MANITOBA SOIL EXPLORATION:
DIGGING DEEP INTO HOW SOIL IS FORMED

A. MEET THE PARENTS

The formation of soil starts with rocks. These rocks are called **Bedrock** and are the 'parents' to our soils. A rock that turns into soil is called the **Parent Material**. The soils in Manitoba come from three different types of rocks.

Limestone

This rock is often formed by layers of marine animal skeletons and bones, and by minerals in water that sink to the bottom of the water. It is especially common in the Interlake.

Granite

This rock was formed by cooling magma (lava) and is found in the Whiteshell. Granite is the oldest rock in Manitoba.

Shale

This rock was created by layers of sediment in old lakes and slow rivers. There is a lot of shale in southern and western Manitoba. Shale is the youngest rock type in Manitoba.

To turn a rock into soil takes a lot of work over a long time. Rocks can be weathered, or broken down, physically (wind, water), chemically (exposed to air, natural chemicals in water) and biologically (insects, animals, plant and tree roots). The broken down rock particles mix with decaying organic matter (plants, animals and insects), minerals and water to eventually form soil.

DID YOU KNOW?

It can take **500 to thousands of years** to make 1 inch (2.5 cm) of soil! Soil is a precious natural resource.

DID YOU KNOW?

Soil is ALIVE! 1 tsp of garden soil has over **1 billion organisms** (bacteria, fungus, protozoa, nematodes) in it.

Soils in Canada and around the world are different from each other depending on the **parent material**, **climate**, **geography** and **organisms** (plants + animals) in that ecosystem and **time** (how old the soil is).

1. Why do soils take so long to form?

2. What three rocks in Manitoba do our soils come from?

a. _____ b. _____ c. _____

3. What are the five factors that go into soil formation?

a. _____ b. _____ c. _____

d. _____ e. _____

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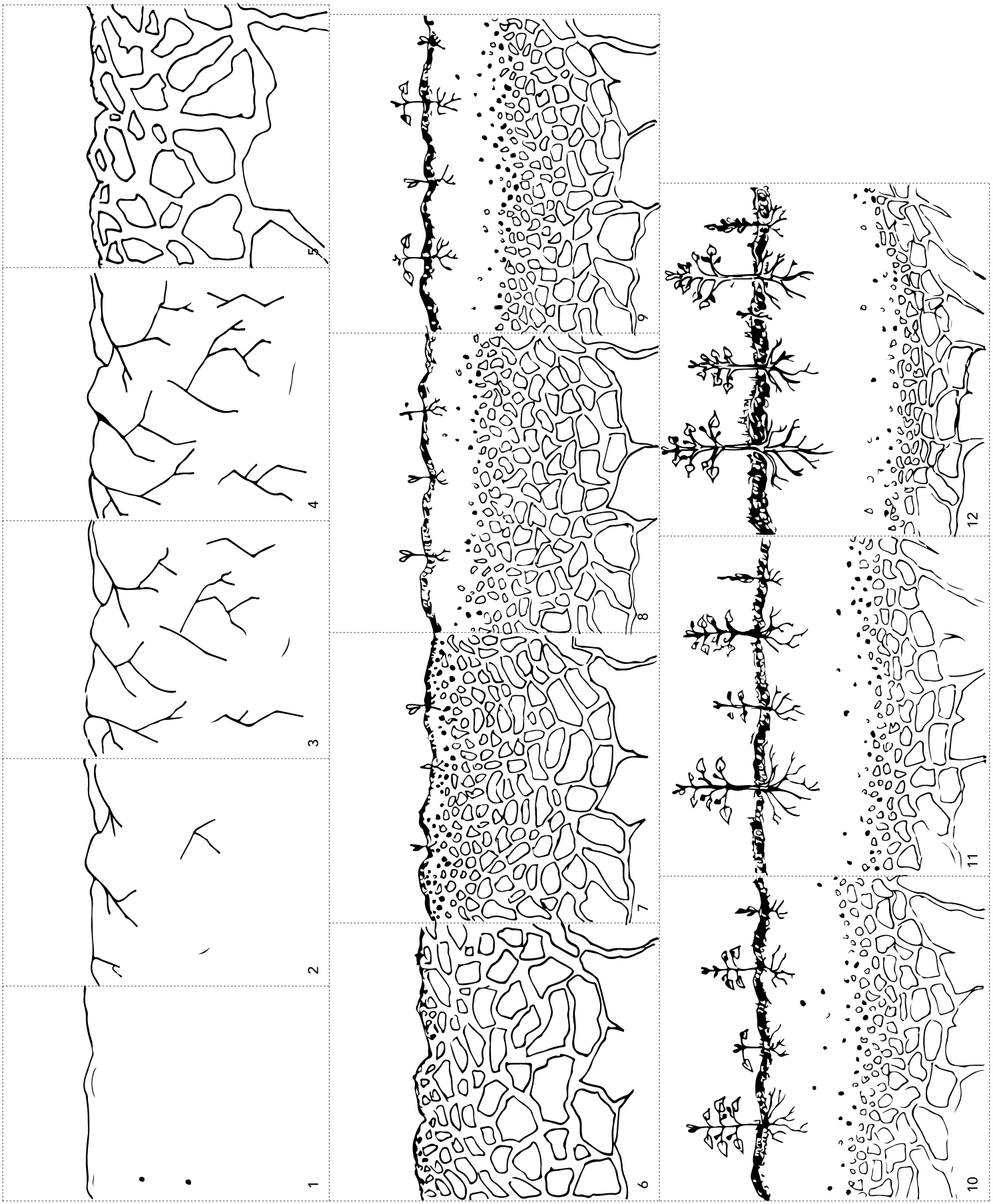
4. 4. Colour, cut, staple, flip! Use this flipbook template to watch rock crack and form into soil!



