microorganism, decompose, topography, terrain

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A link to the glossary provided by Alberta Agriculture and Rural Development can be found at [www.SoilQuest.ca](http://www.SoilQuest.ca). Please note this glossary was written for adults and not students, so it may seem a bit sophisticated at first glance.

### DISCUSSION PROMPTERS:

1. Why is it important for people to know about agriculture?

*We all depend on agriculture for food, clothing and shelter. It is important to understand how our needs are supplied as we make decisions about land use, protecting resources, keeping food safe and much more.*

2. What products have you used today that are dependant on soil?

*Worksheet 1, 'The Dirt on Soil', has a checklist on the first page that gets students thinking about this question. Students may ask you how disposing of garbage or using the toilet is connected to the soil. Note that soil is often a storage container for our waste. Soils that have a heavy clay base can act as a natural basin to contain waste and break its content down over time. People often reinforce the soils' function by adding liners and taking other environmental precautions. Soil also holds the pipes in place that carry water in, and the waste out of our homes.*

3. If it takes so long to create healthy growing soil can we really consider it a renewable resource?

*If you were to make soil from its parent material, it would take 500 to 1000 years to form. Therefore soil isn't really a renewable resource. People in agriculture work to keep their healthy growing soils from blowing or washing away. They also replenish soils with water and nutrients that are taken up by plants during the growing process.*

4. Land is fought over for many different reasons. Often land stakeholders have different views on how the land should be used. Read this case below to your class and discuss their views.



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*Example case: A waste management company has offered a very large sum of money to a long-term resident and farmer of a small community. The company wishes to use this land to build a landfill site that would serve the county and a larger city nearby. The waste management company was encouraged to find the new location by the government of the nearby city, as their growth requires expanded waste management storage centres. The company has brought the citizens together to discuss their plan to convert the land into a landfill site.*

*The resident, and current owner of the land, feels badly for the townspeople but is considering the offer. His age has kept him from properly farming the land for the past few years.*

Ask students what their reaction would be if they (or a parent) were a neighbour to the farm in this example. What concerns would they have? Who would they fight? Would they win? Then flip this around, what if they were the farmer? What issues would they consider in making their final decision?

[A version of exercise is repeated for students in worksheet 3]

4. What does the population trend of the future (more people in cities and underdeveloped countries) mean for agriculture?

*Production must keep increasing in order to feed everyone. Transportation and distribution will be even more important than they are today. A growing urban population will use resources in greater quantities than their fewer rural neighbors who produce the food. Conserving land, water and energy resources and using new technologies to increase production will grow in importance. Marketing new products will continue to be a growing business.*

