

Bank Swallow

Northern Soils Inspiration

The bank swallow is a small, slender songbird that feeds on flying insects. The bank swallow nests on artificial and natural sites with vertical and sand-silt banks such as riverbanks, lake and ocean bluffs, sand/gravel mounds, quarries and road cuts. A burrow is dug into the sides of these sites that leads to a nest chamber. (Source: nwtspeciesatrisk.ca). Please report sightings to ebird.org or nwtchecklist@ec.gc.ca.



SMART Board / Promixa Ready



Northern Resources

Gr.3 Soils Alive

NORTHERN SOILS AND PLANTS

OBJECTIVE Students will learn about the unique characteristics of northern soils through a variety of hands-on activities.

The Northwest Territories covers 1,300,000 km². Within this territory there is a variety of soil types. The southernmost community of Fort Smith has excellent soil for growing food. In fact, the Oblate Missionaries (Oblates of Mary Immaculate) priests were able to provide vegetables to all the other missions in the Northwest Territories from the gardens at St. Bruno farm, near Fort Smith. On the other extreme, the NWT also has communities that exist above the treeline, with very shallow organic soil layers. The effect of the last ice age scraped away much of the organic soils, exposing Canadian Shield. In many communities the soil that is left is only able to support plants adapted to acidic conditions. Therefore, exploring soils can be a challenge for northern teachers.

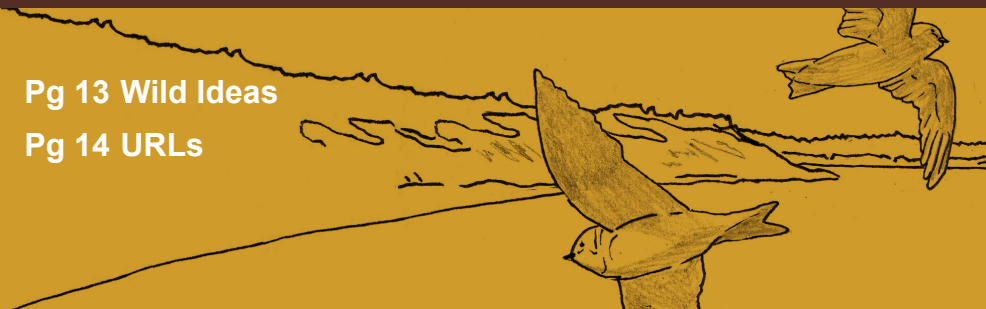
Pg 2 Curriculum Links

Pg 5 Teacher's Resources

Pg 7 Lesson Plans

Pg 13 Wild Ideas

Pg 14 URLs



CURRICULUM Links



The activities and resources in this document are intended to tie in with grade three science curriculum *Earth and Space Systems: Soils in the Environment*, as well as the *Dene Kede* and *Inuuqatigiit* curriculum relating to the land. You can find specific learning outcomes for each of these by following the links below. The *Dene Kede* and *Inuuqatigiit* curriculum contain a lot of useful advice about bringing northern culture, language and traditional knowledge into the classroom. Here are some examples of where the lessons in this resource connect with these different curricula. Some suggestions for making connections have been included in the lesson plans, too.

Grade 3 Science

General Learning Outcome

Students will demonstrate an understanding of the similarities and differences between various soils and the effects of moving water on soils.

Specific Learning Outcomes

Students will describe, using their observations, the differences between sand, humus and other soil components (e.g. texture, smell, malleability) and compare and describe soil samples from different locations (e.g. school yard, forest, riverbank).

Connected Lessons

Lesson 1 - What is Soil?

This lesson focuses on comparing the composition of soils from different areas.

Lesson 2 - Northern Soils

This lesson introduces students to some of the factors that shape northern soils.



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CURRICULUM Links



Dene Kede - Land

General Learning Outcome

With the aid of the Dene Language, students are expected to enjoy the land, become capable on the land, appreciate and respect the land and be familiar with the Dene history of the Land.

