Ecosystems: Understanding Our Place in the Natural World

An Integrated Science Learning Unit for Yukon Grade 7 Students

November 2014

Acknowledgments

In 2008, the Yukon First Nation Education Advisory Committee proposed several goals and priorities for education in the Yukon. Central priorities included the development of curriculum and resources that integrate into curricula, First Nations content, perspectives, values, knowledge *and ways of teaching and learning.* This resource provides teachers with the support for providing learning experiences that allow for learning to be grounded in the heritage of northern students including culturally preferred learning styles rather than just learning about their heritage.

The development of this resource for teachers and students in the northern Yukon has been made possible through the granting agency Social Sciences and Humanities Research Council. Their support has ensured that northern students are provided with the opportunity to learn about their heritage through means responsive to their learning style preferences, especially when they study core curriculum areas such as science. The development of this resource has also been made possible through the support of the Tr'ondëk Hwëch'in community of Dawson City. The elders and community members have given their time and knowledge to ensure that their experiences can be recorded and incorporated into learning activities valuable for their community's children.

As well, the school community of Robert Service School, especially the teachers of the Intermediate grades is thanked for its support in the development of the learning activities outlined in this resource.

Contact details:

Dr. Brian Lewthwaite
Faculty of Education
University of Manitoba

Guiding Principles of the Unit

- Draw upon teaching orientations that are identified as culturally located practices.
- Affirm cultural competencies honored by the local community.
- Provide two-way learning experiences by integrating traditional knowledge, beliefs and values and contemporary scientific knowledge, processes and attitudes.
- Use traditional and contemporary cultural examples as contexts for student learning.
- Include the local community and its people in students' learning opportunities, especially in the use of narratives including local people.
- Foster Han language development where possible.
- Use diagnostic and formative assessment to inform planning and teaching and monitor student learning.
- Engage students by starting lessons by providing first-hand experiences for students or drawing upon common experience.
- When using story to engage students, use the interrupted-story-line as a vehicle to prompt consideration and first-hand investigations.
- Deliberately promote scientific and cultural habits of mind (curiosity, problem-solving, working to end) student through thoughtful independent consideration of questions and challenges posed.
- Move from the experiential, first-hand experiences to the psychological; that is, after providing concrete experiences assist students in making sense of experiences by using purposeful strategies to promote understanding such as role plays, illustrations and analogies.
- Assist students in their consolidation of ideas only as an extension of the initial experiential and psychological learning experiences.
- Provide opportunities for student-initiated and directed investigations.
- Provide opportunity for students to make connections among science and all other learning areas.
- Foster student independence, creativity and curiosity by providing opportunity for students' ideas and questions and follow-up opportunities for problem-solving and investigation.
- Provide students the opportunity to make connections between what they are learning and career opportunities specific to the local context.

Cross-Curricular Applications

This unit is developed to reinforce the learning outcomes of the Grade 7 Ecosystem unit. It is expected that students will:

- analyse the roles of organisms as part of interconnected food webs, populations, communities, and ecosystems
- identify populations of organisms in communities and ecosystems according to simplified food webs
- explain how habitats provide basic needs for the organisms living in them
- identify factors that are critical for healthy populations and ecosystems, including air and water quality and explain their significance
- assess survival needs and interactions between organisms and the environment
- identify interactions between decomposers, producers, and consumers, ac cording to the food pyramid
- describe in detail how decomposers recycle nutrients within ecosystems, and how plants, animals, and decomposers depend on each other
- explain and provide several examples of how energy is transferred
- through food webs and food chains within an ecosystem
- assess the requirements for sustaining healthy local ecosystems
- create and justify a description of a suitable environment for a specific org anism, taking into account the limiting factors
- explain relationships between living (biotic) and non-living (abiotic) things within an ecosystem with reference to several examples
- evaluate the likely effects of habitat loss for certain species
- evaluate human impacts on local ecosystems
- describe, using examples, how forestry practices affect ecosystems (e.g., riparian zones, fishing, forest debris, beetle kill, controlled burn)
- determine the sources of pollutants, and analyse their effects (e.g., water contamination)
- describe, using examples, how practices of Aboriginal peoples affect environmental sustainability in a specific ecosystem.

The unit is also developed to reinforce or address some of the learning outcomes of the **Social Studies** curriculum of British Columbia (2005). These include:

A1:

- apply critical thinking skills including comparing, classifying, inferring, imagining, verifying, using analogies, identifying relationships,

summarizing, and drawing conclusions to a range of problems and issues

- select a relevant problem or issue for inquiry use comparison, classification, inference, imagination, verification, analogies, and relations hip identification to clarify and define an issue or problem
- compare a range of points of view on an issue
- draw conclusions about an issue or problem

A2

- use various types of graphs, tables, timelines, and maps to obtain or communicate information
- compare the advantages and disadvantages of various graphic forms of c ommunication
- demonstrate an ability to interpret scales and legends in graphs, tables, and maps (e.g., climagraph, topographical map, pie chart)
- draw conclusions from maps, tables, timelines, and graphs
- select an appropriate graphic form of communication for a specific purpose

A3

- compile a body of information from a range of sources
- compare the advantages and disadvantages of specific types of sources for specific purposes
- compare information-gathering methodologies
- apply criteria to evaluate information and information sources
- explain why it is important to cite information sources (e.g., respecting others' intellectual property, keeping track of where they acquired the information, distinguishing between fact and opinion, helping readers identify sources of additional information)
- represent information fairly and cite sources consistently

A4

- deliver a formal presentation on a selected issue or inquiry using two or m ore forms of representation
- select and clarify a topic for presentation
- organize researched information to prepare a presentation
- select appropriate forms of presentation suitable for the purpose and audience
- plan, prepare, and deliver a presentation on a selected topic

A5

- defend a position on a contemporary or historical issue
- demonstrate skills of debate, including
- identify, discuss, define, and clarify the problem, issue, or inquiry
- consider competing positions from various perspectives
- conduct research
- select a real or simulated contemporary or historical issue and apply problem solving strategies to address it

- justify their position in terms of factors such as geography, gender, historical perspective, culture, and religion

Identity, Society and Culture:

B1 analyse the concept of civilization as it applies to selected ancient cultures
B2 analyse social roles within one or more ancient civilizations
B3 identify influences and contributions of ancient societies to present day cultures

Governance:

C1 describe the evolution and purpose of rules, laws, and government in ancient civilizations
C2 assess how ancient systems of laws and government have contributed to current Canadian political and legal systems

The emphasis in Social Studies on the validation of Aboriginal Cultures and Continuity and Change in Society are emphasized in this unit. As students are engaged in science, they will also be engaged in social studies learning. They will also be developing oral and written language and numeracy skills specific to Grade 7. The unit has strong connections to understanding of fundamental ideas in ecology within the northern Yukon environment drawing attention to the utility of Traditional Ecological Knowledge to contemporary social context.

Students are encouraged to explore the principles of ecology especially through the stories and accounts of persons from the community. By hearing these accounts and having their own first-hand experiences, students can develop a rich understanding of their place within the natural ecosystem and the contributions Traditional Ecological Knowledge to contemporary society.

There are obvious connections to social and environmental change and personal health and well-being. Teachers are encouraged to make reference to how technology associated with has changed over time and the importance of a healthy lifestyle. The activities suggested are starting points. Broaden the focus by adding stories and activities of your own or from the experiential base of your community.

Conceptual Ideas and Progression

The recommended sequence for supporting student conceptual development of the phenomenon of ecology is suggested below. For the most part, the activities and the conceptual and skill development embedded within the activities is sequential. Elementary science experiences and ideas primarily focus on experiencing and communicating these experiences. Middle Years science experiences focus on understanding and investigating these experiences and appreciating applications of this understanding to their students' everyday world. It is suggested teachers address the following key ideas:

- Our local history is grounded in an understanding of the natural world and our place in the natural world
- In our natural world all things are Creator-given, alive, related, interconnected, interdependent and seek to operate in balance. Because of this, all things should be respected. Da'ole is the code we need to live by
- Within our local area, there are a variety of ecosystems
- Within each of these ecosystems, there are interactions and relationships between the (living and non-living) components of the environment
- The health of an ecosystem is determined by the strength of these interactions
- Each organism within an environment has a role (niche, producer, consumer, decomposer, predator, prey)
- Scientists have a variety of terms to describe and represent these relationships, commensalism, parasitism, mutualism, predation)
- There is a close relationship amongst organisms in an ecosystem. Changes to one thing can cause changes to another.
- We have a variety of traditional and scientific ways we can monitor ecosystems
- There are a variety of ways nature and people can influence these relationships, positively and negatively. Many of the negative impacts have resulted because we haven't recognized our place in the natural world
- We need to make decisions wisely and based upon both scientific and traditional ecological knowledge to conserve and protect our ecosystems
- Increasingly, TEK is being applied to contemporary life.

Skills Development

This unit emphasizes that the learning of science ideas is inextricably linked to the development of the processes of science. As asserted by British Columbia Science Grade 7 (2005), the legislated curriculum for Yukon schools, science experiences should provide opportunity for the development of conceptual understanding within the context of relevant investigative experiences. Although individual scientific process skills may be emphasized in specific activities, they are to be supported more holistically in teacher-facilitated or student-directed inquiry. The skills to be developed are expected to be appropriate to the level of the learner. These skills are outlined in detail in the Science Grade 7 (2005) guide.