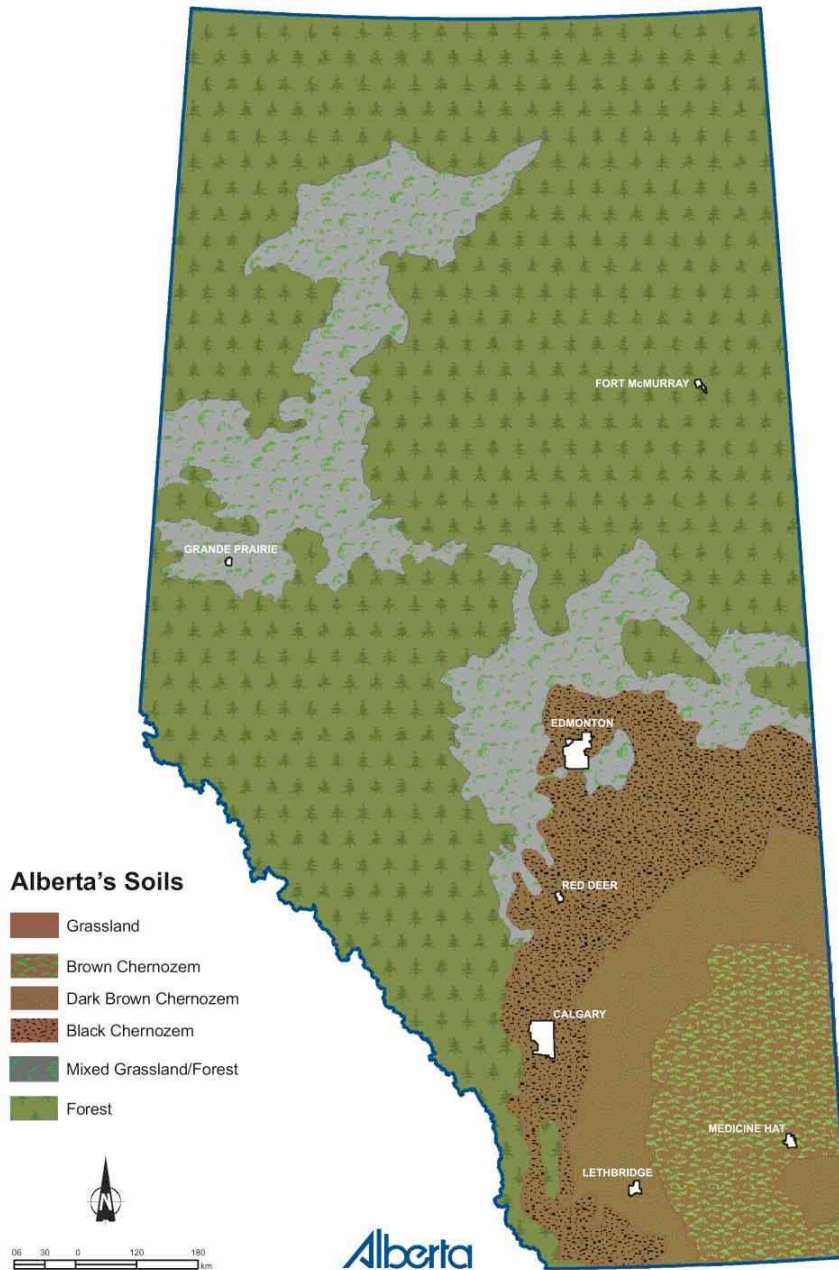
### SOIL MAPS

The soil maps that follow will help teachers better understand the types of soils in the province of Alberta. These maps may be used in classroom and making copies is permitted.

