

Lesson 4

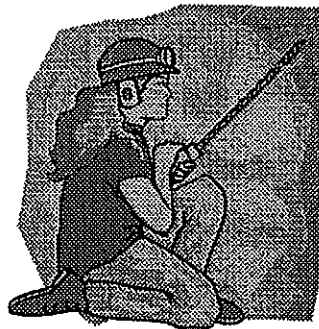
Geological Resources**Learning Outcomes**

After completing this lesson you will be able to

- describe how geological resources are located, extracted, and processed
- identify environmental impacts of geological resource extraction

Minerals, Mining, and Manitoba

Manitoba has an abundance of mineral resources. It presently ranks fourth among Canadian provinces in terms of mineral production. Metallic minerals are found in the Canadian Shield portion of the province.



Manitoba's chief mineral resources are nickel, copper, and zinc. The Thompson nickel belt is one of the richest in the world. Gold, silver, cobalt, and platinum have also been found in Manitoba's nickel and copper mining areas. Flin Flon,

Lynn Lake, and Leaf Rapids are also major mine sites. Their main production has been zinc and copper. Manitoba is unique in that all of the tantalum mined in Canada comes from a mine in southeastern Manitoba.

Locating, extracting, and processing mineral resources, while considering environmental and economic impacts at every step of the way, is a complex task. The following readings will provide you with an overview of this process from a Canadian perspective.

Questions: Locating, Extracting, and Processing Geological Resources

The magazine *What Metals & Minerals Mean to Canadians* has been included with the course for you to use with this lesson. It provides a wealth of information on mining in Canada, and will help you with Assignment #4, which you will complete later in this lesson.

Turn to the section "About Geology, Prospection and Exploration," found on pages 8-15. Read this section carefully, and then answer the questions provided below.

Note: You can use the headings in the article to help you locate information. Scanning the key words provided in each question (below) will also help you to quickly locate information. The key words from the questions have been written in **bold type** to assist you.

- a) What are the **five main geological regions** geologists have divided Canada into?

- b) Which region are you located in?



2. Why are **junior exploration companies** important to mineral exploration in Canada?

3. a) The **Hemlo deposit** is a spectacular mineral deposit that geologists found in an area they never expected a mineral deposit to exist. Where was this deposit discovered?

b) What do discoveries like this tell you about the process of locating mineral deposits?

4. What are some examples of **technologies** that are used in **modern prospecting**?

5. What are geological **anomalies** and why are they so important to geologists?

6. What support do the **Geological Survey of Canada** and other provincial geological surveys provide to prospectors and mining companies?

7. A description is provided of how to **stake a claim** in the province of Ontario. If you were to stake a claim there, what would you have to do to hold on to your claim and the exclusive right to proceed with its exploration and development?

8. If the value of a mineral deposit or mineralization is higher than what it costs to dig it out of the ground, process, and market it, then the deposit becomes known as an _____ . Sometimes, concentrations of minerals that have no economic value today will come into demand in the future.

In preparation for Assignment #4, read the rest of the magazine. This includes the following sections:

- “How Ore is Extracted from the Earth,” pages 16-22
- “Adding Value to Our Mineral Resources,” pages 23-27
- “Mining and the Environment,” pages 28-32

These three sections, plus the section you’ve already read (“About Geology, Prospection and Exploration”), provide a comprehensive overview of the major areas you will need to address in your hand-in assignment. This magazine can be used as one of your references.



Assignment #4: Geological Resources in Manitoba and Canada

You will now prepare an information booklet by completing the following steps. **Note that this assignment will be graded by your tutor/marker.** Do your best.

1. **Decide on your topic.** Select one geological resource that is present in Manitoba or elsewhere in Canada. Refer to the magazine *What Metals & Minerals Mean to Canadians* for ideas.
2. **Research the topic.** You must find the following information (refer to the grading rubric for further details):
 - use and importance of the geological resource
 - location of mines in Manitoba and/or Canada (locate them on a map)
 - methods used to locate the resource
 - methods used to extraction the resource

- methods used to process the resource
- concerns related to environmental impact of extraction, and techniques used to minimize the impact

You must use at least three different sources for your information. (See “Possible Sources of Information” at the end of this lesson for some online starting points).