Test a hypothesis by planning and conducting an experiment that controls for two or more variables

- supply relevant supporting evidence for hypotheses presented
- develop a testable question that considers the variables involved based on previous inferences
- communicate precisely the question under observation so others can review the plan and procedures
- question the relevance of the hypothesis by checking the control and the accuracy of the testing methods (fair test)
- communicate the results of an experiment, using graphs and charts

Create models that help to explain scientific concepts and hypotheses

- observe a problem situation, and formulate a plan for investigating a solution
- plan in detail all of the steps necessary to build or make a product, and prepare a written outline showing the order of events
- identify key components of the system or process being modelled.
- develop a testable question that considers the variables involved (independent and dependent)
- build a relevant and appropriate model based on the available materials and constraints of the problem
- apply all appropriate safety measures when building a model

These skills involve coordination between cognitive and psychomotor skills. Handling and manipulating equipment require not just the physical ability to perform a task but also the intellect to know how to measure or observe accurately. It is anticipated that by the end of intermediate school, a student might be able to, with assistance, conduct a scientific investigation. This unit provides opportunities for students to work physically and cognitively towards this end.

There is no universal list of scientific process skills. Those identified in this curriculum are not intended to be a linear scope and sequence; instead, they suggest multiple ways in which learning science can be explored. Process skills are best learned in hands-on activities where students engage in a problem-solving task while doing science. The hands-on model of learning science allows students to construct meaningful connections within the brain. In young children, process skills can be found in the natural practice of manipulating materials while asking questions and being curious. The names of the skills can be used and reinforced by teachers as students use and learn to apply these skills to science activities. The science process names will become familiar to students, enabling them to use the correct vocabulary when they explain their involvement in science and technology inquiries.

Attitudes and Beliefs Development

An explicit goal in the development of this resource and the other resources being developed in this northern Yukon project and the accompanying professional development provided for teachers is to use these as a vehicle to contribute to student 'success' in science. Although success in science is often attributed to measurable outcomes such as knowledge acquisition and development, the intent of this development project is much more encompassing. It extends this notion of success to investigate the influence of 'two-way' learning experiences on students' perceptions of success, especially in their personal attitudes and self-beliefs.

What does success in science mean to northern Yukon students? It is anticipated that students will experience success in a variety of ways, beyond the border of knowledge into the domain of attitudes and beliefs. Attitudes are regarded as states of mind, behavior or conduct regarding some matter, as indicating opinion or purpose. The program of study suggested in the activities that follow will foster habits of mind such as curiosity and creativity, and openness to new ideas of thinking. As well students will develop confidence in their perceptions of self as students of science. Similarly they will develop confidence as evidenced in risk-taking and their effort to conduct science investigations. Their participation in the processes of science will foster their perseverance, precision and objectivity in solving scientific problems. As members of a team they will develop in their respect for and ability to work co-operatively towards purposeful goals with their peers.

Above all, it is anticipated that students will develop a more positive sense of themselves in contemporary society as they learn about the inextricable link between science and the world in which they live. It is anticipated that students will see science as part of their life trajectory both in future formal and informal settings as a result of science study that advocates 'two-way' learning.

Our Local History is based upon an understanding of the Natural World and our place in the Natural World

Understanding Weather: *Based on an interview with Alfred Kendi of the Fort McPherson area.*

You learn that you have to respect the environment. You have to understand the weather. It is not something you can just ignore. You grow up in the north hearing stories about how people have got in trouble and there have been tragedies because people have taken things for granted.

I know my father told me that I had to respect the environment and be sure to just ask God for travelling safety because things can change so much and so fast. It's like if you see yourself better than the environment or stronger than it, you are asking for trouble. Be careful, be well planned, be respectful, be wise, don't take things for granted; that is what is important. If you don't know how to get somewhere, just don't head off thinking you will get there. You need to ask for advice.

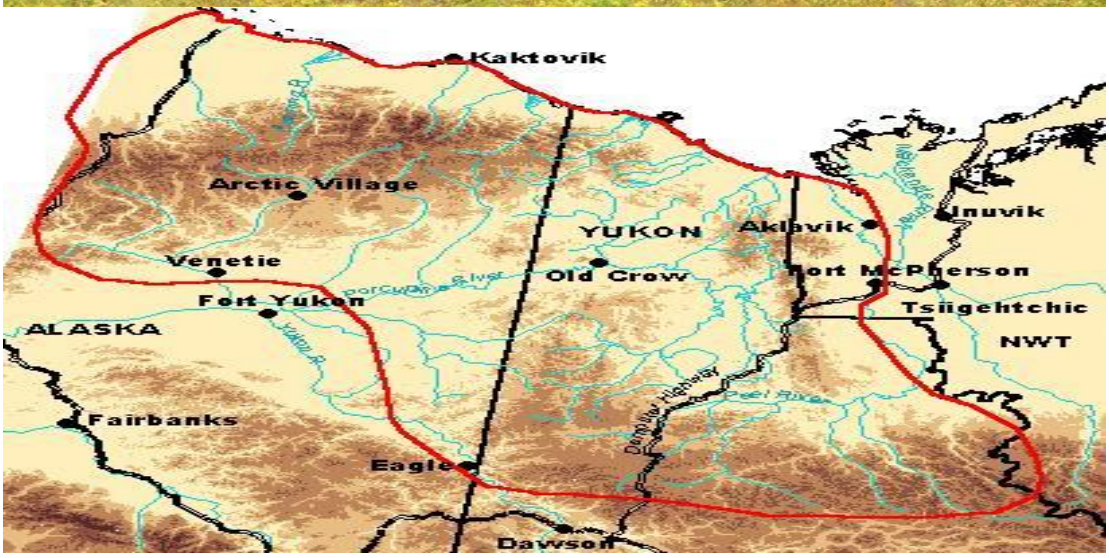
I think the story of the Lost Patrol and the death of the RCMP going from Fort McPherson to Dawson City is an important one. The police were told to be careful and not be too confident in their own ability. I think they might have been too confident and should have listened to advice.


Anchorage Museum of History & Art. Library & Archives.

The "Lost Patrol" had set out from Fort McPherson, N.W.T., Dec. 21, 1910, heading for Dawson, Yukon Territory, a trek of roughly 800 kilometers (500 miles). Failing to find their way through the mountains, the lost patrol had turned back to Fort McPherson in a desperate race against cold and starvation. The grisly discoveries of the bodies of Taylor and Kinney, then Carter and Fitzgerald, were all made within 50 km of Fort McPherson on March 21-22, 1911. They are now buried in Fort McPherson. The image below is of Corporal Dempster who was the leader of the patrol who found the remains.

Understanding the Caribou Migration: *Based on an interview with Dick Field in Dawson City.*

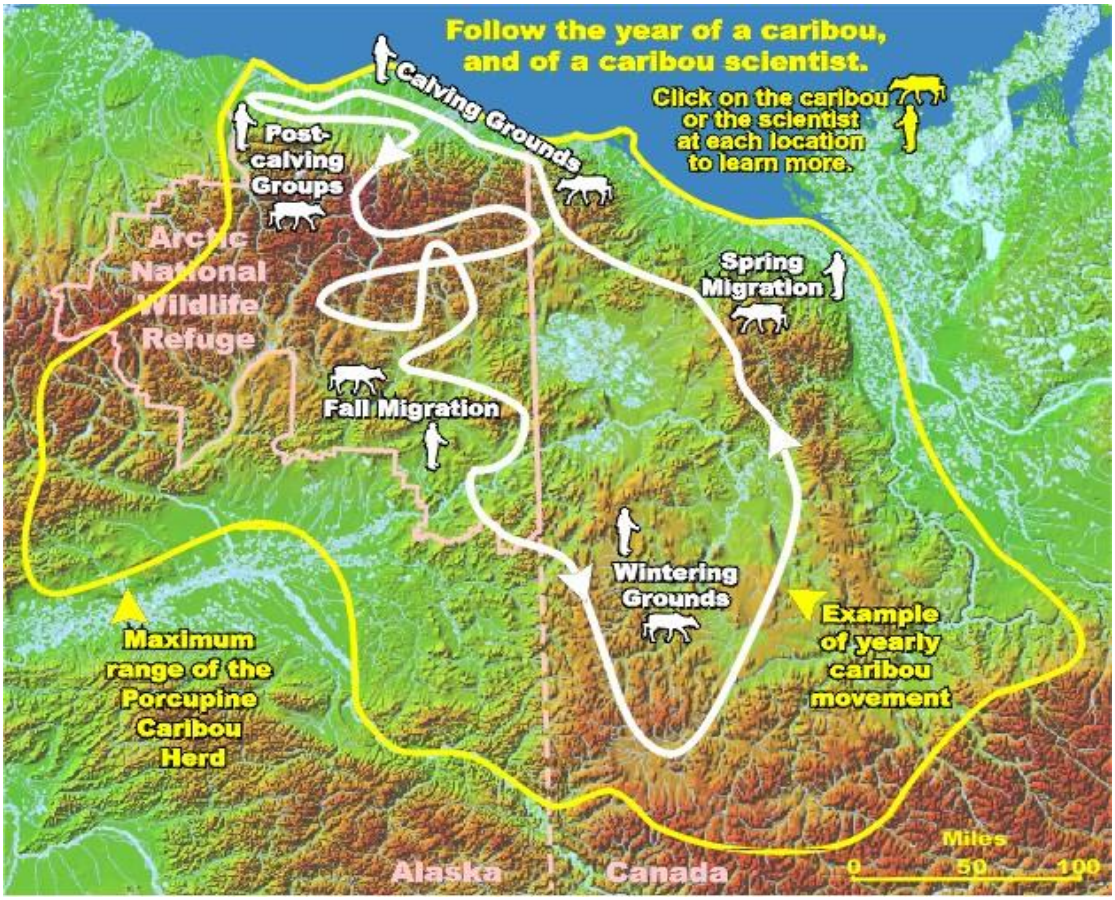
As young man living in the northern Yukon, you learned from the elders about caribou and their migration. The Porcupine caribou herd occupies a large area across northern Alaska and Yukon and northwestern NWT. Many of the communities rely on the caribou for food and you had to understand their movement.