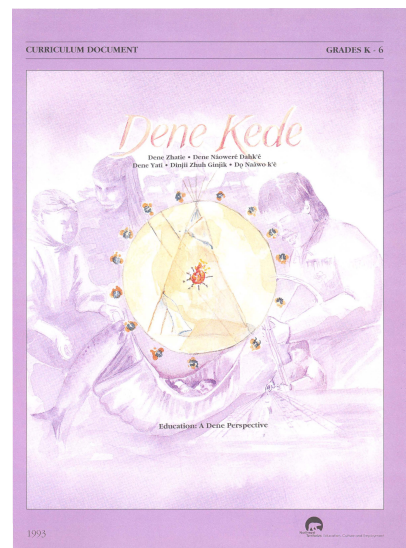
Specific Cultural Expectations

Students should be aware of the sights, sounds, smell and feel of the land. Students should show appreciation for the challenge of land experiences, recall personal land experiences and enjoy and retell others' stories about the land.

Connected Lesson

Lesson 2 - Northern Soils

This lesson provides an opportunity to take children out of the classroom to explore soil types around where they live. Elders can also be invited to talk about soil changes over time through erosion or warming.



Inuuqatigiit - Land

General Objectives

Students will hear stories about ways of keeping the land clean, share their stories about being on the land, learn the names of traditional landmarks or landforms around their community and identify ways to keep the land clean.

Key Activities

Have the students talk about going out on the land. Invite parents and elders to explain how they learned about what the land can provide

Connected Lessons

Introductory Lesson and Lesson 2 - Northern Soils

These lessons discuss how local geography determines the properties of northern soils and how, these, in turn shape the ecosystem.



JOURNALS



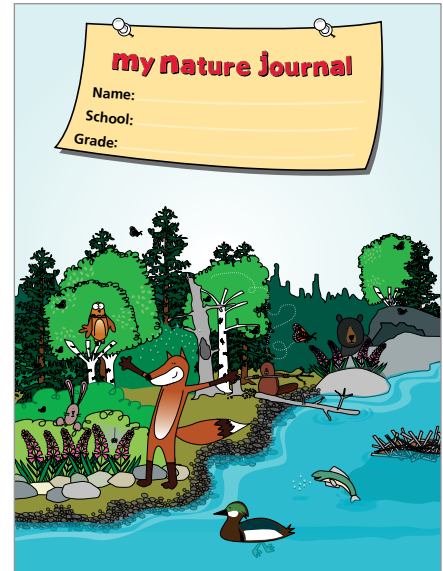
My Nature Journal

The Department of Environment and Natural Resources (ENR 2009) developed this student-friendly book. It has information regarding forests and seasons. The journal begins in the fall as students explore nature and “adopt” a tree. We encourage Grade 3 teachers to use the journal to guide the students in their study of northern plants and soils. This resource will indicate which page of the journal matches a task or exploration activity.

Soil and Plant Field Journal

Students can design their own journals for recording observations and questions as they explore the soil types and plants around them. Keeping a field journal helps develop scientific inquiry and research skills. Journals can be simple homemade books with lined pages or sections for note taking and plain sections for sketching. It’s also a good idea to reinforce some or all of the pages with card so that they’ll be strong enough to have things like twigs, leaves or even little plastic bags containing soil samples stuck to them. **Great Stems** has an excellent, step-by-step guide for making nature journals. You can find the link in the **Teacher’s Resources** section on page 6.

Journals can be used as assessment tools for almost all of the lesson ideas in this resource. Some suggestions for how to use them have been included, too. Consider pairing students who need help writing their ideas down with a student who can scribe for them, allow them to complete their notebook on the classroom computer or create a video blog.



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© Bishop EQ Jennings Senior

TEACHER'S Resources



Books

The Delta is My Home

Tom McLeod & Mindy Willett
Illustrated by Tessa Macintosh
The Land Is Our Storybook series
Fitzhenry & Whiteside, 2008
ISBN 978-1897252321
www.fitzhenry.ca
Language focus
Inuvialuktun, Gwich'in

Living Stories

Therese Zoe, Philip Zoe
& Mindy Willett
Illustrated by Tessa Macintosh
The Land Is Our Storybook series
Fitzhenry & Whiteside, 2009
ISBN 978-1897252444
www.fitzhenry.ca
Language focus
Tlicho (French edition available)

Come and Learn with Me

Sheyenne Jumbo & Mindy Willett
Illustrated by Tessa Macintosh
The Land Is Our Storybook series
Fitzhenry & Whiteside, 2009
ISBN 978-1897252574
www.fitzhenry.ca
Language focus South Slavey (Dene
Yati) (French edition available)