Remember to look at the sources carefully to make sure they are up-to-date and contain accurate information, and record the sources you used in a bibliography. Refer to *Nelson Science and Technology Skills Handbook*, Section 4, Researching (pages 30-31) and Section 8A, Writing a Report (pages 76-78), for guidance.

3. **Prepare the Information Booklet.** Compile the information you have collected into a booklet form. Your audience is a fellow student or family member of about your age, and your purpose is to inform. Refer to the following points for guidance:

- If there are any terms that you don't think your reader will know, use other terms or provide explanations.
- Point form can be used in some places to provide the reader with short and easily accessible information.
- Include a map that identifies the location of mines that contain the resource you are researching. Diagrams or pictures can also be used to provide visual information.
- You must provide five multiple choice questions that a peer could answer using your information booklet, along with an answer key.
- You must include a bibliography.
- Your booklet should be 2-4 pages in length (including the map).

Refer to the Grading Rubric on page 36 for details on what your tutor/marker will be looking for when grading your assignment.





Once you have completed your information booklet, put it in an envelope for mailing. Mail to:

Tutor/Marker Grade 7 Science
Distance Learning and Information Technologies Unit
Manitoba Education, Training and Youth
555 Main Street — Main Plaza
Winkler, Manitoba
R6W 1C4

Don't forget to include the Assignment #4 cover sheet, found in the course introduction.

Assignment #4: Geological Resources in Manitoba and Canada—Assessment	
Criteria	Possible Marks
<p>Content Includes information related to:</p> <ul style="list-style-type: none"> • use and importance • location, extraction, and processing • environmental concerns and techniques to reduce impact 	<p><i>18-20 marks:</i> All required information included, information presented in a clear and concise manner, in language suitable for the audience.</p> <p><i>15-17 marks:</i> Most of the required information included, information presented in a clear and concise manner, in language suitable for the audience.</p> <p><i>12-14 marks:</i> Most of the required information included, information generally clear and in a language suitable for the audience.</p> <p><i>10-11 marks:</i> Most of the required information included, information sometimes unclear, rambling, or stilted.</p> <p><i>under 10 marks:</i> Major pieces of information missing, information sometimes unclear.</p>
<p>Includes required pieces:</p> <ul style="list-style-type: none"> • map showing mine sites • bibliography • 5 multiple choice questions and answer key 	<p><i>9-10 marks:</i> All required information included, and clearly and accurately presented.</p> <p><i>7-8 marks:</i> Most required information included, may contain minor errors.</p> <p><i>5-6 marks:</i> Most required information included, contains major errors.</p> <p><i>under 5 marks:</i> Required pieces missing.</p>
<p>Presentation The booklet:</p> <ul style="list-style-type: none"> • is clear and easy to follow • has a pleasing presentation/is eye-catching • is interesting to read 	<p><i>5 marks:</i> Clear and easy to follow, eye-catching and interesting.</p> <p><i>3-4 marks:</i> Eye-catching and interesting, may be unclear or hard to follow in places.</p> <p><i>under 3 marks:</i> Unclear and difficult to follow.</p>
Total	/35



Possible Sources of Information

- Association of Manitoba Museums
<<http://www.escape.ca/~amm/>> (204-947-1782) can assist with the location of museums in Manitoba that provide information on resource extraction (e.g., museums in Flin Flon, Thompson, Lynn Lake, Wabowden).
- Manitoba Industry, Trade and Mines
<<http://www.gov.mb.ca/em>> (204-945-6569)
- INCO Mines, Sudbury
<<http://www.inco.com/about/enviro/env00-g.htm>>
- INCO Mines — Sudbury, Thompson
<<http://www.inco.com/about/primary/mtls00-g.htm>>
- Main Minerals and Metals Produced in Canada
<<http://www.nrcan.gc.ca/mms/school/min&met/english.htm>>
- How Iron and Steel Work
<<http://www.howstuffworks.com/iron.htm>>
- How Oil Refining Works
<<http://www.howstuffworks.com/oil-refining.htm>>
- Take a tour and find out what minerals are used to make computers, telephones, pens and more
<<http://www.nrcan.gc.ca/mms/wealth/home.htm>>
- Natural Resources Canada addresses environmental concerns of mineral extraction at this site
<<http://www.nrcan.gc.ca/mms/school/env/mining.htm>>