Elders knew from generations past that although they had wintering grounds and calving grounds, their movement was influenced by things like weather and food supply. If there was deep snow in an area or if there had been ice rain, the caribou would travel differently year by year. An important food source for caribou was Caribou moss (*Cladina rangiferina*). If a large number of caribou had migrated through one valley one year, it might be several years before they

might return to that valley. It could be predicted but you never knew for sure. Nothing was for sure. You wanted to have some idea because in those days you hunted by foot and dog team, not like today where you have skidoos. Some people would say they knew where the caribou would travel, but that was foolish because you could not be certain about those things

You might have an idea but you could not be certain. The advice of elders was important. They had much more understanding about how things work. They had knowledge and were wise. It was one thing to have knowledge but you also had to be wise.



The Importance of Being Wise: *Based Upon an Interview with Percy Henry of Dawson City*

When the Gold Rush occurred and for many years after, logs and wood were very important. Because there was not much timber in this area, the logs needed to be brought from far up river, mainly from the Stewart River area. The logs used to be put together into huge rafts that were then navigated down the river. [They could be larger than five school gymnasiums put together].

The raft was guided by someone who knew the river. He would use a 'tato' – a long 65 foot (20 metre) log paddle – as a rudder to keep the log raft in the current. Without the tato, the log raft would crash up against the Yukon River canyon walls. He had to be a good navigator. The navigator did not work alone. Others helped him and assisted him in identifying the hazards so to keep him in the right channel.

Everyone in their life needs a *tato* – a guide that can help them move through life without being in trouble. Without a tato – a guide in our life – we are likely to lose our way. This tato might be our language, our culture, our faith, our sense of who we are. What makes us feel important and worthwhile. It is what is in us. We need to know who we are and believe in ourselves. Without this, things will not go well. We must find this and then we will travel well.

It starts by being confident in yourself but also by not thinking too much of yourself. Some people think too much of themselves. You must have knowledge but you need to be wise. If you think too much of yourself, you will get in trouble. You must be respectful in the world.

Our Local History is based upon an understanding of the Natural World and our place in the Natural World

The three stories are from people who are considered by their communities as being wise and successful people.

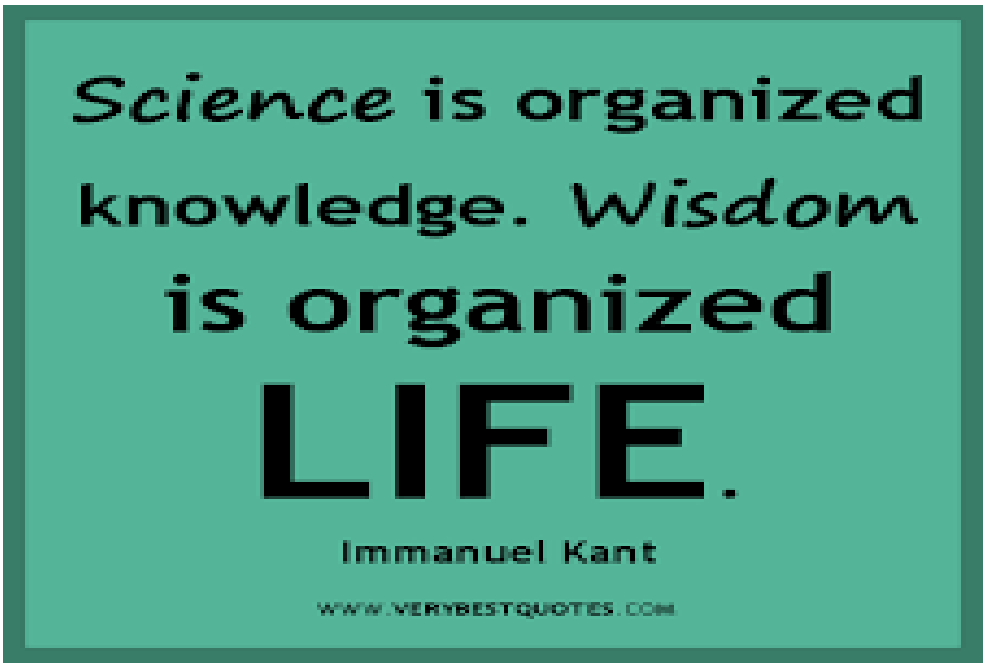
1. Take time to consider why they are considered successful. Do you think it had to do with how much money they had? Or, their career? Why were they seen as successful?

2. All three make mention of what is important to leading a successful life, especially in the north. Write a short paragraph and draw a picture that illustrates what they say is important in leading a successful life.

3. All three make the point of stating the difference between knowledge and wisdom. What is the difference between these?

4. Why do you think all three see wisdom is very important?

5. Today, communities talk about the importance of listening to *both* scientists and elders. Why might this be so?



In our natural world all things are Creator-given, alive, related, interconnected, interdependent and seek to operate in balance. Because of this, all things should be respected. *Da'ole* is the code we need to live by

Harvesting Salmon: *An adaptation of an interview with Peggy Kormendy* (2007).

We have been going to fish camp for years. It is a special time of year when we get to harvest fish. There are always things to be done. Mending nets, cutting fish, hanging fish, and smoking fish, all these things need to be done. We cut and clean the salmon so that every bit is used. It's hard work. Everyone, even the children have work to do. It is important to go down there to fish camp. There is really no time for anyone to just sit around. We have to work together.

We are very thankful for salmon. You are always thankful for what you have with the salmon. Money couldn't buy fish. No money could buy my dry salmon.

Things are changing fast. In the past, sometimes there were seasons with many, many fish and sometimes it was smaller numbers. It was just a natural process. In the last years the numbers are getting lower. In Alaska, they are taking too many fish, especially at the mouth of the Yukon. We always have known you can't take too many fish. The nets or salmon wheel will be in for a day and then out for a day. You can't overharvest. We have said for years you can't over-harvest, and we knew this was starting to happen. People get greedy and they harvest for money.

(Salmon Wheel) http://www.youtube.com/watch?v=IarZQFsDAiM

That is not the only problem. The salmon need really clean water for spawning. There has always been mining on the waterways but now there is so much mining. Some of these streams that feed into the Yukon were really important for salmon and spawning. The water has to be clean and the mining can make the streams not good for the salmon. We are not respecting the salmon. Things will not be good if we don't care more. We have to be careful about the number of fish taken and the way we treat the water. We have to be careful about how we treat the waterways. We have not treated it with respect, but today I wonder if we realize the impact we are having. It's changing now. It must.

Harvesting Salmon by Dipnet; http://www.youtube.com/watch?v=_EVFcD-kCH4

Harvesting Bear: *An adaptation of an interview with a Dawson City elder* (2001).

We live in an area where we have so much from the land, just the amount of wildlife we have to harvest. I used to live in the northern Yukon, near the arctic coast and there were stories about people coming to the northern Yukon and the MacKenzie region because there was so much game. We have so much they said.

You couldn't take this for granted. What you had you couldn't take it for granted. It had to be respected.

Several years ago for the first time we started to hear about people getting cancer. It did not occur here before and then some people started to get cancer. We used to talk about why it was becoming more common. Many people thought it was because of the food we were eating and the changes in our lifestyle and environment.

Then some people started to poach Black Bear. Not for the meat, just for the gall (bile). It was believed that the gall would cure the cancer. Some men would kill Black Bear just to get the bile. Nothing else would be taken. The carcass would be left there after the gall bladder had been removed. It was maybe the size of a golf ball in a small bear. It would be dried and then taken when it was dried. Sometimes it was just taken as a fluid. Maybe there would be two tablespoons of dried gall. It was believed it would cure the cancer.

There was lots of discussion about this. Many people thought it was wrong to kill the bear just for this. It meant that in the Dawson area, the number of Black Bear really dropped.

Black Bear are more important than this. They have a place in the natural world and you can't kill them just for the bile.

CBC Documentary:

http://www.cbc.ca/archives/categories/environment/endangered-species/endangered-species-in-canada/rare-bears.html

I don't hear of this anymore, but it does still happen around the world. In some countries, bears are kept in captivity and the bile is extracted while the bear is kept in a cage.

http://www.youtube.com/watch?feature=player_embedded&v=j8zgCASRtw0

http://www.youtube.com/watch?feature=player_embedded&v=r9snODccgIc

I can see why people might see the need to do this when they are sick from cancer. They put their health above everything else.

Harvesting Caribou: *An adaptation of an interview with Robert Alexie of Fort McPherson* (2007).

The elders would say that when there was bad weather, like a storm, or really big winds, and it went on for days. It was likely because someone had been disrespectful to the environment. You couldn't do that. You had to be respectful.

When the Dempster Highway opened, things really changed for hunting. We could take big trucks with skidoos down the highway to where the caribou were. Without too much effort you could harvest many, many caribou. It was very different that in the old days when you did it by foot and dog team.

Then a few days later you could go back and do the same thing again. You could fill the truck again with caribou. The elders thought we were starting to take things for granted and were not showing respect. It was too easy to harvest and people started to take things for granted. It was not like in the old days where it was a lot of work to get caribou and you were very thankful for what you got.

