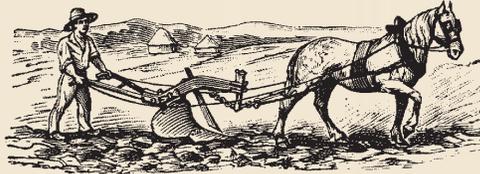


The History Of **PLOWING**

Agriculture employs 440,000 Canadians who add \$27.9 billion to the Canadian economy. Here is the story of one invention which makes this possible - the plow.



THE BEGINNING OF FARMING



Before there were farms, early people lived as nomads. They travelled from place to place killing animals and gathering plants, berries and fruits for their food, clothing and other necessities.

Later, people settled in permanent homes. Their meat was provided by animals which they kept in nearby fields and in pens. To provide for their other food needs, they collected seeds and planted them in fields. Thus, people became farmers, and agriculture was born.

THE FIRST PLOWS

Farmers need to till the soil before they plant seeds for their crops. The plow, one of mankind's oldest tools, prepares soil for planting by cutting it and turning it over.

The first plow was probably a forked digging stick. One branch of the stick was pulled or pushed through the ground while the other branch or branches served as the handle.

Another early plow was the stone adze. One side of a stone was sharpened, and then the stone was tied to a wooden handle by a strap made of reeds or animal fibres. This adze was pulled or pushed through the soil by the farmer, or perhaps the farmer tied the handle of the adze to an animal which then pulled the stone plow through the ground.

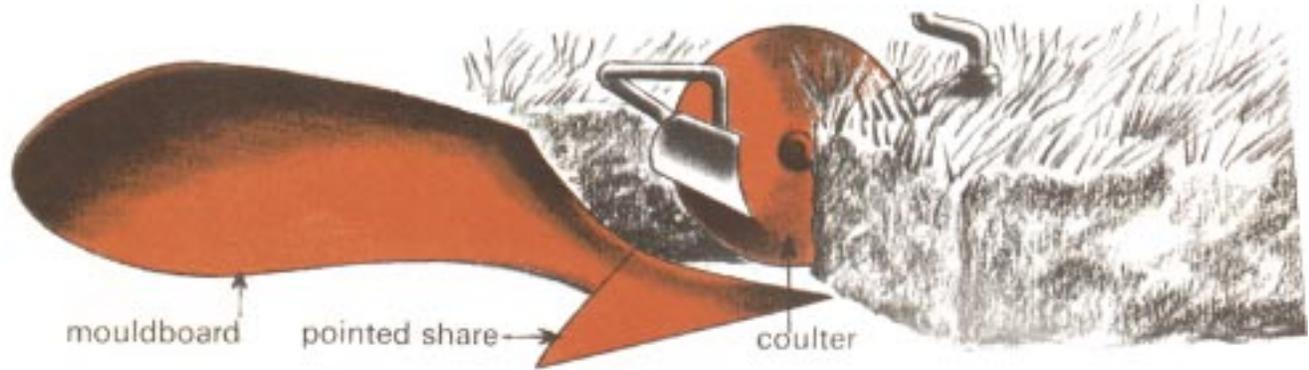
The ancient Romans invented a light iron cutting blade called a share. This blade was tied to a harness, and was pulled through the soil by hand or by using a team of oxen. This wheel-less plow worked well in the light soils of Southern Europe, but proved to be not strong enough for the heavier soil of Northern Europe. In Northern Europe the plow was attached to wheels, and it was pulled first by oxen and later horses.



PARTS OF THE SIMPLE PLOW

There are four parts to a simple (or Mouldboard) plow:

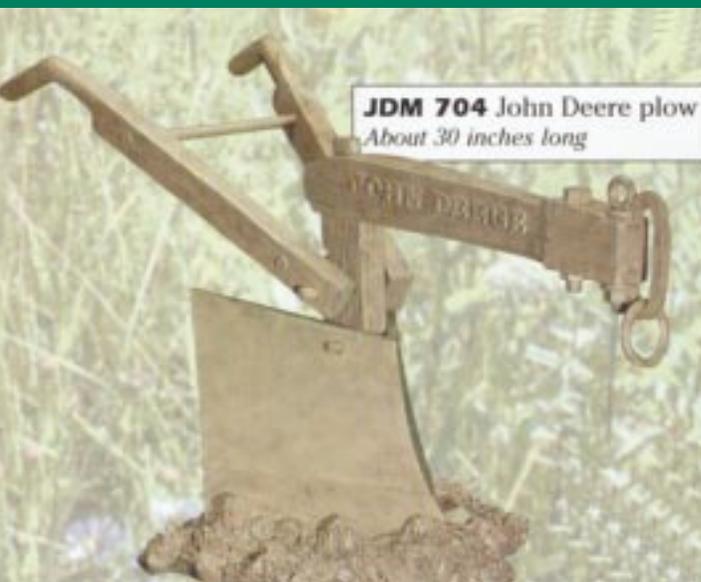
Diagram of a mouldboard plow showing all the components.