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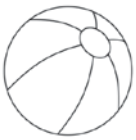
B. SOIL TEXTURE WORKSHEET

Weathered rocks break down into small particles of different sizes. The three soil particle sizes are sand, silt and clay. The size of the particle depends on the rock they came from. The largest particle is sand followed by silt and then clay. Imagine that a particle of sand is as large as a beachball. Silt would be the size of a mini soccer ball and clay would be the size of a ping pong ball. Each soil has a mix of soil particle sizes. Soil Texture is the unique mix of sand, silt, clay and organic matter in each soil.



SAND

SILT

CLAY

Soil texture makes a big difference in what can be planted. Farmers need to know what kind of soil they have to make decisions on what they can grow.

DID YOU KNOW?

Soils that have a lot of **sand** in them are hard for crops that need a lot of water (corn) to grow well in without the use of irrigation. The sand drains water quickly, making it hard for corn to have enough water to grow tall.

DID YOU KNOW?

Soils with a lot of **clay** in them are hard for crops that grow underground (potatoes and carrots) to grow in. The clay is sticky and heavy, making it hard for big roots and tubers to expand.

SUPPLIES

- 1 cup of soil. If you have no backyard soil you can ask a relative or neighbour for some. You can also use items from your kitchen to mimic large (cornmeal), medium (flour) and small (corn starch/icing sugar) soil particles.
- Access to water

QUESTIONS

1. Where is your soil from (location)? _____

2. What colour is your soil:

   O Black O Dark Brown O Light Brown O Grey O Other_____

3. What objects are in your soil sample?

   O Twigs O Leaves O Roots O Hard lumps of soil

   O Stones O Stems O Other_____

4. What living things are in your soil sample?

5. O Earthworms O Insects O Roots/Plants O Other_____

6. What does your soil smell like:

_____

7. Take a small sample of soil (around 1 Tbsp) from your container and put it in the palm of your hand. Make sure it doesn't have any soil clumps or bits of plant material in it. Add a few drops of water to the soil sample. What does it feel like in your hand?

O Slippery like soap (silt) O Gritty (sand) O Sticky (clay)