Not long after those days of big harvest we had a bad winter storm in the Fort McPherson area. The Dempster Highway was closed and the storm went on for days and days. People did not even go outside their houses because the storm was so severe.

During the storm, I remember the elders would be on the local radio, and they would say that the bad weather had come because we had been disrespectful in the harvest. Maybe some caribou had been killed and left there. Maybe the leader of the herd had been killed. Maybe someone just took meat and did not use everything from the caribou. They said that this had to change; how we harvested had to change. They said we were not to take so many and to make sure that we left tobacco to show respect for what had been given.

They said the storm would go on until someone did that. It was important for someone who had hunted to return to that area and make an offering.

We are very thankful for caribou, but we have to not take them for granted. It is easier to hunt now, but that does not mean we have to take more caribou. We have always taken caribou, just like wolves and bears, but you can't take too many.

(Animal Planet – Wolves and Bear)
http://www.youtube.com/watch?v=FlA4J19ji3o

In our natural world all things are Creator-given, alive, related, interconnected, inter-dependent and seek to operate in balance. Because of this, all things should be respected. *Da'ole* is the code we need to live by

1. The three stories are about harvesting different animals. Although they are about different animals, the stories are very similar. Complete the chart below to show you can identify the main message in each story.

Story Teller?	Animal?	Main Message?

2. Look at the main messages from the three stories. How are the stories the same? How are they different?

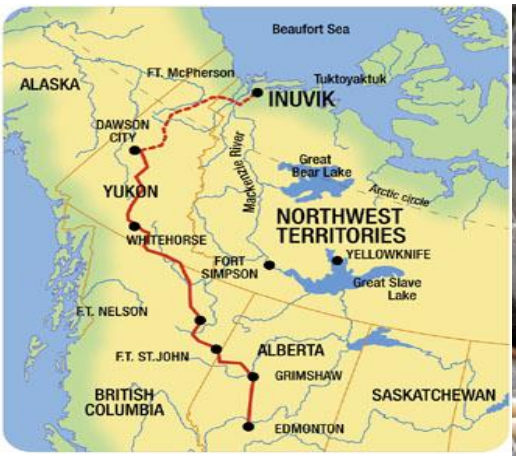
3. The elders of Tr'ondëk Hwëch'in speak about **traditional law, called Da'ole**, which is the traditional Han law and beliefs. These are the things you need to know in order to conduct yourself properly in the world. It is about having respect for the land, its provisions and people. If you treat things properly things will go well. For example, how you think of the animal and how you take care of it when you've taken its life. One of the first things you must do is cut off the animal's head and turn it away from the body so it doesn't see itself being butchered. It's a sign of respect for the animal because it's understood that its spirit is still very strong and present, and the animal is providing for you and your family.

4. If these elders came to your class and spoke to you about the Natural World, what would be the main message they would have for you?

Da'ole: *A story form Percy Henry about Traditional Law (Da'ole)*

When my mom and dad lived at Wolf Creek when they were old, they did not have dogs to protect them. A wolf stayed with them for all that time they were alone out there and the wolf used to come at night and stay at their camp.

I was coming along in the morning and here I see a big grey wolf, so I shot it and my dad just about kick me out of camp. Because he say, "Why you shot animal like that? It's no good for you, his fur is no good. Leave it alone, because he just sit around here, we feed him. He don't bother nobody, he don't bother nothing. Don't do that".



So my dad tell me never shoot anything unless you are going to use it. And you never shoot game unless you are going to use it. Like wolf, you don't shoot it and leave it. If you shoot it, you have to skin it. I was told by elder that if you don't use it you could have bad luck.

Sometime the animal will get in your way to save your life. And sometime that animal give itself to you to save you. There are things the animals do for you. You have to respect that.

There are lots of things we have to practice. I think we went too far into the white man world and taking things for granted. Now we back out and start to look at things again our way. We have to know how to live with the world (again) and how to behave with the world. This means learning to respect others, particularly the many teachers and to value the resources of the world.

Da'ole is the unwritten ways we need to live, for fishing and hunting. How to respect everything Then the world will continue to provide.

Da'ole: *A story from a young scientist about Traditional Law (Da'ole)*

In 1977, I was asked by the University of Saskatchewan to carry out a research project on the lichens found in the Tombstone, Ogilvie and Eagle areas. It was thought that because the climate and geology of the regions is different in each area, the plants and animals in each area would be different to.

Tombstone Mountain

Eagle Plains (Richardson Mountains)

Ogilvie Mountains

As a young scientist, I did not realize that people in Dawson, Old Crow and Aklavik knew so much about lichens. I thought only scientists knew about lichens.This is because lichens are the main food of caribou.

Although there are many types of lichen, maybe thirty or so in the area, there is one main type of lichen eaten by caribou. The two pictures below are of two different species of lichens. They look very similar but the one on the right is the lichen preferred.


To find out about the lichens in the area I spoke to Joe Henry, a Tr'ondëk Hwëch'in elder who at that time lived at Wolf Creek. During the summer, he took me to an area of open forest just below Klondike maintenance camp. This area has many different kinds of lichens, especially lichens eaten by caribou.

I walked ahead of Joe into the open forest across an area where there were huge beds of lichens. The lichens crunched under my feet as I walked across the bed of lichens. After only a few steps, Joe stopped me and said, “No, no, not that way!” I stopped and watched how he was walking carefully through the lichen trying not to crush them under his feet.

Later, as we looked at the lichens I began to understand how much knowledge he had of the lichens, especially his ability to identify the one lichen that is the food of caribou.

“Without (lichen) we have no caribou”.

It was simple as that. He knew the importance of lichen for ensuring the survival of caribou and the importance of caribou in supporting Tr'ondëk Hwëch'in survival. Everything was interconnected.

Upsetting the Weather: *Based on a conversation with Alfred Kendi and Mary Kendi of Fort McPherson.*

There is a plant that is very important to us. It is called White Moss or Uudeezhu. You would call it a lichen. It is small and bushy. It grows on the tundra and is very important. White moss had several uses for us. It can be boiled and used as a tea. When drank, it was good for chest and stomach pains. It was also drank before you would go in the mountains walking because it helped you to keep your wind for walking and climbing.

It can be used to make food good go further by mixing it in with soups. Some people would boil it and then fry it. It was like Corn Flakes after it had been fried. When the White Moss is dry, it is very brittle. It snaps like spaghetti noodles snap when they are dry. But, when they are wet, they are very spongy. You could also boil it and put the broth of the pigments taken from flowers to change colours. We would then use the colours as dyes to make moose hair tufting.

White Moss is the main food eaten by the caribou. Even we know the caribou will travel and feed on this plant. If there is plenty of this food in one area, we would expect to find the caribou in that area. We had a good idea what way the caribou would travel based upon where this plant was most plentiful.

The plant takes a very long time to grow. Even a plant that is only 5 centimetres tall can be many, many years old. Because the plant grew slowly and was the main food diet for the caribous, we had to treat it carefully. We were told not to step on it. We were told not to step on it ever, but especially when it was dry.

If we did step on it, there was a chance that the weather would turn. Maybe there would be an ice rain and it would put ice covering the plants and the caribou wouldn’t be able to eat it and then they would starve. We would then get hungry.

This was what we were told. We were told to respect things that were given to us and not take things for granted

Upsetting the Weather: *Based on a conversation with Bella Kay of Inuvik*

We have always been told that you have to be considerate of things. You can't take things for granted. If you do, there can be bad weather. If there is bad weather, you are not able to hunt and bad things might happen.

In the 1970s the Dempster Highway was being built. Coming from Dawson City before you get to the border between the Yukon and N.W.T in the Richardson Mountains you go through an area called the Rock River. This was a special area. For a long time it has been a special area.

This area we collect a red colored material called Tsaih. It has a red-coppery colour. When you drive down the Dempster, you might see it. It is a red-coloured rock. You will call it ochre. We can get this Tsaih from burning driftwood as well. The colour was used for dying the soft hide and canvas which was used on tent trim, moccasins, slippers and dog tie harnesses. It made things look very colourful, so it was valuable.

We were told that when we take Tsaih from Rock River area, we were required to leave an offering, like tobacco or something valuable.

When the Dempster was being built, there was a very bad storm. It went on and on for days and people were even afraid of it because it was so severe.

The elders spoke on the Fort McPherson radio about what had caused the storm. They said that someone had taken Tsiah from the Rock River area and not left an offering. They told everyone that if they had taken something, they had to take responsibility for the storm. They told them to go to that place as soon as they could to leave an offering.

You have to respect the land and what the elders said.

Traditional Laws and Values: Reclaiming the Past

Finding about Tr'ondëk Hwëch'in values, especially with how we treat the land, has become very important over the past few years. It has been so important that a social scientist, Jen Laiberte has worked with the elders in the Yukon and Alaska to find out about local values and traditions.

Tr'ondëk Hwëch'in Heritage Department Update July 2012

Summer Dä'ôlè Research

by Jen Laiberte

Each of us has our own ideas about the world and all its gifts, but the places and people we are from shape these thoughts and perspectives. How we interact with land, animals, plants and other people are really important things in life, and we learn these things from our families and relations. This knowledge can be shared through talking, teaching, or just "doing". Even small lessons can have a lot of meaning and significance in the way we understand and live. This can include teachings about respect, rules, protocols, roles, responsibilities, and going about daily life. For Tr'ondëk Hwëch'in, these ideas are traditionally carried within Dä'ôlè' ("the law" or "the way it is"). Dä'ôlè' shows people how to live in a good way—in harmony and balance with each other and the land.