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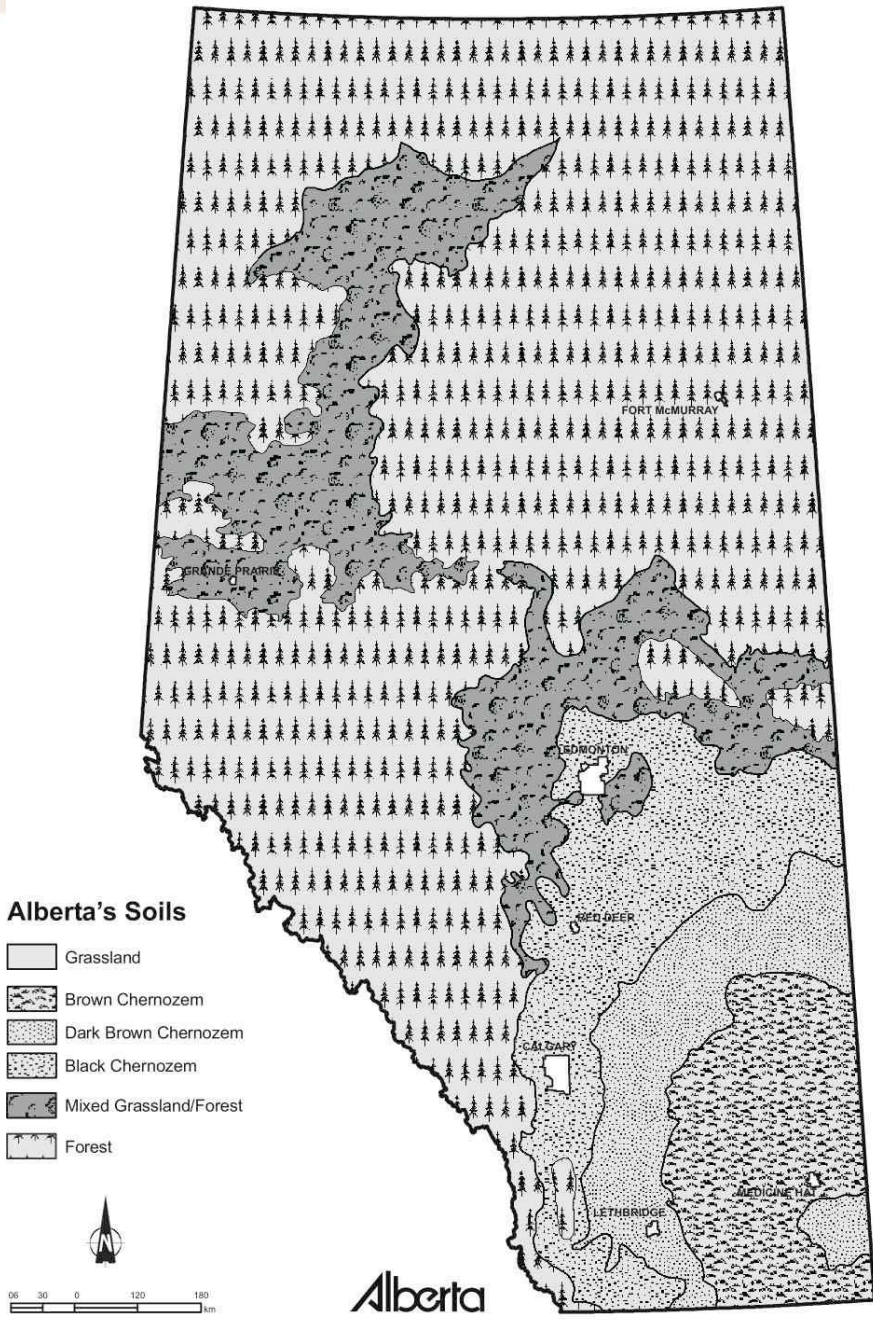
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### IN CLASS EXERCISE 1:

Materials required: apple(s), paring knife

#### *World Apple Exercise - A Slice of Soil*

Complete this activity to learn just how little soil we have to grow food.  
An apple and a paring knife are needed for this activity (teacher supervised).

1. Take an apple and explain to your students that it will represent our earth. Tell them you are going to use this simple example to show them why we need to protect our soil.
2. Explain that the earth is covered in topsoil that contains all the living and non-living things plants need to grow. Once this is scraped off or depleted of life, it will no longer be able to grow food. The topsoil is like the skin of the apple and proportionately about as thick. Peel off a little slice to demonstrate this point.
3. Cut the apple into four equal parts. Three parts represent the oceans of the world. The fourth part represents the land area.
4. Cut the land section in half lengthwise. Now you have two  $\frac{1}{8}$  pieces. One section represents land such as deserts, swamps, Antarctic, arctic and mountain regions. The other  $\frac{1}{8}$  section represents land where we all live and play.
5. Slice this  $\frac{1}{8}$  section crosswise into four equal parts. Three of these  $\frac{1}{32}$  sections represent the areas of the world that are too rocky, too wet, too hot, or where soils are too poor to grow food. Plus, we can't grow food on some land because cities and other human built structures are on it.
6. Carefully peel the last  $\frac{1}{32}$  section. The peel on this small piece represents the amount of soil on which we have to grow food. This amount of soil will NEVER get any bigger.

With so little soil and so many people on the earth, how can we grow enough food to feed our growing world population?

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This exercise demonstrates one of the reasons why we need to study the soil and determine how we share it. It also demonstrates why we need to take care of the fertile soil we have, replenishing it properly with nutrients that are depleted during harvests.