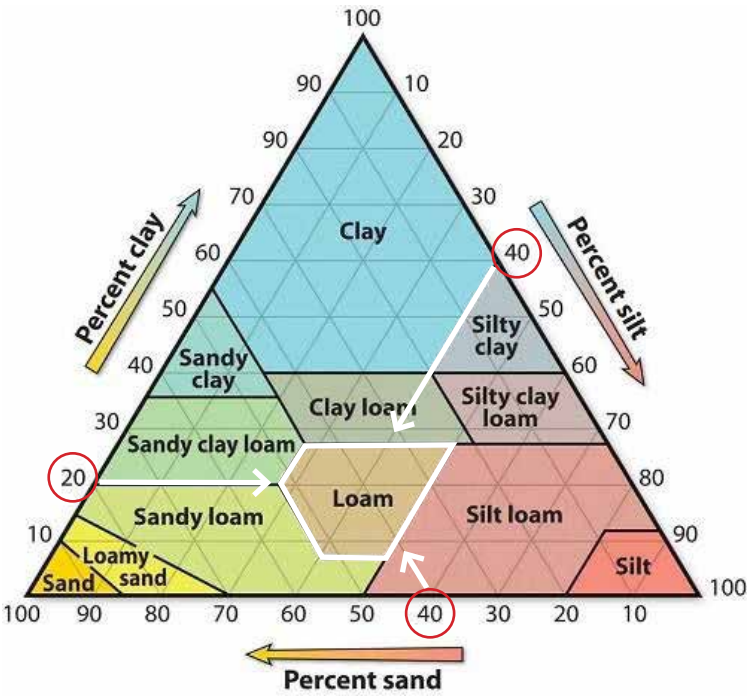
8. Take a small handful of soil from your container. Add enough drops of water to the handful of soil so that the soil is damp. If your soil is already damp don't add any more water. Squish the soil in your palm to break up any clumps. Now try to roll your soil sample into a ribbon, between your two palms, and see how long it gets. How long a ribbon can you make?

O A long ribbon- more than 2.5 cm (clay)

O A short ribbon – less than 2.5 cm (silt)

O No ribbon – falls apart (sand)

Most soils are made up of a mixture of soil particle sizes. Below is a soil triangle. This is used to name soils by soil scientists. A great gardening soil is a **Loam** (20% clay, 40% sand and 40% silty). It drains well, but doesn't dry out, and is not prone to getting packed down (compaction) or blowing away (erosion).



9. What kind of soil do you think you have?

O Sand O Silt O Clay O Loam

C. SOIL ZONES (COLOURS) IN MANITOBA

Each area has a different colour of soil depending on how it was formed. Soil colours can be different from region to region. What is yours?

I live in (your Town or City):

_____

The colour of the soil in the area I live is:

_____

* The soil in the Canadian Shield (green zone on map) is very shallow and not good for farming but it still has a colour! What is yours?

DID YOU KNOW?

Glaciers helped form the soils in Manitoba! When the Lake Agassiz glacier melted it left us with **crushed and eroded rocks** to start forming soil.

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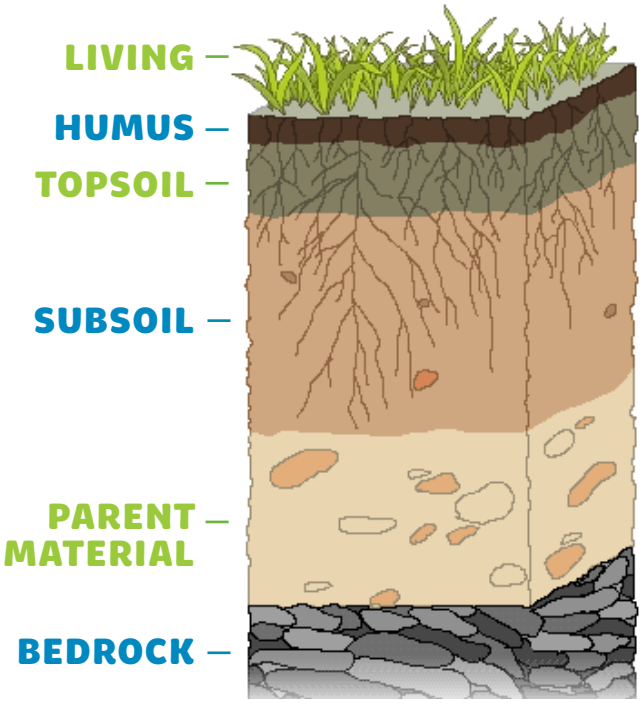
D. SOIL PROFILE ACTIVITY

A soil profile is like a story of how a soil was formed. You can see a soil profile by digging a hole in the ground that is as deep as yourself. You will see distinct layers in the soil. The soil at the top is usually the darkest because it has the most organic matter. It takes a long time for a rock to become soil and for soil to develop these distinct Layers (or Horizons). Go back in time to make soil from rocks with the **Soil Formation Flip Book**.



DID YOU KNOW?