1. **The coulter:** a sharp pointed knife or rolling disc which cuts the soil vertically.
2. **The share (or plowshare):** a sharp pointed knife which cuts flat underneath the ground, loosening the soil cut by the coulter.
3. **The mouldboard:** a curved blade which pushes the slice of earth to the side and turns it upside down. This slice of earth is called the furrow.
4. **The landslide:** a plate located on the opposite side of the plow from the mouldboard, which stops the furrow from pushing the plow off course.

John Deere: North America's Plowmaker

Immigrants from all over Europe came to North America in the 19th Century looking for a new way of life. Many of these homesteaders decided to settle in the Canadian and American West, and to build their future on the fertile soils of the Prairies. They brought with them the plows they had used in Europe, which were made entirely of wood, except for the share, which was cast iron.



John Deere (1804 - 1886) was born in Vermont and became a blacksmith at the age of 17. In 1837, he headed west and eventually settled in Illinois where he set up a blacksmith shop.

In his work, Deere repaired many of the cast iron and wood plows that immigrants had brought. These plows were breaking in the heavy, black soil of the prairies. He patented a plow that was made entirely of steel. The share and mouldboard were fashioned from one piece of steel and shaped over a wooden form. This made the plow much stronger. Because it was light and very sharp, Deere's plow required much less animal power to turn the soil.

John Deere first patented his new plow in 1838. By 1857, Deere's company was manufacturing 10,000 plows each year.

*...and they shall beat their swords into plowshares, and their spears into pruning hooks:
Nation shall not lift up sword against nation, neither shall they learn war any more.*

*The Bible
Isaiah 2:4*



The United Nations garden in New York City contains several sculptures and statues that have been donated by different countries. This one is called “Let Us Beat Swords into Plowshares” and was a gift from the then Soviet Union presented in 1959. Made by Evgeniy Vuchetich, the bronze statue represents the figure of a man holding a hammer in one hand and, in the other, a sword which he is making into a plowshare, symbolizing man’s desire to put an end to war and convert the means of destruction into creative tools for the benefit of all mankind.

PLOWING TODAY

The mouldboard plow, pulled by horses or a tractor, is still in common use today. However, other types of plows have been developed for specific purposes or to till particular types of soil.

The last few years have seen major changes in soil preparation practices, and plowing fields is no exception. But modern plowing methods continue to promote good land stewardship:

- ◆ Plowing loosens soil compacted by heavy machines, making the soil porous;
- ◆ Burying weeds by plowing is an effective way to eliminate weeds without the use of toxic chemicals;
- ◆ A furrow made up of definite ridges and troughs will trap rainwater, which will sink through the slits between each furrow;
- ◆ Corn stalks, grain stubble and other products left over after the field has been harvested and plowed will prevent the soil from being blown away during the fall and winter seasons.



VOCABULARY

Adze: *n.* a tool for cutting, which resembles an axe, but has a curved blade with its cutting edge set across the end of the handle.

Agriculture: *n.* farming; the raising of crops and livestock; the science or art of cultivating the ground.

Compact: *v.* put firmly together; compress.

Coulter: *n.* a sharp, pointed knife or rolling disc which cuts the soil vertically.

Furrow: *n.* a long, narrow groove or track cut into the ground by a plow.

Homesteader: *n.* a person who settled on a parcel of land in the Canadian West during the 19th Century.

Landslide: *n.* a plate located on the side of a plow opposite the mouldboard. Its purpose is to stop the furrow from pushing the plow off course.

Mouldboard: *n.* a curved blade, part of a plow, which pushes a slice of earth to the side and turns it upside down.

Nomad: *n.* a person who moves from place to place to find pasture for cattle, and a supply of food and water.

Plow: *n.* a farm implement used for cutting the soil and turning it over.

(Plow)share; *n.* a sharp, pointed knife, part of a plow, which cuts flat underneath the ground, loosening the soil cut by the coulter.

Porous: *adj.* Allowing water and/or air to pass through.

Ridge: *n.* a raised, narrow strip of plowed ground.

Stewardship: *n.* taking responsibility for carefully managing the resources of the earth.

Till: *v.* prepare for planting by plowing.

Trough: *n.* a long hollow between two ridges.