### IN CLASS EXERCISE 2:

Soil Texture - observation

Have the kids feel the soil in their hands - first dry, then wet. Have them record their observations. Make sure they write down where the soil was collected (be specific), what colour it is, how does it feel when dry and the same when wet. Is it sticky? Can they create a ball or does it crumble into smaller pieces?

Do they think there is organic matter in their soil which helps the particles stick together?

Topsoil Colour	Percent Organic Matter
Black	5 to 10
Dark Brown	3 to 5
Brown	2 to 3
Dark Gray	2 to 4
Gray	1 to 2

Experiment:

Teachers may wish to use the following procedure to show students the size and range of particles that make up soil. Place a handful of soil you collect in a 150 mL graduated cylinder.\* Add water to within 5 cm of the top. Completely cover the top with your hand and shake vigorously for a few seconds. Place the cylinder upright and allow the settling to occur over several minutes. Different particle sizes will settle at different rates to form distinct layers:

Sand settles quickly and is clearly visible as a mixture of light and dark sand grains. Silt may need several minutes to settle. Distinct silt particles are barely visible.

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Clay and organic matter settle as a grey or black banded layer on top. Clay particles are so small that they can remain in suspension for days in still water.

\* Note: its best that you collect the soil from outside or have the students bring soil in from home. The students should enjoy the exercise as well. Soil bought in a garden market tends to have more organic matter and nutrients added to it to help grow seedlings and this may distract from the purpose of the exercise. However, if it is winter and snow covers the ground, buying potting soil may be your only option.

### WORKSHEETS:

The Dirt on Soil Worksheets may be used in classrooms and copies are permitted. The answer key for these worksheets is found on the pages that follow.

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Answers for the fill in the blank exercise on worksheet 1

- |               |                 |                |                |            |
|---------------|-----------------|----------------|----------------|------------|
| 1. NUTRIENTS  | 8. HEALTHY SOIL | 15. DAIRY      | 22. FORESTS    | 29. PLANTS |
| 2. PRODUCTS   | 9. GROWING      | 16. FIELDS     | 23. PRODUCTS   | 30. CANOLA |
| 3. CONSUMER   | 10. PRESERVES   | 17. BIOFUELS   | 24. LEVELS     | 31. WHEAT  |
| 4. MANURE     | 11. CROPS       | 18. BUSINESS   | 25. RECREATION | 32. CORN   |
| 5. BREAD      | 12. HEALTHY     | 19. MORE       | 26. GARDEN     | 33. FEED   |
| 6. CONSUMER   | 13. OPERATION   | 20. OIL        | 27. NUTRIENT   | 34. SOIL   |
| 7. FERTILIZER | 14. DEVELOPMENT | 21. VEGETABLES | 28. FOOD       | 35. PROFIT |

You add 1, 7 to the soil to create a healthy growing environment for your 11, 29. You and your family benefit from the 28, 30, 31, 32, 21 you grow, and the money you make, selling your 23, 10, 21, 5 at the market.

A field with 8 allows farmers to produce more 28, 11 on less land. This means they don't need to expand their 16 to produce more. This is important because farmers may need to contribute to our energy reserves by growing 32, 30 for 17. Because they can produce 19 with less, farmers can meet the demand of a 9 population while leaving space for 25, 14 and wildlife habitat.