Manitoba has an official Provincial soil called the **Newdale.** It is found in and named after the town of Newdale in Manitoba. It is made from granite, limestone and shale and is a Black soil. It is a clay loam and covers 1.3 million acres in MB.

LAYER/HORIZON	DESCRIPTION
LIVING plants (above) + roots (below)	Plants and trees are capturing carbon dioxide from the atmosphere (carbon sequestration)
HUMUS (organic matter)	Decomposing dead plant and animal matter on the surface of soil; insects, worms + microorganisms
TOPSOIL	Dark soil; most fertile layer; seeds germinate, and plants grow roots in this layer; burrowing animals, insects, worms + microorganisms
SUBSOIL	Less fertile layer than the Topsoil; tiny clay particles and minerals are carried into this layer by water from the Topsoil; plants and trees grow roots in this layer; burrowing animals, insects, worms + microorganisms
PARENT MATERIAL	Infertile layer; very hard for roots to penetrate this rocky layer
BEDROCK	The parent rock of the soil.

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MAKE YOUR OWN SOIL PROFILE

Use what you have in and around your home to make a soil profile. We have given you some ideas, but you can create a soil profile with any supplies you have.

Materials to try:

Craft supplies

- Construction paper (various colours) + scissors to cut out construction paper; glue onto heavy paper/cardboard
- Colouring pencils or markers to draw a soil profile on a paper
- Different colour sandpaper (soil layers), string (roots); glue onto heavy paper/cardboard
- Felt or fabric scraps; glue onto heavy paper/cardboard

Outdoor treasures

- Soil, stones, twigs, grass, sand; glue and heavy paper/cardboard

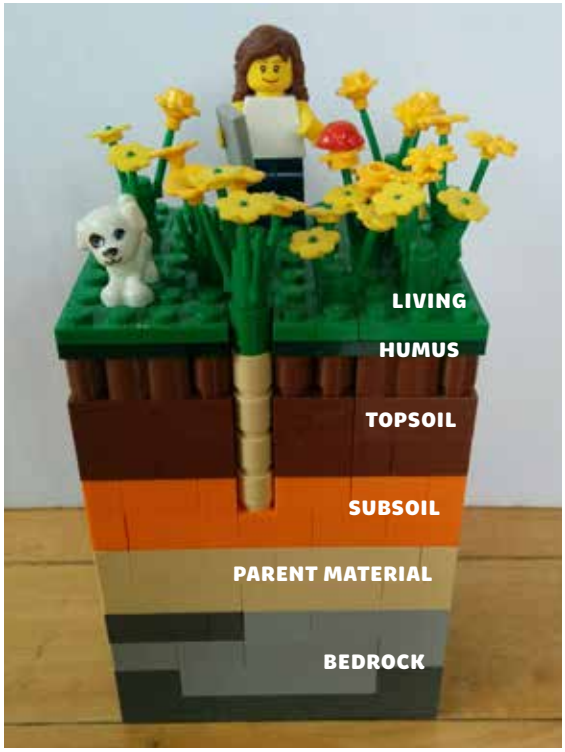
Food from the pantry

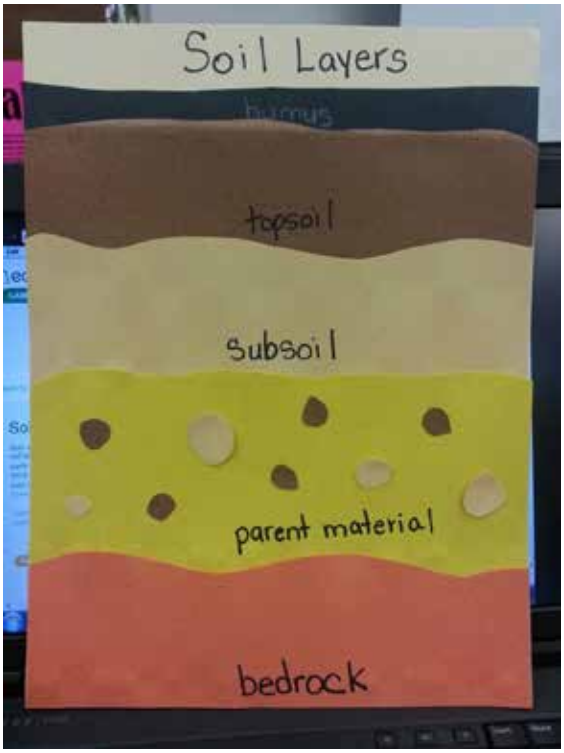
- Coffee grounds, flour, wheat/oat bran, rice (green food colouring for grass), cooked and dried spaghetti (roots), dried beans (roots); glue and heavy paper/cardboard

Lego or other blocks

- Grey, beige, orange, brown, and green bricks, flowers or plants (Optional: farmer, pet..)