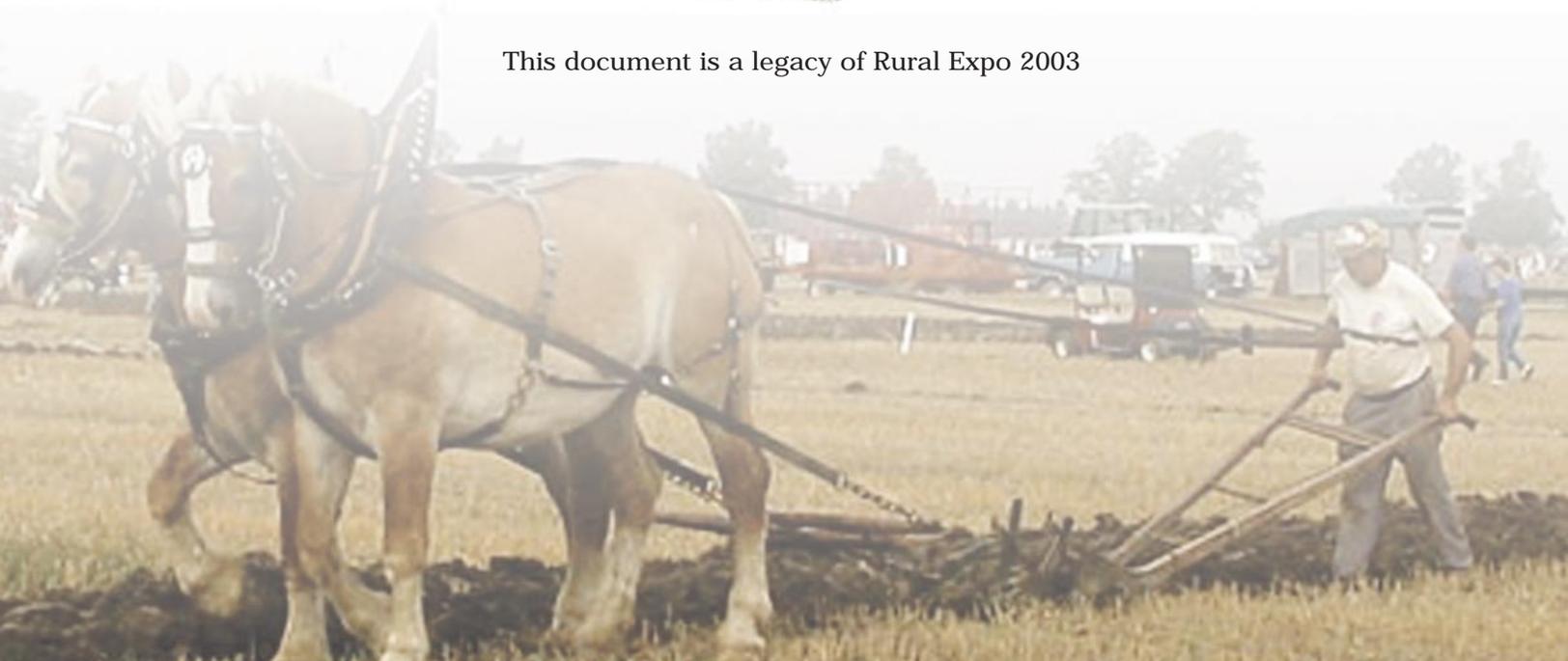
Windbreak: *n.* growth planted to prevent soil erosion.



Ontario Agri-Food Education Inc.



This document is a legacy of Rural Expo 2003



The History Of **PLOWING**



Teacher's Guide

The Plow as a

SIMPLE MACHINE

A Science and Technology Lesson for Grade 2

Through observation and experimentation, students will learn about the parts of the plow, and its function as a wedge, one of the simple machines.

Curriculum Expectations Grade 2, Science and Technology

Strand: Structures and Mechanisms

Understanding Basic Concepts

- describe different mechanisms through observation and investigation (e.g., hinge, inclined plane), and identify the components that are simple machines (e.g., lever, wedge);
- describe, using their observations, the characteristics and movements of simple mechanisms (e.g., hinge, wheels and axle);
- identify changes in the position of an object in relation to other objects (e.g., movement upward or to the left).

Developing Skills of Inquiry, Design and Communication

- use appropriate vocabulary to describe their investigations, explorations, and observations (e.g., use words such as rotate, turn, faster, and slower to describe the motion of wheels and axles);
- record relevant observations, findings, and measurements, using written language, drawings, charts, and concrete materials (e.g., record what happens to the movement of a vehicle released from a ramp if the size of its wheels is changed).

Relating Science and Technology to the World Outside the School

- identify, through observation, the mechanical parts of objects (e.g., hinges on doors) and describe the motion of these parts.

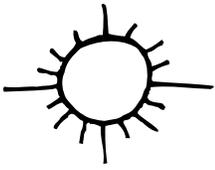
Notes on The Wedge

Instead of using the smooth side of the inclined plane to help you move things to a higher level, you can also use the pointed edge to do other kinds of work. When you use the pointed edge to push things apart, the inclined plane is a wedge.

A wedge is an inclined plane turned on its side, or, perhaps, a double inclined plane, where two planes are joined at their bases. The blades of a knife or a shovel or a plow are wedges.