This summer, I'm helping with research in the Heritage Department. One of the ongoing projects is gathering information about Tr'ondëk Hwëch'in Dä'ôlè' so it can be there for future generations to understand where they came from and why things are how they are. I've been told in older times Dä'ôlè' would have been shared orally through conversation and storytelling, but now there is also attention to collecting different stories and keeping records for the future so that knowledge doesn't get lost. Dä'ôlè' knowledge is important for sacred times and ceremonies, but also for activities like hunting, fishing, and harvesting plants.

I hope to have a Dä'ôlè' knowledge-sharing circle at the First Fish Camp so Elders can talk about the different teachings they know, with the youth there to listen and learn, in a setting where it can be practically applied. It's great to learn from our Elders through both listening and taking part in activities on the land so that traditions can be carried on by youth in the right way.

Stay tuned for details about the Dä'ôlè' knowledge-sharing session at First Fish, and if there are any stories or customs you know or remember from past times that you'd like to share, you can stop by and visit with me anytime. I'd be grateful for your time and knowledge and can also help with anything you might want researched, too. I'm happy to be here learning about Tr'ondëk Hwëch'in and Dä'ôlè'. I hope my skills can be of help.

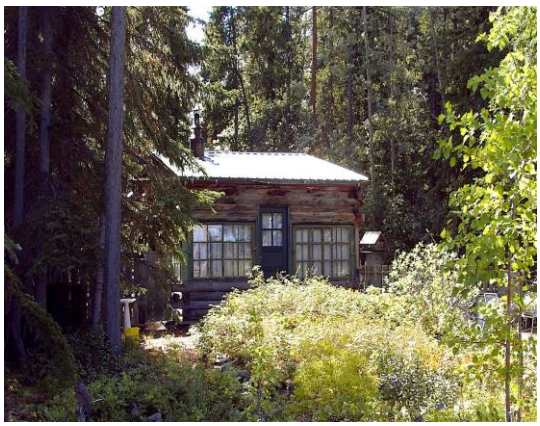
Some of the Most Important Ideas of Da'Ole

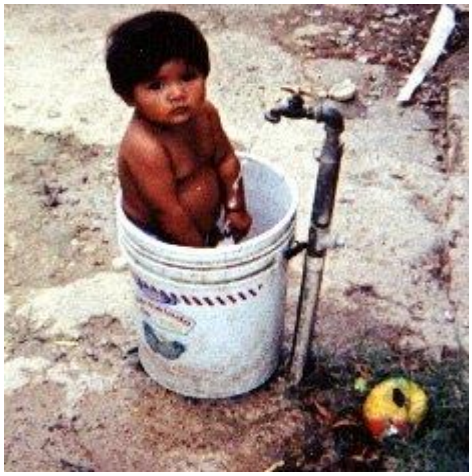
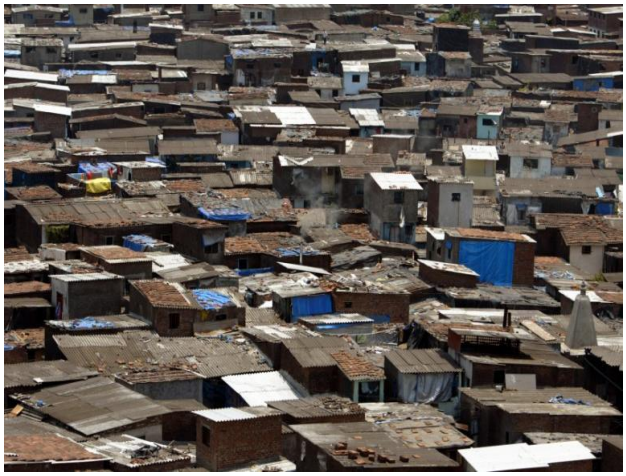
- Animals, fish and plants must be treated with respect at all times – kept clean, handled carefully, treated gently as possible
- Use what you take and don't take more than you need for all resources, and don't use everything you take.
- Don't over-use an area for hunting or berry picking. Move around so that the area can replenish.
- When harvesting animals, fish or other foods or medicines, it is important to give thanks. There are lots of ways of giving thanks – it can be in your thoughts, or in words, or in the form of an offering – some sage or tobacco.
- You shouldn't play with or make fun of any animal you have hunted or caught. That animal will give you food, so you should appreciate it.
- After a successful hunt, remove the head and face it away from the body, the spirit of the animal can still be around for several days. Close or puncture the eyes.
- Be respectful of any blood when hunting and preparing an animal; keep it in a controlled area where it will not be walked on.
- Remember that animals can hear us, so don't make fun of them or speak ill of them when you are in the bush. If you offend them, it can make your hunting/fishing luck bad.
- Treat all hunting and fishing gear with care, and don't mess around with other people's gear, step over it, or throw it down onto the ground.
- Recognize signs and signals in the natural environment. They are messages.
- Have a good habit of mind. If you do, you will be patient, humble and of strong character.
- Go out into the bush or to any sacred or special place with a good, clean mind. Leave the negative thoughts behind or they can cause the hunting to not go well.
- Share your harvest with your Elders, family and community and you will be a successful hunter and fisher.

Compiled by Jen Laiberte with the support of Tr'ondëk Hwëch'in community

Within our local area, there are a variety of ecosystems

The picture below shows two pictures of where a young person in three very different parts of Canada. The pictures are of each person's **neighborhood** or **habitat.** Within this neighborhood, everything a person needs for survival can be found. The **food, shelter, water and space** the person requires are provided by this environment.



Compare the three environments:

Needed for Survival	Rock Creek	Urban Vancouver	Slums of Mexico City
Food			
Water			
Space			
Shelter			

In a paragraph, explain the major differences among these habitats.

Below are pictures of living things (organisms) from our local area. For each organism **draw and describe a picture of its habitat**; that is the preferred environment in which it typically lives. Give consideration to its need for food (including oxygen), shelter, water, and space. Use the internet links alongside to get information about each animal's habitat.

Caribou  http://www.youtube.com/watch?v=Hu9KkwoMYAk	Salmon  http://www.youtube.com/watch?v=5DqjsWsY8-g
Beaver  http://www.youtube.com/watch?v=drKhx4RfwSQ	Golden Eagle  http://www.youtube.com/watch?v=XafAdkZIYKA

Creating an Ideal Habitat for Yeast

Introduction: Yeast, which is used in baking bread and brewing beer is a living organism. It is a kind of fungus, and is related to mushrooms and mold. It can reproduce, requires nutrients, excretes and respires.

Yeast that we buy from a store is in its dormant (sleeping) state. When the conditions are right the individual yeast cells, which are about the size of a red blood cell, become active. The conditions for its activity are the same as most organisms. They need a **food supply, mainly in the form of sugar, and heat**. Each yeast cell takes in food and digests it. It **eliminates wastes in the form of gases and alcohol**, both of which are used in baking bread and making beer. For example, as the yeast are active they digest sugar and release gases and alcohol that not only causes the bread to rise but also gives it a flavored taste. In this experiment you are going to trial a variety of temperatures and food supplies to get some idea of **what its ideal habitat is**.

Begin by watching this clip to give an idea of how this experiment can be carried out.
http://www.youtube.com/watch?v=vh_pWJYh5yg

The problem with these young scientists is they did not carry out the experiment **fairly. What are ways in which there investigation is not being done fairly?** Ideally if they wanted to find out what type of sugared food is the best habitat for yeast **they should have** ensured the:

(1) amount of water in each bottle was the same;

(2) amount of yeast added to each bottle was the same;

(3) the temperature of the water was the same and

(4) the amount of sugared water in each bottle was the same.

As well, they didn't **measure anything to prove which one worked best. They could have measured the height of the balloon in millimetres (mm). The balloon height will change as more gas is produced as the yeast**

What Food Source is Preferred by Yeast?

In this experiment you are going to do two investigations. In the first investigation you are going to find out **what type of sugared food provides the best habitat for yeast.**

Your research question is:

How does the <u>type of sugared food</u> effect the amount of <u>gas produced</u>?

Materials:

- 3 plastic bottles, beakers al the same size (or even better, **use measuring cylinders**)
- Water **(50 mL)**
- Thermometer
- Spoon
- Sugared foods – examples, raw sugar, orange juice, sweetened pop, diet pop
- Balloon
- Ruler

Planning Your Investigation

Use the following chart to help you plan a fair test investigation. In a fair test all aspects of the experiment **are kept the same** except for the aspect you are testing. **This means for this investigation only the *type of food* can change.**

Note that you are changing one variable only to make the test fair.

What is it you are changing?

Note that you have to keep everything else the same such as the amount of water, the amount of yeast, the temperature of the water, and the amount of sugared food added.

***How will you measure the amount of gas released? You could measure the height of the balloon or the* circumference of the balloon. Or if you do this in a measuring cylinder or a jar, you can measure the height with a ruler.**

What will you change?	What will you keep the same?	What will you measure? How will you measure? How often will you measure?

In the space below draw a picture to show you know how to carry out the investigation fairly.

Once done, now carry out the investigation, recording your results below:

Height of Foam	Sugar Type 1	Sugar Type 2	Sugar Type 3

0 minutes			
2 minute			
4 minute			
6 minute			
8 minute			
10 minute			
12 minute			
14 minute			
16 minute			
18 minute			
20 minute			

Discussion:

1. Compare your results to other groups. Are they the same?
2. Draw a line graph for your results. Describe in words what the line is saying about the yeast's habitat preference?
3. Why do you think some sugared foods are a better food source than others?
4. As the yeast are active, they produce alcohol as a waste. As well they produce carbon dioxide as a waste. What effect do you think these have on the yeast cells?
5. Why will the yeast activity begin to slow down? What is happening in their environment to cause this to happen?