Proud to be Inuvialuit

James Pokiak & Mindy Willett
Illustrated by Tessa Macintosh
The Land Is Our Storybook series
Fitzhenry & Whiteside, 2009
ISBN 978-1897252598
www.fitzhenry.ca
Language Focus Inuvialuktun
(French edition available)

The Caribou Feed our Soul

Pete Enzoe & Mindy Willett
Illustrated by Tessa Macintosh
The Land Is Our Storybook series
Fitzhenry & Whiteside, 2008
ISBN 978-1897252673
www.fitzhenry.ca
Language Focus Chipewyan
(French edition available)

At The Heart of It

Raymond Taniton & Mindy Willett
Illustrated by Tessa Macintosh
The Land Is Our Storybook series
Fitzhenry & Whiteside, 2008
ISBN 978-1897252697
www.fitzhenry.ca
Language focus North Slavey
(Sahtugo'tine) (French edition
available)

We Feel Good Out Here

Julie-Ann André & Mindy Willett
Illustrated by Tessa Macintosh
The Land Is Our Storybook series
Fitzhenry & Whiteside, 2008
ISBN 978-1897252338
www.fitzhenry.ca
Language focus Gwich'in

No Borders

Darla Evyagotailak & Mindy Willett
Illustrated by Tessa Macintosh
The Land Is Our Storybook series
Fitzhenry & Whiteside, 2009
ISBN 978-1927083079
www.fitzhenry.ca
Language focus Inuinnaqtun

Dirty Science

Shar Levine & Leslie Johnstone
Illustrated by Lorenzo Del Bianco
Scholastic Canada, 2013
ISBN 978-1443113540
www.scholastic.ca

Earth Cycles and Ecosystems

Beth Savan
Addison Wesley Publishing
Company, 1992
ISBN 978-0201581485
www.pearsoned.co.uk/Imprints/
Addison-Wesley

Life in The Tundra: Alaska's Coastal Plain

Cherie Winner
Lerner Publishing, 2003
ISBN 978-0822546863

Planet Arctic: Life at the Top of the World

Wayne Lynch
Firefly Books, 2012
ISBN 978-1554076321
www.fireflybooks.com

Yucky Worms

Vivian French
Illustrated by Jessica Ahlberg
Candlewick, 2012
ISBN 978-0763658175
www.candlewick.com

TEACHER'S Resources



Printable Materials



My Nature Journal

<http://www.assembly.gov.nt.ca/sites/default/files/09-06-01td49-163.pdf>

This free, downloadable resource was developed by the Government of the Northwest Territories Department of Environment and Natural Resources. There are lots of great activities in this journal focused on trees, plants and wildlife.



Agriculture in the Classroom

<http://www.farmnwt.com>

Teaching Guide and Resource written by the Territorial Farmers Association - Hay River, NT, 2014. This is an excellent resource all about growing food in the North! You can also contact the Territorial Farmers Association for advice at (867) 874-4706.



Elders in Schools Handbook

http://www.ece.gov.nt.ca/files/publications/elders_in_schools_handbook_en_web.pdf

This resource provides valuable information about inviting Elders to contribute to lessons and related activities. Interview templates are included as well as practical advice about compensation.

Videos

Bill Nye the Science Guy (24:00)

Full episode on rocks and soil
https://www.youtube.com/watch?v=a1_WPMuoZiI



Soil Brownies (3:00)

This video shows the collection of a soil sample ("soil brownie") on the tundra.

<https://www.youtube.com/watch?v=AmDVFKYlqEU>

"Worm poop" song (2:00)

Birdsong and Ecowonder
Get your students giggling!
<https://www.youtube.com/watch?v=gXs5cdIT9Ec>

Composting for Kids (5:00)

An animated video that explains composting and the reasons for doing it.
<http://www.youtube.com/watch?v=dRXNo7Ieky8>

Hunting for Methane with Katey Walter Anthony (2:00)

This video, produced by the University of Alaska Fairbanks, shows how methane released from permafrost gets trapped in frozen lakes.
<https://www.youtube.com/watch?v=YegdEOSQotE>

Websites

Soils 4 Teachers

<http://www.soils4teachers.org/glossary>

Great Stems

<http://www.greatstems.com/2013/05/wildlife-projects-for-kids-making-a-nature-journal.html>

Grow the Planet

<http://www.growtheplanet.com/en/blog/learn/article/289/soil-composition-an-easy-garden-experiment-for-children>

Science of Everyday Life Discovery Education

<http://scienceofeverydaylife.discoveryeducation.com/teachers/videos.cfm?grade=gradesk2>

Missouri Botanical Gardens: Biomes of the World

<http://www.mbgnet.net/sets/tundra/index.htm>

Atlas of Canada

Free, downloadable maps.
<http://atlas.nrcan.gc.ca/site/english/index.html>

NWT Species at Risk

<http://www.nwt-speciesatrisk.ca>

LESSON Plans



Introductory Lesson

1 class period. No formal assessment.