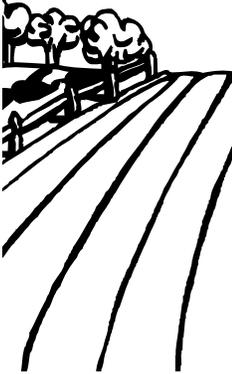
Wedges transfer energy downwards when the effort is applied to the blunt edge of the wedge. This energy is then transferred to the sides of the wedge to help it cut through an object. Since effort is applied directly to a wedge, the wedge is different from an inclined plane where the effort travels along the plane. Wedges are used to split materials. Since there is much friction involved, the mechanical advantage of a wedge is difficult to determine.

The main benefit of the wedge is changing the direction of effort to help split or cut through an object.

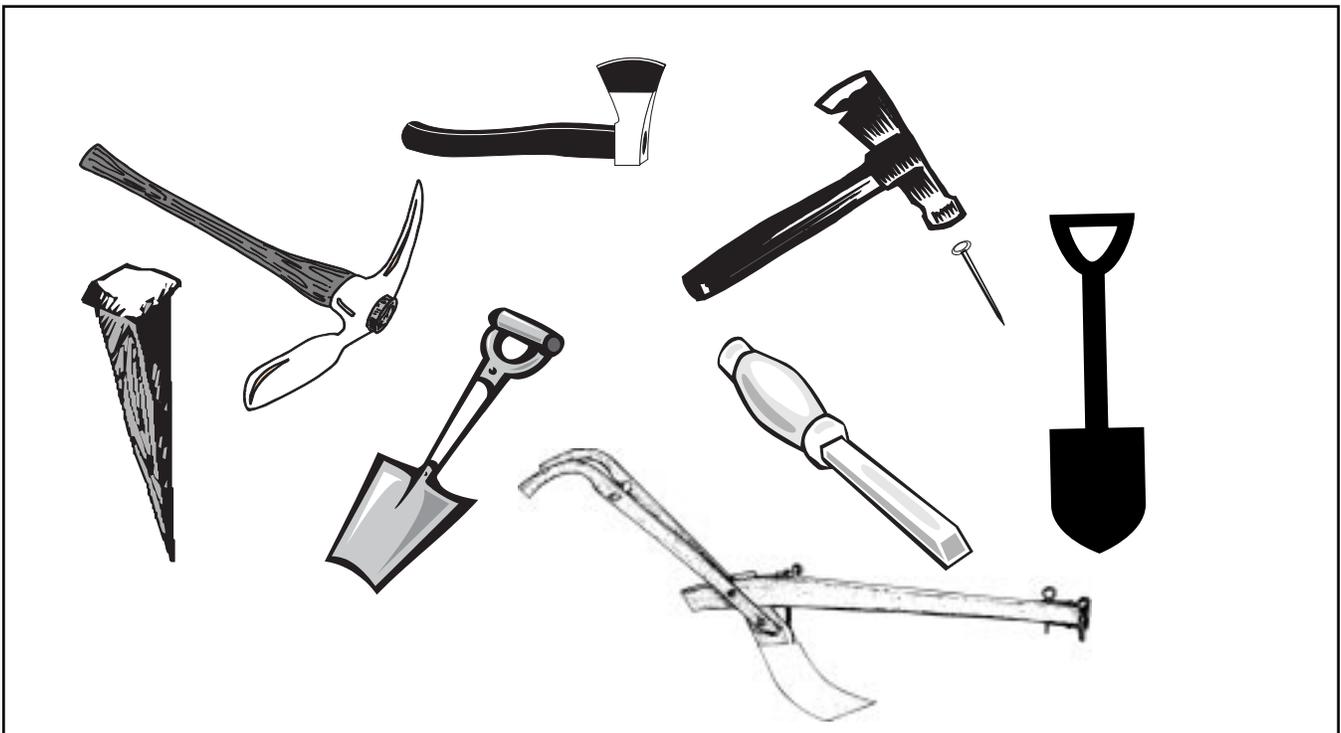


How a wedge works.

ACTIVITY 1



1. Using a kitchen knife and a pound of butter or similar everyday substance, demonstrate the motion of the knife and the butter as force is placed on the knife. If the knife is pushed **DOWN**, the pieces of the butter are **PUSHED** or **SPREAD APART**. (This is the effect of the coulter on the plow.) Encourage students to use appropriate vocabulary to describe this motion
2. Demonstrate to students that if the knife is used to slice **ACROSS** or **THROUGH** the butter, the pieces are pushed **UP** and **DOWN**. If the wedge is rotated, the top piece will ultimately fall and turn over beside the bottom piece. (This is the effect of the other two wedges on the plow, the share and the mouldboard.) Again, encourage students to use the appropriate vocabulary to describe these motions.
3. Take students on a walk around the schoolyard or building. Ask them to locate examples of wedges. Point out to students that the shape of a wedge is the shape of an inclined plane turned on its side; thus, the wheelchair ramp could be a wedge. Ask students to record what each wedge is being used for.
4. Provide students with the wedge illustrations below, and/or bring in actual examples. Some wedges, such as the front (prow) of a boat or the blade on a snowplow, are clearly 'wedge-shaped'. Other wedges, such as a pin or a nail, need to be examined more closely to see the wedge structure. Emphasize the function of a wedge is to cut or spread an object apart.
5. **Assessment Activity:** Using a variety of knives with different blade lengths or widths, demonstrate for students how these variables affect the work of the wedge. Then, demonstrate for students the effect of varying the amount of pressure placed on the wedge. Ask students to record their observations and conclusions on the worksheet found as Appendix 1.
6. A criterion chart for assessing the student's understanding of how a wedge works follows the observation chart.