Notes



- natural resource

Lesson 5

Soil

Learning Outcomes

After completing this lesson you will be able to

- recognize the importance of soil as a natural resource
- describe the characteristics and locations of different soils in Manitoba

Is Soil a Natural Resource?

A **natural resource** is something found in the natural environment that humans can use to satisfy a need. We often think of trees (used for lumber and paper) and minerals (used for the production of materials) as examples of natural resources. Another important natural resource is soil. The following article describes the soils in Manitoba.

Soils in Manitoba

Like water, soil is a valuable resource for many forms of life. Green plants derive their energy from sunlight. Water, gases, and mineral nutrients are absorbed by plant organs and are incorporated into plant bodies. Plants that are consumed by animals or humans are eventually converted into animal tissue. Decomposition of plant and animal bodies and their waste products in soil allows matter to be used again and again by living organisms. In this way, soil serves as an important link between the living and non-living worlds.

Soils are made up of different compounds. Rocks are eroded by rain or wind and are broken down by physical or chemical processes to form tiny mineral particles. The size of the mineral particles is important in determining the characteristics and classifications of soils.

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- *Clays* have the finest particles, the largest total air space, and the ability to soak up and hold much water.
- *Sands* and *gravels* have the largest particles and large pores, but less total air space. They hold little water and allow water to pass through easily.
- *Loams* have particles of intermediate size and space. They have the ability to hold water more easily than sands and gravels.

Irregular spaces between the mineral particles allow *atmospheric gases*, water, and water vapour to enter the soils. Atmospheric gases include oxygen, carbon dioxide, and nitrogen.

The decaying *organic matter* within the soil is added over many thousands of years. This organic matter provides many nutrients for plants and is responsible for aerating and loosening soil and helping with water absorption.

Also present in “dirt” are millions of *living organisms*. Bacteria, fungi, protozoans, and larger organisms are instrumental in determining the characteristics of soils.

Soil Zones

A *soil zone* is an area of relatively uniform soil colour and composition. In Manitoba, provincial soil maps generally identify from three to five soil zones. The soil zones shown on the Soil Zones of Manitoba map (later in this lesson) include

- bog and subarctic
- peat and podzolic
- lime-rich forest (grey)
- grey brown
- black

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Brown soil zones are found in warmer and drier regions that may experience drought. Lack of moisture is usually the main factor limiting crop production. This short grass prairie soil zone has less organic matter than black soils. It has lower than average provincial yields and a higher chance of crop failure.