What Temperature is the Preferred for Yeast?

You are now going to repeat the experiment and are going to find out **what temperature of water (cold, warm, hot) provides the best habitat for yeast.**

What is your research question is:

How does _____ effect _____?

Materials:

- 3 plastic bottles, beakers all the same size (or even better, **use measuring cylinders**)
- Water **(50 mL)**
- Thermometer
- Spoon
- Sugared foods – the one that worked best from your first experiment
- Balloon
- Ruler

Planning Your Investigation

Use the following chart to help you plan a fair test investigation. In fair test all aspects of the experiment **are kept the same** except for the aspect you are testing. **This means for this investigation only the *temperature* can change.**

What will you change?	What will you keep the same?	What will you measure? How will you measure? How often will you measure?

In the space below draw a picture to show you know how to carry out the investigation fairly. Also list the steps you follow to carry out the investigation. Your steps must be clear enough that someone else would be able to carry this out given your description of the steps

Once done, now carry out the investigation, recording your results below:

Height of Foam	Temperature 1	Temperature 2	Temperature 3
0 minutes			
2 minute			
4 minute			
6 minute			
8 minute			
10 minute			
12 minute			
14 minute			
16 minute			
18 minute			
20 minute			

Discussion:

1. Compare your results to other groups. Are they the same?

2. Draw a line graph for your results. Describe in words what the line is saying about the yeast's habitat preference? Ensure you explain what a steep line means in comparison to a falter line.

3. Why do you think some temperatures are a better than others?

4. Do you think boiling water will be the most **optimum habitat?** Why or why not?

5. Why will the yeast activity begin to slow down? What is happening in their environment to cause this to happen?

6. What would happen if you used ice cold? What does this say about yeast's preferred habitat?

7. Describe the ideal habitat for yeast.

Understanding Ecosystems

Note that other plants and animals are associated with these animals' habitats. In the spaces below are a variety of environments. In in each environment, identify, what organisms – plant and animal – live in this environment. Also identify the environmental conditions that influence these living organisms and describe this environment. Is it extremely cold? Is it windy? Is there soil? Is there plenty of sunlight? Each of these environments is an **ecosystem.** An ecosystem is all the organisms that live in an environment as well as the conditions that influence the organisms in this environment. If possible, **write these words in Han language**.

In each ecosystem list the animals might you find (birds, mammals, insects)?
In each ecosystem list the plants might you find (moss, trees, flowers)?
In each ecosystem list the conditions (wind, sunlight, temperature)?

Forest Ecosystem

Alpine (Above Tree line) Ecosystem

Open Tundra Ecosystem:

Marsh Ecosystem:

Reef Ecosystem:

Videolink to comparing aquatic ecosystems:

http://www.youtube.com/watch?v=kL-9TB4qAho

Within ecosystems, there are interactions and relationships between the (living and non-living) components of the environment

An ecosystem is a community of living organisms (plants, animals and microbes) in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system. All things work together for the benefit of all.

http://www.youtube.com/watch?v=SWvtRf4TAO4

Both scientists and elders understand that they all parts of our environment, both living and non-living are important. It is not surprising that some non-living things such as wind, weather and water are seen as living things because of how important they are and how they behave. They are said to be **anthropomorphic;** they take on the form of living things. An example is weather.

Understanding Weather: *Based on an Interview with Lazarus Sittichinli of Aklavik*

To understand the weather you need to understand SILA (Hila).

SILA is an old word; I am not certain what it is but SILA has to do with anything outdoors including the weather. A child must understand the outdoors and being sent outside to see SILA in the morning was part of the training. Upon returning indoors, we would always be asked how the weather was (SILA).

I cannot fully understand what SILA can really mean. When a person goes outdoors he would say that he went out to SILA. On the hand we can term it as SILALUKTUQ [bad weather] or SILATTIAVAK [good weather].

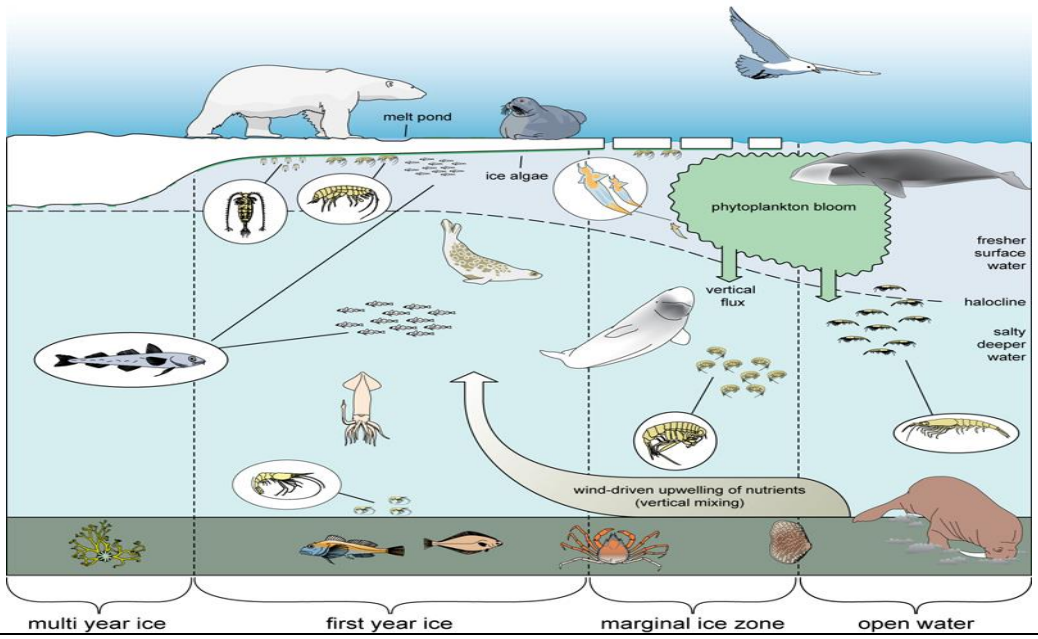
SILA could be angry. When there was bad weather it was always believed to be associated with someone breaking a taboo. Taboos are things that cannot be done. Should someone breach a certain taboo, their life would change. Perhaps they would get some kind of an illness or it might have an effect on the game animal that they hunted or it might change the weather because one person had breached a taboo. This was the most common occurrence when certain taboo had been breached.

Taboos were often with things that there is not too much of. There were taboos with albino caribou or special coloured bear or an eclipse. You had to respect these things especially.

This is what was and is still believed.

The pictures below show two ecosystems. In each identify three relationships that exist to show how these relationships are essential to supporting life.

1.
2.
3.



1.
2.
3.

Our community is like an ecosystem, because all the parts of it work to support the people that live there. Below is a view of Dawson. **Identify some of the living and non-living parts in our community that work to support life within the community**. For example, the Klondike River provides water we need for drinking and household duties. The hospital provides us with health care when we are ill. Talk about 10 more interrelationships and write a paragraph that describes these relationships within the community.

Dawson City is an example of a community in the same way that an ecosystem is also a community. In biology, a community is an *interacting group of various species in a common location.*

Creating an Ecosystem:

In the classroom we can create an ecosystem. An aquarium is an ecosystem. Building an enclosed ecosystem allows you to observe the natural cycles that sustain our planet. Living elements (plants, animals) and nonliving elements (light, moisture, temperature) work together to create a closed environment that contains all the nutrients needed to support life. Such an ecosystem is self-sufficient: once constructed, it requires no input except sunlight. Enclosed ecosystems are easy to make, and they take up little space and require little maintenance, making them a convenient addition to the home, classroom or other educational setting.

Things you'll need:

FOR AN AQUATIC ECOSYSTEM:

- Large, clear container that can be made airtight (such as a bottle, fishbowl or small aquarium)
- Potting soil
- Sand
- Aquatic plants (such as Anacharis, Elodea or Vallisneria)
- Duckweed
- Snails
- Small fish (guppies or algae eaters)
- Fork or other long utensil
- Light source (window or 100-watt light bulb)
- Silicone seal or duct tape

FOR A TERRESTRIAL ECOSYSTEM:

- Pebbles
- Terrestrial plants (such as clippings from house plants)
- Water sprayer

Making an Aquatic Ecosystem

- Fill your container with about 3 cm of soil, then cover the soil with a fine layer of sand.
- Trickle water slowly into the container, making sure it does not disturb the sand and soil. Fill almost to the top, then allow the water to remain stagnant for 48 hours for dechlorination (unless you have used filtered water without chlorine).
- Add your aquatic plants, carefully pressing them into the soil using a fork or other long utensil.
- Add the duckweed, snails and fish, gently placing them into the water

- .Place the container near a reliable light source. If you do not have access to a strong source of natural light, position a 100-watt light bulb overhead, low enough that it will provide continuous light but high enough that it will not heat the water. The best height will vary given the size and shape up your container, so experiment to find the right position.
- Close the container with a temporary seal until you can observe your ecosystem over several weeks to ensure that it is functioning properly. If the system does not remain healthy, you may need to manipulate the light source or alter the number of fish or plants. If materials appear to be cycling efficiently after several weeks, seal the container permanently with silicone seal or duct tape.