Student Name _____

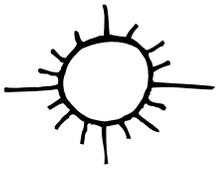
Changing the Length and Force Of a Wedge

Description	Amount of Force	Observations
Wedge 1	Light	
	Medium	
	Heavy	
Wedge 2	Light	
	Medium	
	Heavy	
Wedge 3	Light	
	Medium	
	Heavy	

Conclusion: Describe the most effective wedge to perform the task you witnessed.
Why have you chosen this wedge?

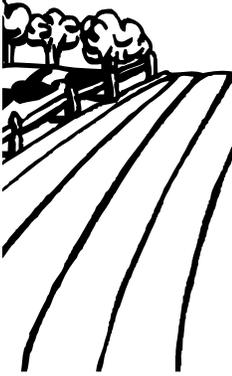
Criterion Checklist

	MET	NOT YET
1. describe, using their observations, the characteristics and movements of simple mechanisms.		
2. use appropriate vocabulary to describe their investigations, explorations, and observations.		
3. record relevant observations, findings, and measurements, using written language, drawings, charts, and concrete materials.		



The Plow as a Simple Machine

ACTIVITY 2



You will find a template for construction of a model plow in Appendix 2. It is recommended that students construct their plows from cardboard or another material that is equally sturdy.

Students may use the diagram of the plow on page 2 of "The History of Plowing" to guide them in putting the model together. They should crease the plowshare part of the template as indicated on the template. Bending the mouldboard is part of the experiment.

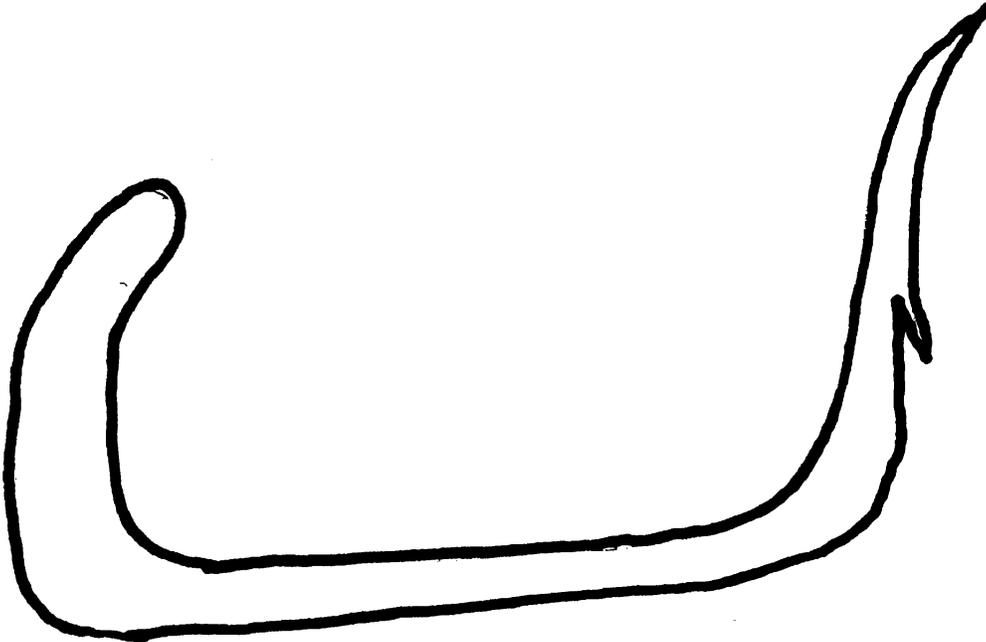
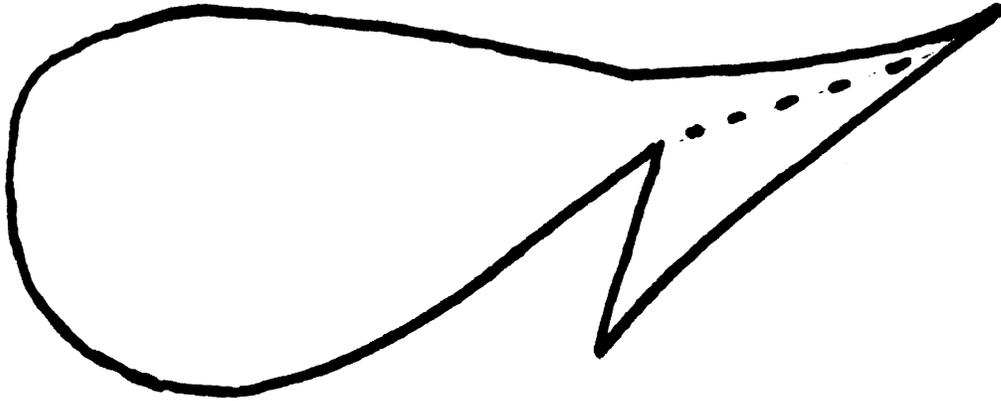
The landslide has been included in the template, but it is not necessary to add it to the plow for these experiments.