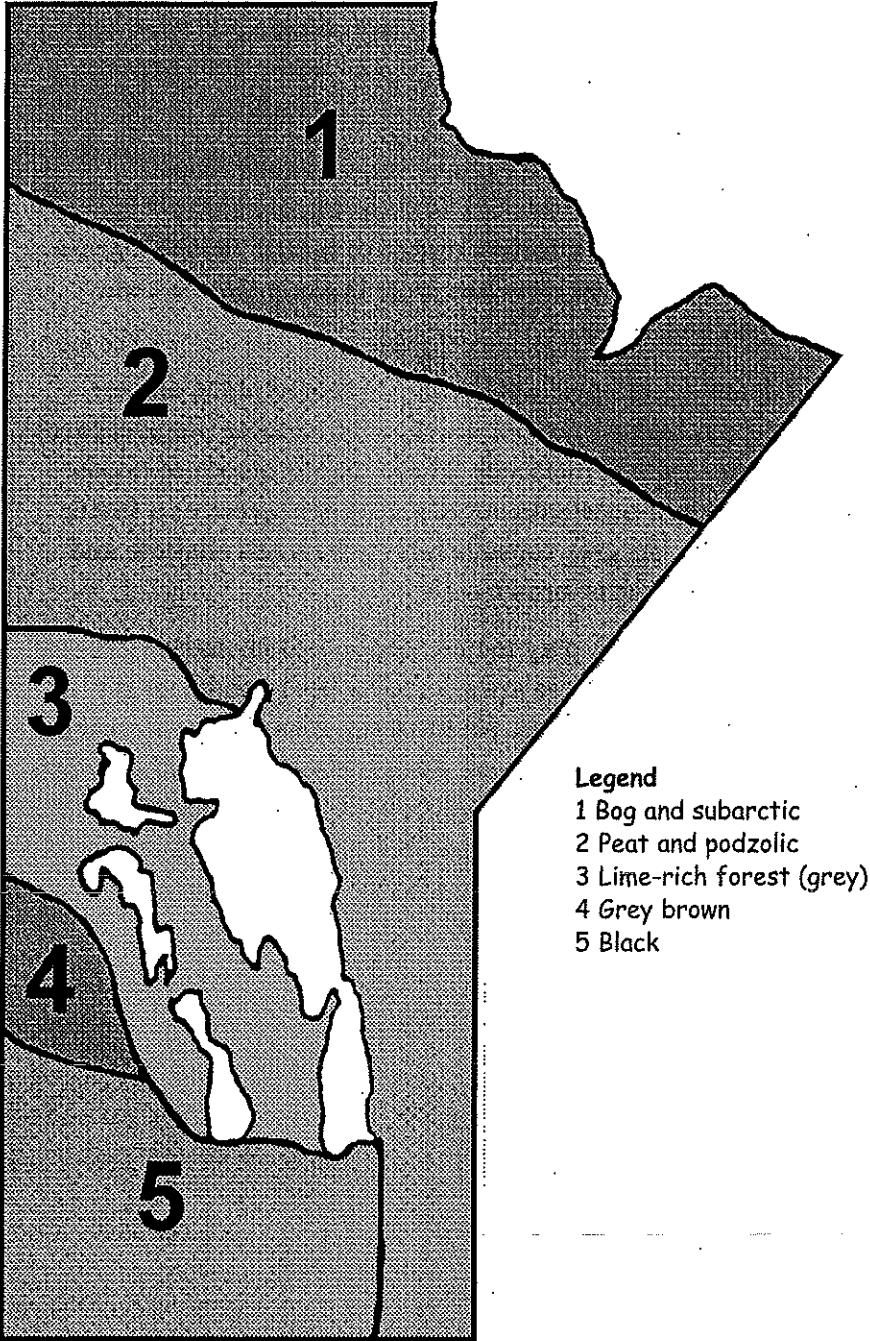
Black soil zones are much more favourable to good crop production. They are found in areas with slightly cooler temperatures and more effective moisture levels. This tall grass and parkland prairie soil zone has more organic matter than brown or grey soil zones.

Grey soil zones experience less decomposition of plant matter. This soil type is located farther north, where cooler temperatures result in increased soil moisture. These higher moisture levels leach minerals and nutrients out of the upper layers at a faster rate. As a result, the grey topsoils tend to be more shallow and less fertile than black or brown soils.

Climate and vegetation play major roles in soil formation. The boundaries of the soil zones are similar to the boundaries for climatic and vegetation belts. All have significant effects on the farming operations of their areas. About 12 percent of Manitoba's land area is considered to have soils suitable for agriculture. Compare the following three maps: Soil Zones of Manitoba, Climatic Regions in Manitoba, and Natural Vegetation in Manitoba. Notice the similarities.