Making a Terrestrial Ecosystem

- Line the bottom of your container with pebbles, then add a layer of soil until the container is filled to one-third of its depth.
- Insert your plants into the soil, covering the roots and gently tamping around the base to hold them in place.
- Spray the plants with water until the contents of the container are covered with a fine mist.
- Place the container near a reliable light source.
- Close the container with a temporary seal until you can observe your ecosystem over several weeks to ensure that it is functioning properly. If the plants begin to wilt, you may need to add more water. If the plants start to mold or look water-logged, you may need to remove water or improve your light source. If materials appear to be cycling efficiently after several weeks, seal the container permanently with silicone seal or duct tape.

Monitor the ecosystem over time..Use your understanding of the interactions and requirements of living things to explain why the living things within the ecosystem are sustained; that is, they remain alive and reproduce over time. It is likely that if the ecosystem is not sustainable, something essential for survival is not present.

Oh Caribou! (Adapted from Project Wild)

Background: a variety of factors affect the survival of organisms over time. Fundamental to this survival is food, water, shelter and space. Without these essential components, animals cannot survive. If these components are available, then animals are able to reproduce and their numbers will increase. The population size will not remain the same. That is, it will not remain **static**. The following game allows you to see that environmental factors can affect wildlife and their numbers.

1. You are going to participate in an activity that emphasizes the most essential things that animals need for survival. Food, water, space and shelter are all important and in this activity we will gain an understanding of how they are important for survival.
2. Count the class off in fours.
3. Move the desks from the middle of the classroom or go to a room that provides space for movement.
4. All the ones become **caribou**, the twos, threes and fours will become **food**, **water** and **shelter. It will be there choice what they become.**
5. Draw two lines with tape on the floor, as far away from each other as possible.
6. All caribou line up behind one line with **their backs to the needs. Each round of the game** they will be looking for one of these things for survival.
7. The needs line up on the other line, their backs also to the caribou.
8. The first round begins by (1) each caribou deciding what need it will look for. If food, it should clamp it hands over stomach; if water, place hands over mouth; if space, arms are extended; and if shelter, place hands over head; (2) each of the members of two, three and four represents the need it chooses to represent in the same way as (1).
9. On the count of “one, two, three”, turn to face each other.
10. On the sound of “go’, the caribou run to the need they require. If they find it, they return it to their side. This represents it met its need and has reproduced. If it fails to find its requirement, it dies.
11. At the end of this first round, record the number of caribou that remain.
12. Repeat another round allowing for both caribou (group one) and requirements (group 2, 3 and 4) to change their need.
13. Continue for 15 rounds, recording on the board the caribou population size.
14. When finished, discuss the questions that follow.

Questions:

1. Draw a graph to show how the caribou population changes over time.
2. Describe the changes in the caribou population that are shown in the graph.
3. Why do these changes occur?

4. In this game we have seen how shelter, food, water and space can affect a caribou population. What affect might humans have on caribou? Read the following story that gives an account of the changes in the Fortymile Caribou herd over the past century.

The Fortymile Caribou Herd: The history of the Fortymile caribou herd is a testimony to the effects of misuse and mismanagement. Prior to the gold rush the herd's population numbered in the hundreds of thousands. The caribou covered a huge area extending from Fairbanks Alaska to Whitehorse Yukon.

When I was a boy, they tell me how to hunt. Oh we got caribou, millions of them around here . . . they stop the riverboat going up the river them days. Come down the other side of the hill. Millions going through, we just kill enough for keep us through the winter. In the fall, somewhere in November, they go across with the ice . . . They come, then we shoot them off. Kill some caribou, we make cache on top the island . . . Around November when the river freeze up, we look for our cache, we find it on scaffold. Leave the hair and everything alone. And very nice, just like fresh caribou when we start to peel them off, skin.

– Archie Roberts, 1993

. . . my dad say when they were kids they used to make a corral with wood, big place, and . . . they used to chase caribou into that. That's how they used to get their meat too, with bow and arrow, no gun.

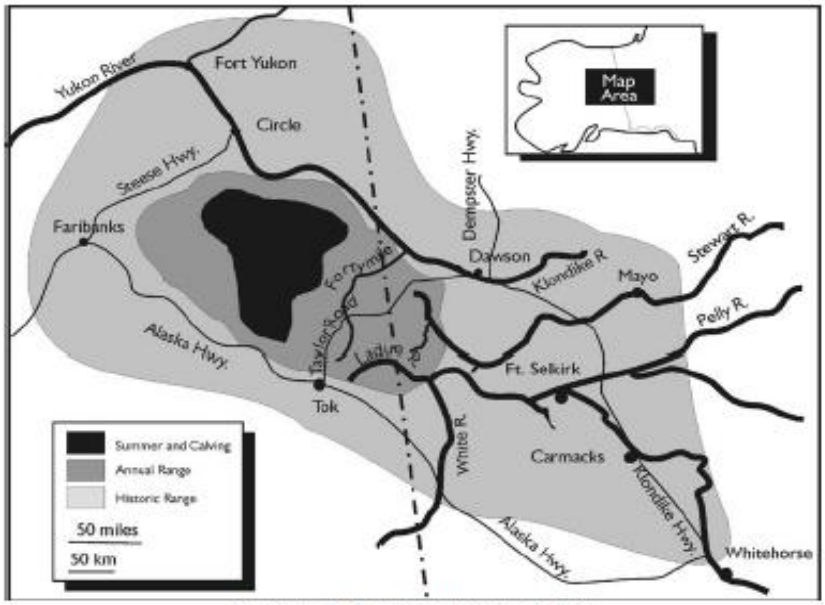
– Emma Kay, 1999

We used to have a lot of caribou up on the summit, each family or friends get together and go back there every summer. It used to be a whole pile of caribou going through there and they'd get as much as they could and now you can't do that and there is no hardly no caribou.

– Angela Harper (Malcolm), 1999

Caribou crossing Yukon River.
Parks Canada/Townsend Coll., 31/037, 394.

Since then the population has fluctuated between hundreds and thousands to near extinction. The herd has many natural predators. Wolves, grizzly and black bear and wolverine have always been natural predators. It is estimated that of every 8,000 calves born in one year, 5,000 are killed by predators, mostly golden eagles, grizzly bear and wolves and this occurs mainly in the summer. Other predators include wolverine and even small living things like mosquitoes and bacteria and viruses that cause disease. Once calves reach 6 months of age, they are unlikely to be killed by predators or disease.



Historic range of the Forty Mile Caribou Herd.
From: U. S. Government, *Fortymile Caribou Herd Management Plan*, October 1995.

Other environmental factors can cause caribou death. Especially important is weather conditions, especially weather events such as unseasonably high snowfalls or ice rain. Anything that limits caribou food supply can be a factor influencing survival. As well, if the summer season is dry, forest fires can be harmful to caribou numbers. Even though predation and weather affected the Fortymile herd, the numbers remained in balance.

This all changed with the coming of the goldrush in the late 1800s. The most significant impact on the caribou has been human. The coming of the gold rush brought pressure on the caribou. The Klondike area gave miners access to the caribou and the harvest of caribou was high. The caribou was the only source of fresh meat for the miners and mining camps. Market hunters slaughtered caribou in great numbers for the miners.

As highways started to be built in the mid-1900s, hunters had easier access to caribou and this again reduced the number of caribou.

In the early 1970s, the Forthmile herd had dropped to under 10,000 from an earlier count of over 500,000. Controls were put on caribou hunting and sterilization of wolves was introduced to reduce the pressure on caribou harvest. As well, the calving ground of the Herd was protected from industrial development.

Today, with increased knowledge and public support, we are witnessing the comeback of a magnificent caribou herd.

Audio CBC archive on Forty Mile Herd http://www.cbc.ca/archives/categories/environment/endangered-species/endangered-species-in-canada/caribou-comeback.html

In the space below, identify all of the factors that influence caribou populations. Note some of these factors are non-living (abiotic factors) and some of these are living (biotic) factors. For example a severe snow storm is considered an abiotic factor.

Biotic Factors		Abiotic Factors

Find Out:

Both scientists from Yukon Government and members of Tr'ondëk Hwëch'in community of Dawson City have played a major part in the recovery of the Forty Mile Herd. Find out how community members have been involved and what decisions they have made that have helped in the recovery in the herd. Some of these decisions have been controversial. Find out why.

> *. . . they moved to another place to spend the fall. By that time it's freezing, so they freeze meat for sale. At the time Dawson buy meat by the ton. After that, they bring the meat in and sell it. That's how things go in them days. After they bring the meat in and sell it, they buy what they need and buy some grub.*
>
> – Annie Henry, 1990
>
> *We have abused both the herd and the land. The land is waiting for an apology. Until then, the herd will not be productive and give itself to people.*
>
> – Alex Van Bibber, in *Fortymile Caribou Herd Management Plan*, 1995

The health of an ecosystem is determined by the strength of these interactions

Starting Activity:

As a class, sit in a circle. You are going to all be members of one ecosystem. Choose one of the ecosystems studies earlier (forest, pond, tundra). Then, each person chooses one biotic or abiotic factor from that ecosystem. For example, one person might be a beaver in the pond ecosystem and another person might be water. The game begins when each person has a 'part' to play in the ecosystem.

Take a large ball of string and hand it too one person. That person identifies themselves (for example, beaver). Then the ball of string is passed to someone **who depends on that part or supports that part.** For example, the ball might get passed on to water or grass or a bear. Continue to pass the ball of string around until each part is connected.

Discuss the importance of these connections in the ecosystem.