Assess the students' knowledge about the Land. Ask the students what they can tell you about the land around their community and what it provides. They may discuss going out on the land, hunting and having fun. Ask *what is the land made of and what do plants need to grow?* They should mention soil. Check the school library for a copy of Bill Nye the Science Guy Episode on Rocks and Soil.

Extension

Alternatively, or if you have more than one class period available, you could use this initial class period to make soil journals.

Lesson 1: What is Soil?



2 class periods. Includes school yard soil sampling and assessment activity.

Project the text 'What is Soil' on page 8 on a SMART Board, or Proxima projector. It may benefit some students to follow along on a printed copy. Read the text as a class.

▶ Soil Brownies (3:00)

Video on taking a soil sample on the tundra which highlights the presence of permafrost.

Provide your students with the tools and materials needed to gather a soil sample from the school yard. Depending on the soil/plants in the yard, spoons and labeled plastic bags might be sufficient.



© Monte HUMMEL / WWF-Canada

Take the samples back into the classroom. Students can reflect on what they saw, write about the different properties of the soil they found and record any questions they have in their soil journals. Reviewing their journal observations provides an assessment opportunity.

Extension

In order to meet the curriculum requirements, soil samples need to be collected from a variety of locations. Ask your students to collect one additional soil sample from a location of their choosing (forest, river bank, home yard/garden etc). You can also order soil samples ahead of time from the Territorial Farmers Association (see **Teacher's Resources**). Once you have a selection of soil samples, compost, riverbank soil, etc., have the students compare the soils and discuss their differences.

WHAT is Soil?



None of the living things on Earth, even creatures that live in the sea, could survive without **soil**. Plants need soil to grow. Animals need plants to eat. Even the air we breathe would be different without **soil**. Over millions of years, the relationship between soil, plants and animals has created the environment that makes all life possible.

Have you ever wondered how soil is made? Some soils are very old and some are very young. Some are thick and others are thin. Soils have **parent rocks**, which give some of their characteristics to the young soil. Over time, wind, snow, ice and rain will break off small pieces of the parent rock. Plants also play an important role in the creation of soil. Hardy plants like **lichens** can grow on the little pieces of rock. If you live on the tundra, you know how beautiful lichens can be in the summer. Lichens make up the tundra soil so that other plants can also grow.

As more lichen grows, animals that eat the lichen and other plants will start spending more time on the young soil. This is good news because it means that more animals will start eating and pooping in that area. For soil **decomposers** this means more food! Soil decomposers are tiny organisms that eat and recycle dead plant and animal remains to create something called **humus**. Humus is the good-smelling part of soil that nourishes plants. Without humus, we would have no boreal forest because the trees would have none of the nutrients they need to live.

Soil takes a long time to form but I hope you agree that it's worth the wait. With your class you will learn all about exciting soil. Maybe one day you'll be a soil scientist!



© Libby Whittall Catling

This muskox in the East Arm of Great Slave Lake is eating the mud along the riverbank for the salts and other minerals in it. This is a natural part of these large mammals' nutrition and usually only takes place at certain times of the year.



© Jeff Hollet

LESSON Plans



Lesson 2: Northern Soils

1 class period. Includes preparing for Elder visit.

Review the glossary terms from the **What is Soil?** student text and record terms on the whiteboard or chart paper. Project the **Northern Soils** text on the next page and ask students to follow along while you read out loud.

Assessment Opportunity

Have your students copy the key terms from the text into their soil journals and write a short definition for each one. You could also introduce the concept of diagrams and have students draw diagrams showing layers of permafrost and active soil over parent rock.

Teacher Note

Proud to be Inuvialuit provides information on the use of the Tuktoyuktuk ice house. The Grade 4 resource, **Extreme Weather**, also discusses flooding and the effects of soil erosion and includes a soil erosion experiment. This would tie in well especially if you have a mixed class of grade 3s and 4s.