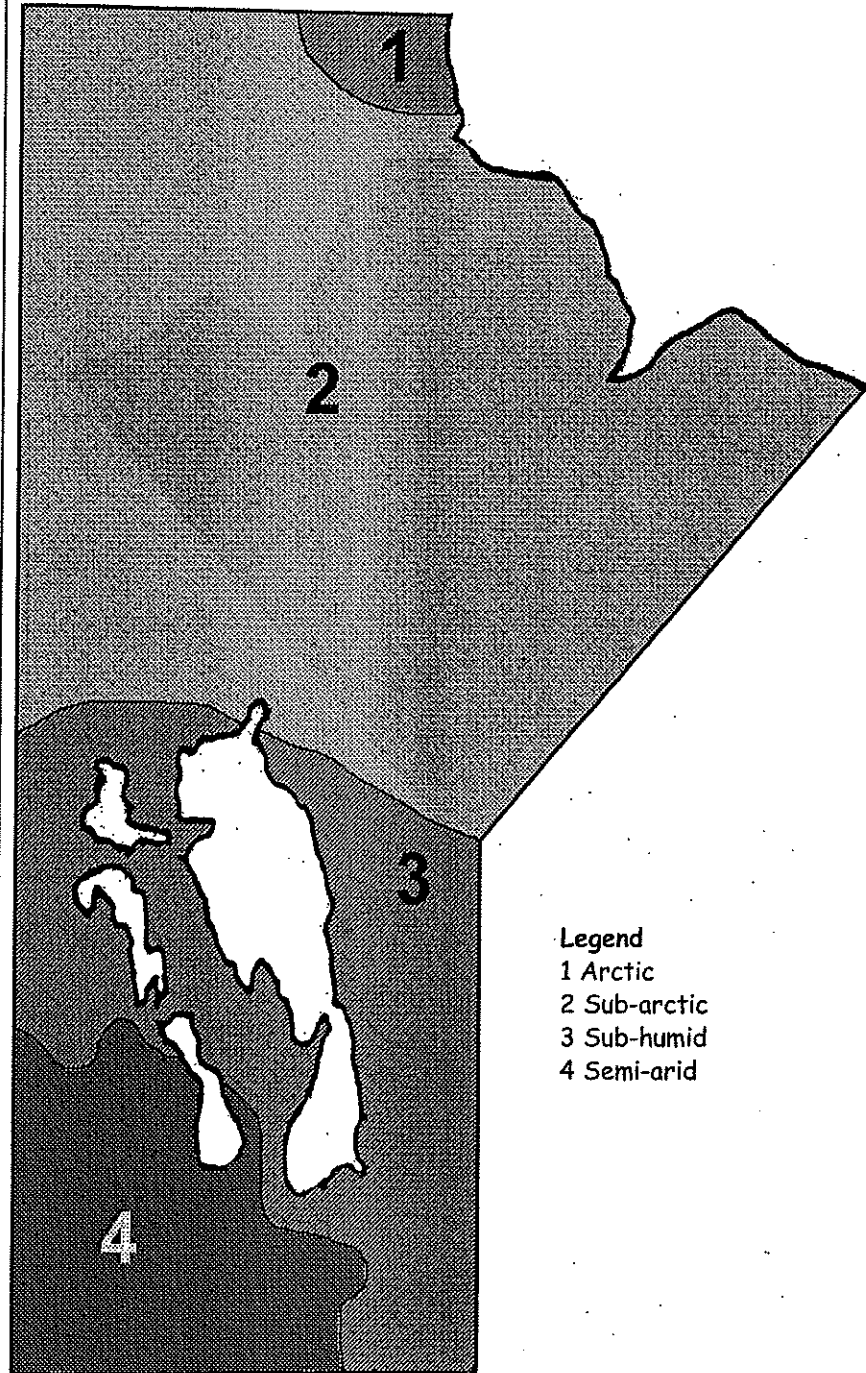
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Soil Zones of Manitoba