It is recommended that the plow be assembled with tape or sticky gum rather than glue in order for students to be able to disassemble it to test its components.

This activity will work well as a small group learning experience.

1. Using the template and the diagram on page 2 of "The History of Plowing", students cut out the pieces of the plow, identify each of the components by name, and explain why each is a wedge.
2. Provide students with a suitable medium for "plowing" in a long container, such as an oblong baking pan. Light potting soil or "soilless" mix is ideal, but sand or flour can also be used. Students will move the various components of the plow through the medium as described in the definition (i.e., down and through for the coulter, through for the share and mouldboard), noting how each wedge affects the soil.
3. Introduce the words "furrow", "ridge" and "trough" and define the terms for the students. (These terms are defined on page 4 of "The History of Plowing".) Students will apply these terms to the cuts they have made in the medium.
4. Students then assemble the plow, according to the diagram in "The History of Plowing". By folding the mouldboard and/or adding the landslide they will note how the ease of plowing and the quality of the furrow is affected. Through experimentation, they will decide which configuration of the plow is most effective.
5. Students add water to a section of their medium to make it damp. (Only a small amount of water should be available - this experiment will not work well if the medium is "muddy"). Students draw their assembled plow through the dampened medium, noting how moisture affects the effectiveness of their plow.
6. Assessment Activity: students will record their observations on the worksheet provided in Appendix 3.

Cutout of plow





Student Name _____

Plowing Observations

In the spaces provided, draw or describe what the furrow looked like at each stage of the plowing.

With the coulter	With the share and mouldboard
With the plow assembled	When the soil is damp

When you bend or fold the mouldboard, what is the difference in the furrow?

Teacher's Checklist

Student's Name	Yes	No
identifies the components of plow that are wedges		
describes movements of plow using appropriate vocabulary		
records relevant observations, findings, and measurements, using written language, drawings, charts, and concrete materials		
identifies, through observation, the mechanical parts of objects and describe the motion of these parts.		

Comments:

Plowing Today

AND YESTERDAY

A Language and Science and Technology Lesson for Grade 3

Curriculum Expectations Grade 3, Language

Strand: Writing

Overall Expectations

- communicate ideas and information for specific purposes and to specific audiences (e.g., write a notice for a community newspaper advertising an upcoming school event);
- organize information into short paragraphs that contain a main idea and related details.

Strand: Reading

Vocabulary Building

- understand frequently used specialized terms in different subject areas (e.g., science, mathematics);

Use of Conventions

- identify various conventions of formal texts and use them to find information (e.g., table of contents, chapter titles, headings, index, glossary, charts, graphs).

Strand: Oral and Visual Communication

Group Skills

- contribute ideas appropriate to the topic in group discussion and listen to the ideas of others;

Curriculum Expectations Grade 3, Science and Technology

Strand: Life Systems

Developing Skills of Inquiry, Design and Communication

- design and conduct a hands-on inquiry into seed germination or plant growth;
- ask questions about and identify some needs of plants, and explore possible answers to these questions and ways of meeting these needs (e.g., predict how long a particular plant could go without water before its leaves started to droop);
- plan investigations to answer some of these questions or find ways of meeting these needs, and explain the steps involved;
- use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., stem, pistil, stamen, flower).



The History of Cultivation

ACTIVITY 1

Using the information provided in the brochure "The History of Plowing", students will enter the significant developments in the evolution of the plow on the timeline provided as Appendix 3A below.

TIMELINE

Using the information in the brochure "The History of Plowing", record the following developments in the proper place on the timeline:

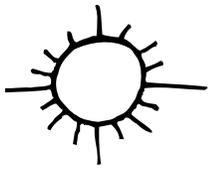
The digging stick; the invention of the share; the wheeled plow; the one-piece steel plow; the rototiller.

Early Man

The Romans

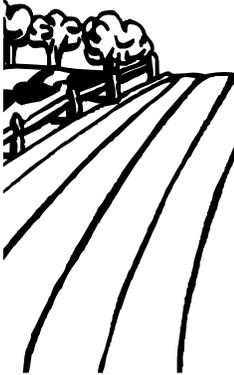
Settlers come to North America

Modern times



Why do Farmers Plow their Fields? - an experiment.