Dene Kede and Innuqatigiit Connection

Explain to the students that you are inviting an Elder to visit the class to talk about land and soil changes over time and reasons for these changes. Review the points listed in the **Elders in the Classroom** guide that pertain to preparing the class. As a class, brainstorm questions to ask the Elder. Here are some suggestions:

- Ask about areas of nutrient rich and nutrient poor soil in the region. *Which animals and plants are found in these areas?* Are there special names for these areas? For example a pile of gravel left behind by a glacier is called an esker (bank swallows nest in this type of landform).
- As a class, discuss with the Elder/parent community about what to do to keep the land clean. Encourage the class to think of ways to get involved.
- If you live in the Arctic, your community might have an ice house. Elders may be good at explaining why it works and if it has changed/warmed over the years.



© Robert Service School

NORTHERN Soils



Northern soils are some of the youngest soils in the world. When the glaciers receded at the end of the ice age, they scraped away the soil and exposed the **parent rock**. The soils had to form all over again. In many parts of the Northwest Territories you can still see a lot of bare rock. Hundreds of years from now that rock may be covered with soil.

As it is so cold for most of the year in the NWT, the soil is often frozen. Part of the soil remains frozen all the time, even in summer. When summer comes, the surface of the frozen ground warms and thaws, allowing small plants to grow. This very top layer is called the active layer. The layer beneath is called **permafrost**. Permafrost is difficult for roots to push through, so plants cannot grow very tall. That is why trees in the **taiga** are shorter than trees in southern Canada.

Northern soils are created very slowly because there is not very much plant or animal residue on the ground and it is too cold in the winter for bacteria to decompose what residue there is. Northern soil is often very thin.

One place where the soil is thick is beside big rivers like the Deh Cho (Mackenzie River). The rushing water carries lots of plant and animal nutrients. These are left on the riverbanks after spring flooding. This helps create healthy soil. But rivers can also destroy soil. When rivers flood, erosion happens. This means the water drags away some of the soil. Erosion can create problems for people, plants and animals.



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LESSON Plans



Lesson 3: Soil Actions in the North

2 class periods. Includes a permafrost experiment.

You'll need: two bread pans, some water, some soil and gravel, toothpicks, playdough or clay, pipe cleaners and some seeds.

Note: This activity requires enough prep time for a pan of water to freeze.

Assessment Opportunity

This is another great opportunity for students to add diagrams to their soil journals.

Alternatively, you could have students take pictures of the two pans of soil and add these to their journals with descriptions of the differences.

Extension

Permafrost also holds lots of methane, a gas that is 20 times more destructive to the atmosphere than carbon dioxide. If permafrost starts melting more frequently, methane is liberated (released) in the atmosphere and contributes to global warming.

Hunting for methane with Katey Walter Anthony (2:00)

This video shows how methane gas released from permafrost gets trapped in frozen lakes!

Steps

1. Mix 3 parts soil and 1 part water in each bread pan.
2. With playdough or clay, make two model houses. Prop the houses into the soil using toothpicks. Leave some of the toothpick visible. There should be one house per pan of soil.
3. Put one pan outside (if winter) or in the freezer until it is frozen solid. Keep second pan inside classroom.
4. When the pan of soil is completely frozen, bring it into the classroom. Have students compare the soils in the two pans and record their observations in their soil journals.
5. *Pretend pipe cleaners are plant roots. Which soil is easiest to penetrate?* Try planting a seed in both soils. *Which soil is easiest to plant in?* Pour a little bit of water on the surface of both soils. *Which one absorbs the water? What happens if the soil doesn't absorb water?*
6. Have students observe the changes to the soil after 10 minutes, 20 minutes, 30 minutes, 40 minutes and record observations in their soil journals. *Does the frozen soil change? In what ways does it change?*
7. Extend your observations to consider what happens to the houses and roads built on permafrost when the frozen soil melts.
8. Finish the activity with a discussion about permafrost. It affects plant roots and growth, as well as buildings. When permafrost melts, the ground becomes unstable. Students can also share stories about their own experience with permafrost.

LESSON Plans



Lesson 4: Decomposers

15 minutes with opportunities to record observations throughout a week.

This activity helps students to think about the role decomposers play in breaking down plant waste.