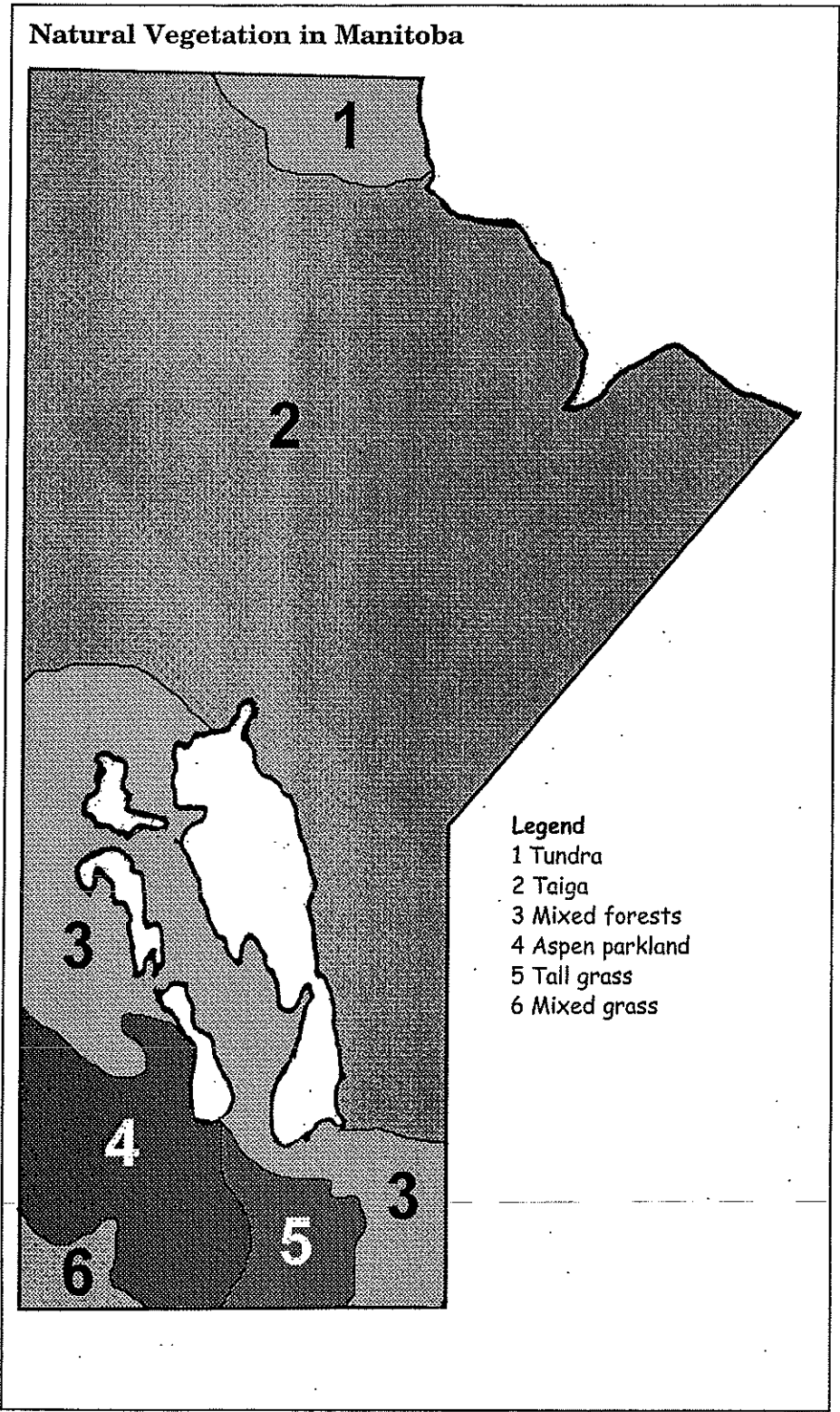
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Climactic Regions in Manitoba



Legend
1 Arctic
2 Sub-arctic
3 Sub-humid
4 Semi-arid

(continued)





Questions: Soils in Manitoba

1. Why are soils important to ecosystems?

2. Where does soil come from?

3. How is particle size used to classify soils?

4. What two other factors are important in soil classification?

5. What similarities are found among the three maps (Soil Zones of Manitoba, Climate Changes in Manitoba, and Natural Vegetation in Manitoba)?