Examples:





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E. SOIL PAINTING ACTIVITY

Did you know you can paint with soil? Soil can be brown, black, grey, red, orange, yellow and even blueish/greenish! Check out this soil painting video celebrating the importance of soil through painting The Three Sisters in Soil.




The Three Sisters in Soil (Cornell University), MB and Tree Templates (Included) and Wheat (Winnipeg student).

You can paint your own design or print off one of our templates on card stock to paint a Map of Manitoba or paint a Spring tree, adding buds/tiny leaves and the sky with pencil crayons, markers, or water colour paint.

NOTE: If you have access to soil, follow the **Soil Paint** instructions below. If you do not have access to soil, you can make your own with our **Kitchen Soil Paint** instructions.

SOIL PAINT
Supplies:

- Soil
- Water
- White glue (or clear acrylic medium)
- Baking sheet or metal pan
- Mortar and pestle, or a can of beans
- Optional: Sieve
- Cup or container for mixing (you will mix glue in this, so make sure it is not an important container. Paper coffee cups work well)
- Colouring pages or thick paper (cardstock, boxboard; water colour paper is best if you have any)
- Paint brushes of various sizes (an old toothbrush or your fingers can also work)

Instructions:

1. **Dig up** enough soil to fill a yogurt container (250mL). *Optional: If you have access to soil from various places you can create different coloured soils.*
2. **Remove** unwanted bits in the soil (twigs, grass, rocks)
3. **Spread** the soil out in on a baking sheet or pan.
4. Let the soil air **dry**.
5. Once the soil is dry, crush it into as small pieces as you can using either a mortar and pestle or rolling a can of beans over the soil on the baking sheet or metal pan. If your soil is very hard and resistant to being broken up, you might need to use a hammer. Put the soil into a double Ziplock bag and firmly, but carefully, hammer your soil into small particles. *Make sure you ask an adult if you can use these items first!*

   Optional: If you have a sieve, pour your crushed soil through it to make an even finer soil powder.
6. Put 1 Tbsp of **powdered soil** into a cup or container.
7. Add 1 tsp of white **glue** and 1 tsp of **water** (if your soil is very sticky, you will need to add more water. Start by adding 1 tsp of water and mixing it before adding more).
8. **Mix** your paint until it is the consistency of tomato soup.
9. **Paint!** You can make soil paint look darker by letting a layer of soil paint dry, and then painting on top of it. You can make soil paint look lighter by adding water to the soil paint. Use the included templates or make your own design.

KITCHEN SOIL PAINT

Supplies:

- 1 cup white flour
- 1 cup warm water
- Food colouring
- Mixing bowl
- Whisk or fork for mixing
- Small containers or cups if you plan on mixing more than one colour soil
- Colouring page or thick paper (cardstock or boxboard; water colour paper is best if you have any)
- Paint brushes of various sizes (an old toothbrush or your fingers can also work)

Instructions:

1. **Mix** the warm water and flour together with a whisk or fork until it is smooth and without lumps.
2. **Distribute** the paint into smaller containers to make more than one colour.
3. Slowly **add** food colouring drops to get the soil colour you want.
4. If your Kitchen Soil Paint is too thick, slowly add more **water** (just a bit at a time) to the container(s).
5. **Paint!** (You can store your unused paint in the refrigerator for up to 2 weeks.)

Use this chart to mix food colouring to make new colours:

	NUMBER OF DROPS			
	RED	YELLOW	GREEN	BLUE
ORANGE	1	2		
PURPLE	3			1
DARK GREEN	1	1		4
LIME GREEN		3	1	
AQUA			2	4
PEACH	2	5		
BROWN	6	6		4