ACTIVITY 2



Students may perform this experiment individually or in small groups. A recording sheet for observations and conclusions is found in Appendix 4.

1. The following materials are needed for this experiment:

- A suitable medium for planting - potting soil or soilless mix in a long container, such as an oblong baking pan, which can be divided into three "fields".
- Seeds, such as bean seeds, which germinate fairly quickly.
- A hand cultivator which will make furrows in the soil.
- A source for water. Only a small amount of water will be needed.

Students will prepare the soil in their container in three fields, as in the diagram below:

Field 1: Compacted Soil (no cultivation)	Field 2: Cultivated Soil	Field 3: Cultivated soil dampened with water.
---	--------------------------	---

1. Students will plant four to six seeds in each field. In the cultivated fields, the seeds will be planted in the trough of the furrow.
2. For the first week, the container should sit in a sunny window without additional water added. At the end of the week, students should check to see if any of their seeds show signs of germination, and record their observations, using appropriate terminology.
3. Then the container should be lightly watered and replaced in the sunny window. From this point, water should be added in order to keep the soil moist. (As a variation, some containers may receive a great deal of water, and some containers may receive no additional water, to judge the effect of excess moisture or drought on seed germination.)
4. At the end of the second week, students again check the seeds and record their observations using appropriate terminology.
5. **Evaluation Activity:** Students incorporate their observations and develop conclusions using the template report form found in Appendix 5. An evaluation rubric follows as Appendix 6.



Why do Farmers Plow their Land?

Step 1 - Planting

When we planted our seeds in each field, we observed:

Field 1: Unplowed	Field 2: Plowed	Field 3: Plowed and Watered
-------------------	-----------------	-----------------------------

We think that Field _____ will germinate first because _____

Step 2 - Week 1

At the end of the first week, when we checked our seeds for germination, we observed:

Field 1: Unplowed	Field 2: Plowed	Field 3: Plowed and Watered
-------------------	-----------------	-----------------------------

Step 3 - Watering

When we poured a small amount of water on each field, we observed:

Field 1: Unplowed	Field 2: Plowed	Field 3: Plowed and Watered
-------------------	-----------------	-----------------------------

We think Field _____ will absorb water best because _____

Step 4 - Second Week

At the end of the second week, when we checked our seeds for germination, we observed:

Field 1: Unplowed	Field 2: Plowed	Field 3: Plowed and Watered
-------------------	-----------------	-----------------------------

Variation 1: Extra Water? Observations

Variation 2: No Water? Observations

Report on Experiment Why do Farmers Plow their Fields?

List the materials you assembled:

How did you prepare the soil for the experiment? What observations did you make about the soil at this time?

What method did you use to plant the seeds in each field? What observations did you make about the ease of planting the seeds? Where did you put your container after you planted it? _____

At the end of the first week, how did you check your seeds for germination? What did you observe in each field? What conclusion did you draw about planting? _____

How much water did you use to moisten your fields? Where did you place your container after the soil was moistened? _____

During the second week, how often did you moisten your fields? How much water did you use each time?

At the end of the second week, how did you check your seeds for germination? What did you observe about the seeds from each field? What conclusion did you draw about watering? _____

If none of your seeds had germinated at the end of the second week, how long did it take them to germinate?

Conclusions:

1. What was the effect of cultivating the soil on the germination of the seeds?
2. What was the effect of keeping the soil moist on the germination of the seeds?
3. What are the best conditions for germinating seeds?

	Level 1	Level 2	Level 3	Level 4
Understanding of Concepts <ul style="list-style-type: none"> about germination and plant growth 	<p>Explanations show limited understanding of concepts with significant misconceptions.</p>	<p>Gives partial explanations with minor misconceptions.</p>	<p>Usually gives complete or nearly complete explanations with no significant misconceptions.</p>	<p>Always gives complete explanations with no misconceptions.</p>
Inquiry and Design Skills <ul style="list-style-type: none"> in completion of the experiment in preparation of the report. 	<p>Applies few of the required skills and strategies; Uses tools, equipment and materials correctly only with assistance.</p>	<p>Applies some of the required skills and strategies; Uses tools, equipment and materials correctly with some assistance.</p>	<p>Applies most of the required skills and strategies; Uses tools, equipment and materials correctly with only occasional assistance.</p>	<p>Applies all or almost all the required skills and strategies; Uses tools, equipment and materials correctly with little or no assistance.</p>
Communication of Required Knowledge <ul style="list-style-type: none"> through experimental procedure in preparation of a report 	<p>Communicates with little clarity and precision; Rarely uses appropriate terminology.</p>	<p>Communicates with some clarity and precision; Sometimes uses appropriate terminology.</p>	<p>Usually communicates with clarity and precision; Usually uses appropriate terminology.</p>	<p>Consistently communicates with clarity and precision; Consistently uses appropriate terminology.</p>
Relating to the world outside of school <ul style="list-style-type: none"> conclusions related to work of farmers and/or family gardens. 	<p>Shows little understanding of the connections between the classroom and the world outside of school.</p>	<p>Shows some understanding of the connections between the classroom and the world outside of school.</p>	<p>Shows understanding of the connections between the classroom and the world outside of school.</p>	<p>Shows understanding of the connections between the classroom and the world outside of school, and their implications.</p>
Group Skills <ul style="list-style-type: none"> contributes ideas to group; listens and values the ideas of others. 	<p>Seldom or never contributes ideas to the group; Seldom or never responds to ideas of others.</p>	<p>Occasionally contributes ideas to the group; Occasionally responds to the ideas of others.</p>	<p>Usually contributes ideas to the group; Usually responds to and constructively evaluates the ideas of others.</p>	<p>Contributes ideas to the group with confidence; Responds to and constructively evaluates the ideas of others; Demonstrates appropriate leadership.</p>