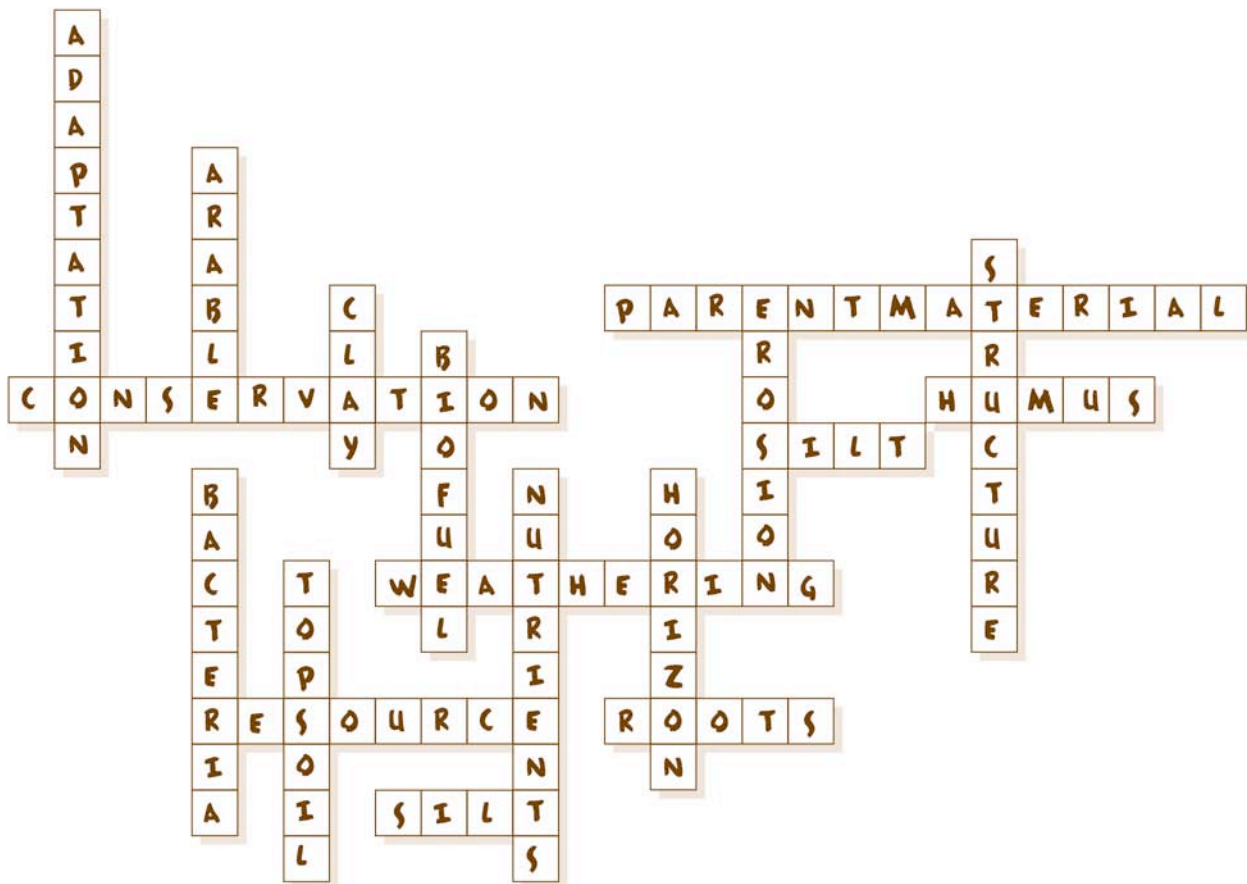
Healthy soil allows farmers to produce 33, 28 for cows and cattle. The livestock gives back by producing 4 that can be used to improve the 27, 24 in soil. When the livestock reaches a certain age, they become useful to us for 28 and other 3 products. The money generated from this 18, 13 allows its owners to 35.

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Answers to the crossword puzzle on worksheet 2





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Answers to the exercise on worksheet 3

Word Scramble:

1. organic matter..... glue
2. clay
3. sand
4. particle.... sand, silt and clay
5. sand

**Discussion points for the exercise:**

This case is based on an actual event in Carseland, Alberta. A long-time farmer and resident of the area was offered a large sum of money to sell the family farm to a waste management company to build a storage and treatment facility there. This centre is needed to serve Calgary's growing population.

In this series, students have learned that bacteria in soil helps to break waste down over time, which is why garbage is mixed and buried in soil. This process does not occur quickly. It can take many years, and sometimes generations, for products to decompose. Plastics may not break down at all. All of this activity takes a toll, on the soil and the land around it.