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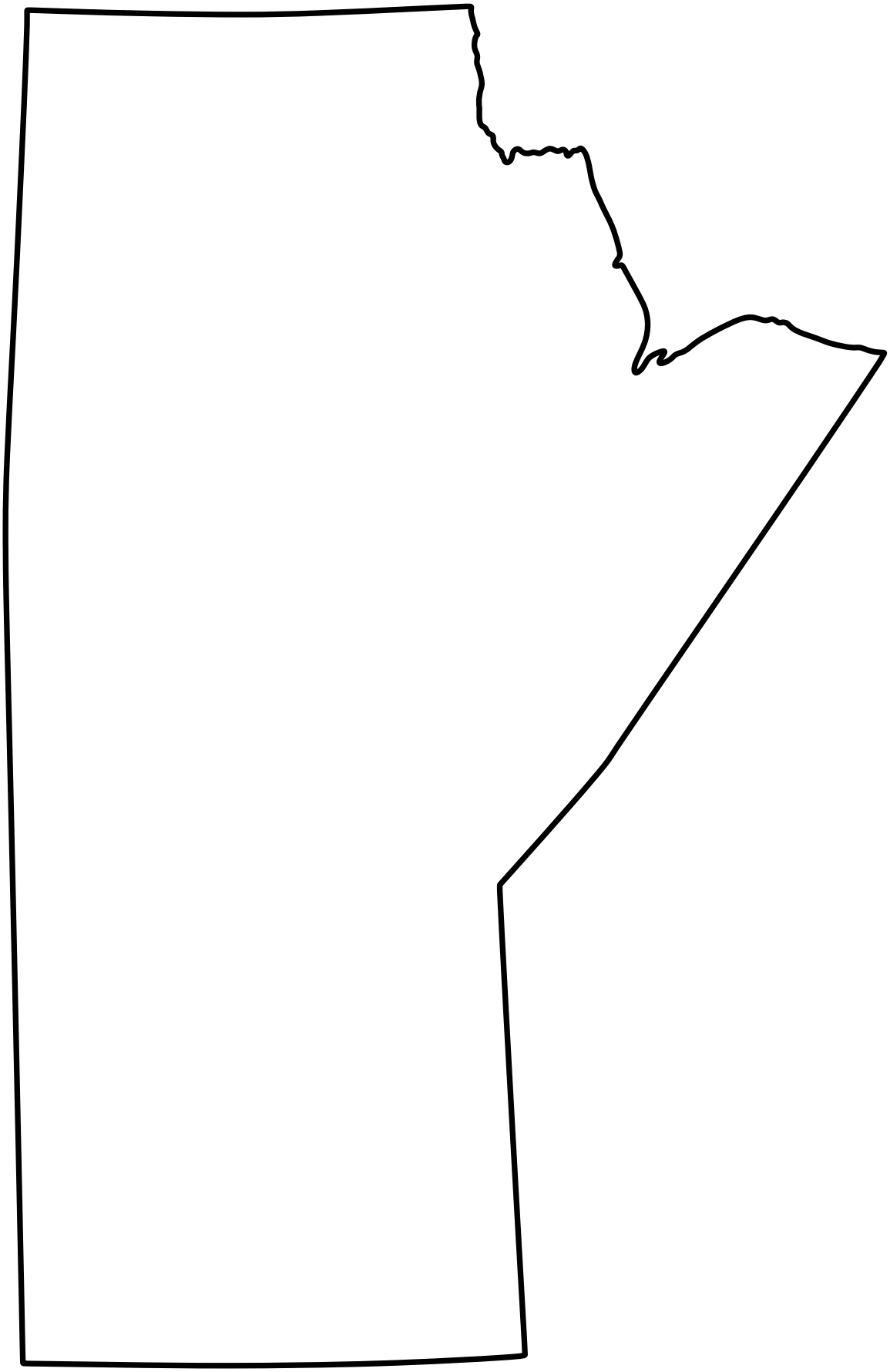