6. In which soil zone, climate region, and natural vegetation region are you located?



- soil erosion



Lesson 6

Soil Conservation

Learning Outcomes

After completing this lesson you will be able to

- recognize the importance of soil conservation
- describe methods used to control the erosion of soil, an important natural resource

Questions: Soil Conservation

1. Read the statement below. In the space provided, indicate whether you agree or disagree with it. Provide an explanation for your opinion.

Soil management is everyone's responsibility.

Opinion (agree or disagree?): _____

Explanation:

Now, read the following article about **soil erosion**. It may prompt you to reconsider your opinion.

Soil Erosion

Erosion is a naturally occurring process that can be either escalated or diminished by agricultural practices. With the disappearance of natural grass cover and the reduction of anchoring material in cultivated topsoil, erosion occurs. Drought conditions and an overextension or expansion of cultivation into regions of light soils resulted in tremendous losses of topsoil to winds in the 1930s.

The loss of mineral particles and organic matter to *wind erosion* continues today. Dry, windy conditions are common to many areas at spring seeding time and clouds of dust can still be seen in certain areas. Treatments to replace topsoil include the use of fertilizer, manure, and irrigation. Some Alberta studies have shown improved yields through these practices. However, those yields were still not as good as those in test plots where natural topsoil remained.

Water erosion occurs frequently. On sloping land, rill erosion of *tiny channels* that are several centimetres deep can eventually lead to gully erosion characterized by *deep-cut channels* that can be measured in metres.

On bottomlands, especially along rivers, *sheet erosion* can take place in times of high water. When water covers large areas of relatively flat land, it will dissolve matter from the upper soil layers and carry it away when the land finally drains.

Solving Soil Problems

Problems created by water erosion and wind erosion can be reduced by specific soil management techniques that are in keeping with the principles of sustainable development.

Water erosion has been reduced by

- hillsides or slopes that are *contour-cultivated* or worked across the slope to create furrows, ridges, or plant strips that oppose the downward movement of water
- *gullies* or pathways for water movement that have been shaped and seeded to grasses or grass-legume mixtures

(continued)

Did you know . . .
it is estimated to have taken anywhere from 200 to 1000 years for organic matter to form? This is why the loss of several centimetres of topsoil to wind or water erosion is considered serious.

- areas of frequently submerged lowlands that have been *grass-seeded* to prevent *sheet erosion*
- crops (such as rye or winter wheat) seeded in the fall as crop cover to prevent spring water erosion

Wind erosion has been reduced by

- *shelter belts* around farmyards, around fields, or along roadsides that reduce wind speed
- tillage and seeding equipment (*cultivators*) that leaves straw stubble upright to hold soil in place
- maintaining a *trash cover* on the soil surface to keep the soil moist for a longer period, reducing the amount of loose, dry soil available to the wind
- *swathing* so that alternate strips are at different heights
- planting fall cover crops (winter wheat or rye) in areas of light, sandy soil that are prone to wind erosion
- planting perennial grass or legumes (for animal forage or grazing lands)

Trends in Sustainable Agriculture

Some soil management practices that have been in use for many years are still being used today. Others are being modified, and still others are being abandoned. Decisions to adapt to new methods are influenced by the following factors:

- costs of new method
- availability of specialized equipment
- time involved
- availability of information
- size of farming operation
- type of farming operation
- values and beliefs

(continued)

Conclusion

Producing, purchasing, and eating foods are all actions that directly relate to agriculture and ultimately relate to soils. Therefore, either directly or indirectly, your actions have effects on soil management. In the past, not much attention was paid to the way soil was handled as a resource. Land deterioration often went unnoticed because the process was slow and fairly widespread. Problems that were recognized received minimal attention. Even though most management practices that led to soil degradation were directly carried out by agricultural producers, the responsibility for good soil conservation techniques lies with us all—from the home gardener to the crop producer. Sustainable agriculture is more frequently becoming standard practice, and is supported by increased research, knowledge, and public awareness.

2. Has your opinion changed? State your opinion after reading the article. Again, provide an explanation.

Soil management is everyone's responsibility.

Opinion (agree or disagree?): _____

Explanation:

Notes