The advantages to the farmer would include financial compensation. He was already thinking of retiring. The money would allow he and his family to move closer to the city. Disadvantages involve upsetting his friends and neighbours with the sale. His fields would be uprooted and the crops that were harvested each year would cease to exist. This may affect supplies at the local market or to distributors that came to depend on him.

Plants that used to take carbon from the air and replace it with oxygen would no longer be able to do so.

The neighbours have a right to be concerned and students can list off the obvious reasons.

Issues that would need to be researched would be the type of soil that exists there now. What do they plan to store there? Do rivers or bodies of water cross this land? Will they be at risk of being affected by chemicals or material when it rains, spreading the problem downstream?

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Neighbours may also want to know how the company planned to manage the site and keep them informed. What environmental measures would be taken to minimize the impact to the surrounding environment? How would the company repair the area when they decide or are forced to leave?

Teachers may want to discuss the balance that needs to be struck between the soil we need for necessary items like city waste management sites, housing developments, hospitals and schools, and fields to grow necessary crops for food and products.

Please note that there are no right or wrong answers in this exercise. Students should become more aware of land development issues that concern adults in their towns and communities. When they are older, they may be part of these debates themselves and it is our hope that they will be able to contribute intelligently because they understand both sides.

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Answers to the exercise on worksheet 4

How would you protect topsoil in the following situations?

1. The downspout of an eaves trough is creating a gully as water drains to the street.

Install a concrete surface canal.

2. Growing grass on a steep, south-facing hill in your yard.

You could also try landscape fabric to hold the soil in place until grass is established. You see this sometimes on hills or burms on the side of a road. You could reduce the slope by landscaping the area.

3. Wind is blowing soil from bare fields in the winter as shown by black snowdrifts along the roadside.

Use shelter belts, cover crops, plant grass and use conservation tillage practices. Have students look up these terms if they are unfamiliar with them. Alberta Agriculture's website found at [www.agric.gov.ab.ca](http://www.agric.gov.ab.ca).

Soil Exercise 2 - Crops and their connections

The intent of this exercise is to show students how many people are economically, socially or environmentally affected agriculture as an industry. It's not just farmers who are affected when, for whatever reason, crops cannot be produced.

Students should complete the top line first and then work down each column (from left to right) following the arrows on the worksheet. The example given uses apples and this may encourage students to continue the path already started. Teachers may want to use the apples as an example to go through verbally in class and then have students choose a different crop to explore on their own.

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Apples on trees at an apple farm	The apples are harvested and sold	They are sold to a company that makes apple juice	A family buys then enjoys the apple juice at home
The farmer benefits People who support the farm The environment The community	The farmer The community	The juice company's suppliers Transportation company The juice company	The store that sells the juice The family that drinks it
The farmer benefits from smaller sales through the year People who work on the farm make money to bring home to their families The environment benefits from the trees taking carbon from the air People in the community may benefit from picking apples on site.	The farmer benefits financially from the large sale The community may benefit from the farmer having money that he or she can spend in the town or contribute to worth causes	Companies that contribute to equipment that make or package the juice or ingredients that go in it The transportation company makes money shipping the juice to various stores The juice company makes money from the stores who buy their juice	The store makes money on the juice so they will be able to buy more and continue to operate The family gets the nutrients from the apples that help them keep healthy and strong

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### FEEDBACK:

**Help us help you!** We would really appreciate your feedback on this series. Your comments will help us improve the resources we provide you and encourage us to continue this series. Let us know if you have ideas for other videos. Also share ideas that may be helpful to other teachers or instructors who are delivering this material. There is a form on the SoilQuest website dedicated to taking your comments, questions and feedback.

[www.soilquest.ca](http://www.soilquest.ca)

[www.agrium.com](http://www.agrium.com)

Thank you for helping us create a generation of people with a greater understanding of soil and its economic, social and environmental impact on us all!