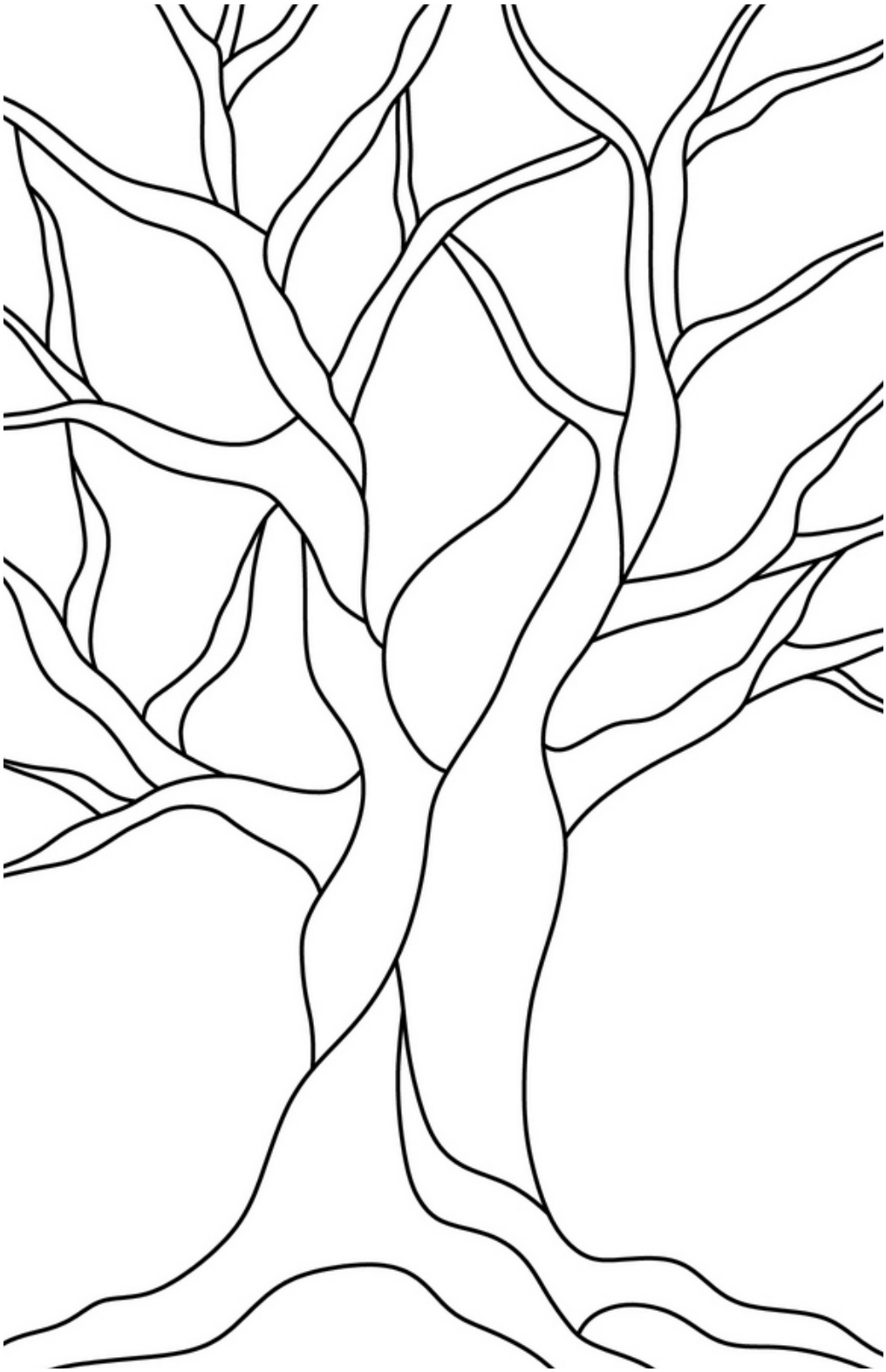

Template courtesy of Stainedglasshobby.com.

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F. SOILS AND WHAT PLANTS NEED TO GROW

The food we eat (fruits + vegetables, proteins and grains), clothes we wear (cotton, linen, hemp) and houses we build (wood) come from soil. *Seed Survivor* has 12 online games you can play to learn about photosynthesis, soil nutrients and watershed management. Go to Seed Survivor to play and answer the questions below. No account is needed.

DID YOU KNOW?

Fertilizers can be made (or manufactured) from the air (nitrogen), fossils (phosphorus) and evaporated ocean salt (potassium).

QUESTIONS

1. What three nutrients do plants need to grow? (*A-Maze-ing Underground*)

   a) _____

   b) _____

   c) _____

2. Plants remove carbon dioxide (a greenhouse gas) from the air by 'breathing' it in. What do they 'breathe' out? (*Survive with Light*)?

   _____

3. How do plants and trees along rivers, lakes, ponds and farm water dugouts protect our water? (*Watershed Explorer*)

   _____

4. What crop do we grow in MB that is an ingredient in both bread and cookies? (*Pick-a-Food*)

   _____

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