Why go to a

PLOWING MATCH?

When students go to a plowing match or other agricultural exhibition or fair, there are many opportunities for learning. Besides those expectations listed in the grade 2 and 3 activities in this teacher guide, here are some of the overall expectations that can be addressed on such a field trip for students in other primary and junior classrooms:

Grade 1

SOCIAL STUDIES

Strand: Heritage and Citizenship: Relationships, Rules and Responsibilities

- Create simple timelines to describe changes over time;

Strand: Canada and World Connections: *The Local Community*

- Demonstrate an understanding that a local community is made up of groups of people;
- Locate and distinguish physical features of their community;
- Describe how people in the community interact to meet basic needs.

SCIENCE AND TECHNOLOGY

Strand: Life Systems: *Characteristics and Needs of Living Things*

- Demonstrate an understanding of the basic needs of animals and plant;
- Demonstrate awareness that animals and plants depend on their environment to meet their needs, and describe the needs for good health for humans.

Strand: Earth and Space Systems: *Daily and Seasonal Cycles*

- Demonstrate an understanding of changes that occur in daily and seasonal cycles and how these changes affect the characteristics, behaviour and location of living things;
- Describe how living things, including humans, adapt to and prepare for daily and seasonal changes.

Grade 4

SCIENCE AND TECHNOLOGY

Strand: Life Systems: *Habitats and Communities*

- Demonstrate an understanding of the concepts of habitat and community, and identify the factors that could affect habitats and communities of plants and animals;
- Investigate the dependency of plants and animals on their habitat and the interrelationships of the plants and animals living in a specific habitat;
- Describe ways in which humans change habitats and the effects of these changes on the plants and animals within the habitats.

Strand: Structures and Mechanisms: *Pulleys and Gears*

- Demonstrate an understanding of the characteristics of pulleys and gears;
- Investigate ways in which different systems function, and identify appropriate criteria to be considered when designing and making such systems.

Strand: Earth and Space Systems: *Rocks, Minerals and Erosion*

- Demonstrate an understanding of the physical properties of rocks and minerals and the effects of erosion on the landscape;
- Describe the effects of human activity (e.g., land development, building of dams, mine development, erosion-preventing measures) on physical features of the landscape, and examine the use of rocks and minerals in making consumer products.

Why go to a

PLOWING MATCH?

Grade 5

SOCIAL STUDIES

Strand: Heritage and Citizenship: *Early Civilizations*

- Identify ways in which the natural environment shaped the cultures of various early civilizations;
- Describe how the knowledge developed by early civilizations has affected modern society.

SCIENCE AND TECHNOLOGY

Strand: Energy and Control: *Conservation of Energy*

- Demonstrate an understanding of the importance of conservation of energy in relation to the wise use of renewable and non-renewable energy sources;
- Evaluate the reasons for conserving natural resources and identify possible ways of conserving energy.

Strand: Earth and Space Systems: *Weather*

- Demonstrate an understanding of the major climactic factors and patterns associated with weather;
- Examine how weather forecasts influence decisions concerning human activity and how humans have adapted to a variety of weather conditions.

Grade 6

SOCIAL STUDIES

Strand: Heritage and Citizenship: *Aboriginal Peoples and European Explorers*

- Identify early explorers and describe their impact on the development of Canada.

Strand: Canada and World Connections: *Canada and its Trading Partners*

- Describe the ways in which Canada is connected to the rest of the world through trade.

SCIENCE AND TECHNOLOGY

Strand: Life Systems: *Diversity of Living Things*

- Demonstrate an understanding of ways in which classification systems are used to understand the diversity of living things and the interrelationships between living things.

Strand: Structures and Mechanisms: *Motion*

- Demonstrate an understanding of the different kinds of motion (linear, rotational, reciprocating, oscillating);
- Design and make mechanical devices, and investigate how mechanisms change one type of motion to another and transfer energy from one form to another;
- Identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.



Ontario Agri-Food Education Inc.



International Plowing Match
www.internationalplowingmatch.com