You'll need: an apple, a coring knife and four plates

Steps

1. Cut the apple into 4 pieces.
2. Put a piece of apple onto each plate.
3. Put one of the pieces in the school fridge, one outside in an area where it will not be disturbed, one on the windowsill in the classroom and one in a cupboard.
4. Have the class observe the changes in the apple after a few hours, a few days, a week. *Which sample has changed the most? Which one has changed the least?*



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Assessment Opportunity

My Nature Journal – Page 6

Students can record their observations.

This activity gives us information about decomposers. As a class, discuss which conditions were the best for decomposing the piece of apple. *Which conditions led to little or no decomposition?* Explain that decomposers do not multiply as fast in a cold environment, so they are slower to work when the temperature is chilly or freezing. This is one reason why northern soils build up so slowly. As a class, discuss how people can improve the nutrients in their soil. Suggestions should include composting or manure if it's available. In areas where soil additives are not available, discuss how humans can create their own supply by composting food waste.

Composting for Kids (6:00)

This animated video explains how composting works and why we should compost. It describes 'centralized composting' where municipalities have large programs that can accept meat and dairy. Yellowknife has a centralized composting program but if your community does not, you should avoid those types of materials.



© Crossroads School

Create a class vermicomposter

Special worms can be ordered online, or contact Ecology North in Yellowknife (867) 873-6019 or Hay River (867) 874-4706.

Get growing

Contact the Territorial Farmers Association for gardening-related resources that can be shipped around the territory. Visit <http://www.farmnwt.com> or phone (867) 874-4706.

Soil sorter

Create an experiment to sort soil into different components using a sieve or a sedimentation jar.

[Grow the Planet](#) has a nice example.

URLS



Some hyperlinks have been embedded throughout the **Soils Alive** resource. If a link appears to be broken, try visiting the homepage or keying in the URL as it's written below.

Grade 3 science curriculum

<http://www.ece.gov.nt.ca/files/Early-Childhood/K-6%20Science%20%26%20Technology%20CurriculumFINAL%20.pdf>

Dene Kede curriculum

<http://www.ece.gov.nt.ca/early-childhood-and-school-services/school-services/curriculum-k-12/aboriginal-languages#dene-kede-grade-6>

Inuuqatigiit curriculum

<http://www.ece.gov.nt.ca/early-childhood-and-school-services/school-services/curriculum-k-12/aboriginal-languages#inuqatigiit>

My Nature Journal

<http://www.assembly.gov.nt.ca/sites/default/files/09-06-01td49-163.pdf>

Agriculture in the Classroom

<http://www.farmnwt.com>

Elders in Schools handbook

http://www.ece.gov.nt.ca/files/publications/elders_in_schools_handbook_en_web.pdf

Soil Brownies

<https://www.youtube.com/watch?v=AmDVFKYIqEU>

Worm Poop song

<https://www.youtube.com/watch?v=9Xs5cdIT9Ec>

Composting for Kids

<http://www.youtube.com/watch?v=dRXNo7lekY8>

Hunting for Methane with Katey Walter

www.youtube.com/watch?v=YegdEOSQotE

Soil sorter example

<http://www.growtheplanet.com/en/blog/learn/article/289/soil-composition-an-easy-garden-experiment-for-children>



ECOLOGY NORTH



WWF is Canada's largest international conservation organization, working to build a future where people live in harmony with nature. The Schools for a Living Planet program empowers educators and students of all ages with the tools they need to lead us into a sustainable future. Schools for a Living Planet is grounded in the principles that make WWF a global success - including strong science and a focus on solutions.

Ecology North is a charitable, non-profit organization that has engaged Northerners in hands-on learning opportunities in the Northwest Territories since 1971. Our mission is to bring people and knowledge together for a healthy Northern environment. Education, public engagement and youth involvement are integral to all of our program streams that include climate change adaptation, watershed protection planning, waste reduction, food sustainability and alternative energy promotion.

This project was made possible with the financial support of CIBC. For more information, visit www.cibc.com.

WWF-Canada and Ecology North would like to thank the classroom teachers across the Northwest Territories who contributed many of the ideas presented here, especially. Marlene Martin, Megan Miller, and Michelle Wright. Ecology North Education Committee members Marianne Bromley and Mindy Willet also provided guidance. This resource is available as a free download from WWF Canada Schools for a Living Planet. Visit schools.wwf.ca. © 1986 Panda symbol WWF-World Wide Fund For Nature (also known as World Wildlife Fund). ® "WWF" is a WWF Registered Trademark.