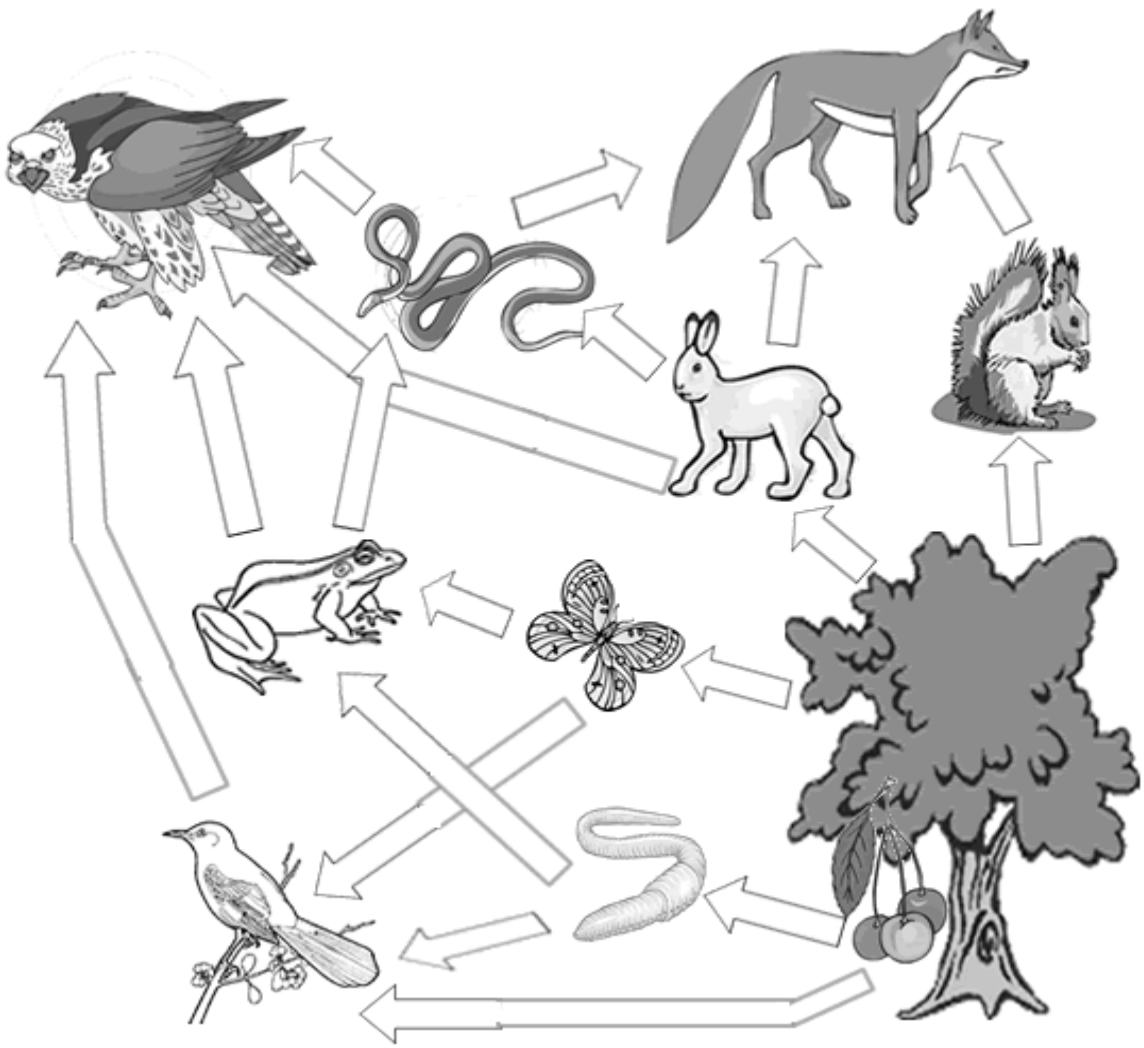
What happens if one part of the ecosystem is removed? Demonstrate this by removing this part of the ecosystem.

Each organism within an environment has a role (niche, producer, consumer, decomposer, predator, prey)

Food Web

Look the food web below:

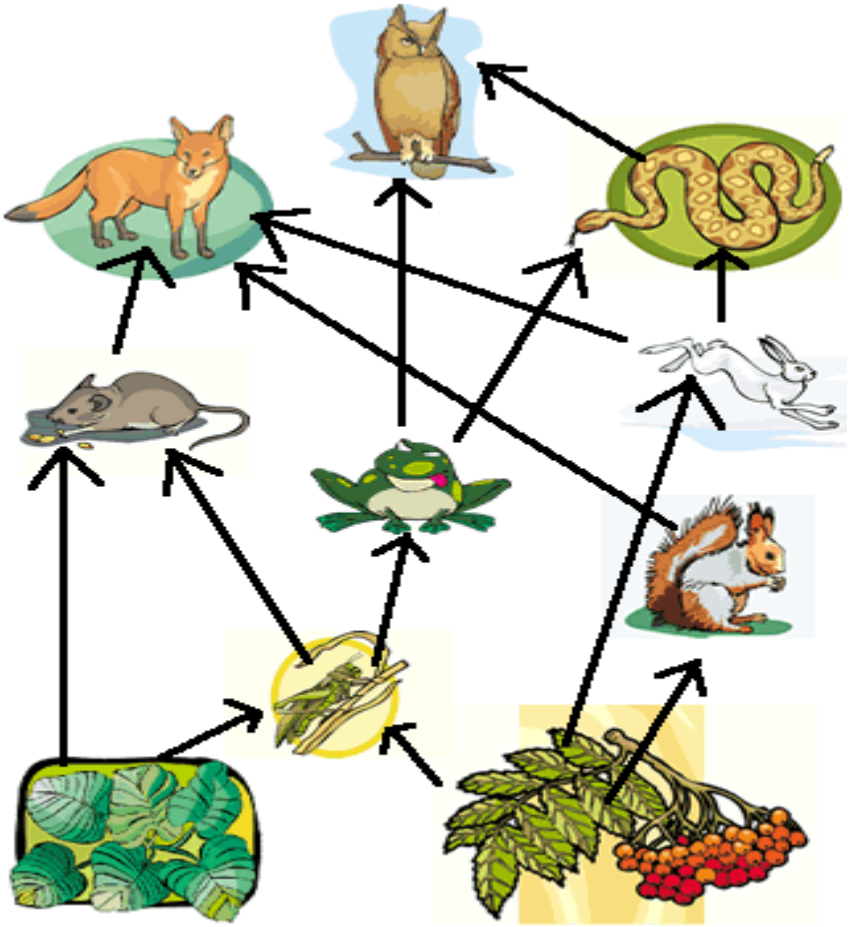
1. Beside each picture provide the common name for the organism;
2. Use the words below label each organism: (Some may have more than one label) P = producer | 1 = Primary Consumer | 2= Secondary Consumer | 3 = Third Order (Tertiary) Consumer | | 4 Forth Order (Quartenary) Consumer
3. Now label each animal as either a : H = herbivore C = carnivore O = omnivore



Food Web II

In the picture below identify:

1. Producers
2. Primary Consumers
3. Secondary Consumers
4. Tertiary Consumers
5. Herbivores
6. Carnivores
7. Omnivores
8. What elements are missing from this food web?



As a class, list the living things that live in the wild around the Dawson area within a forest ecosystem. Draw a food web below to show their interaction. Ensure the arrows are pointed in the direction the food energy goes.

Food Chain Chambers

Night Creatures of the Kalahari
NOVAactivity

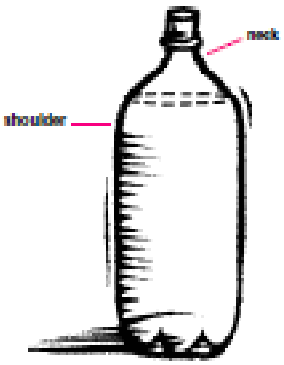
Materials for four chambers

- 8 two-liter soda bottles
- 4 soda bottle caps
- utility knife
- hammer
- nail
- permanent marker
- 3 spiders
- 4 twigs
- banana slices

Directions for One Chamber

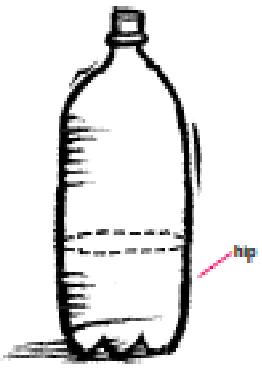
1 Remove the labels from the bottles.

2 Cut bottle #1 between the shoulder and the neck—about 2.5 cm (1 in.) above the shoulder. Remove the top part.



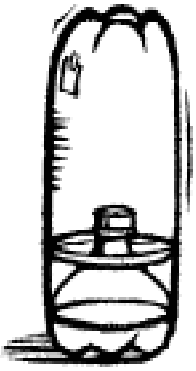
3 Unscrew the cap from the top of bottle that you just cut. Punch a hole in the cap using a hammer and nail. The hole should be about 2 cm (a little less than 1 in.) in diameter. Screw the cap back on.

4 Cut the second bottle 2.5 cm (1 in.) above the hip.



5 Fit the top of bottle #1—cap pointing up—into the bottom of bottle #2. This will be the fruit fly chamber.

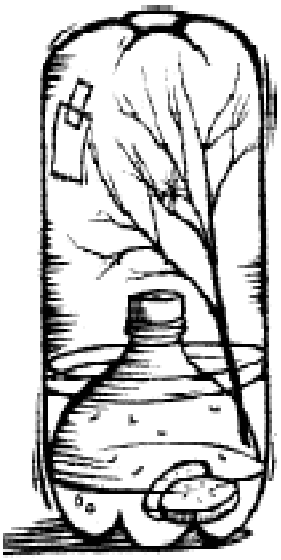
6 Invert the remainder of bottle #1 over the fruit fly area, and fit it into the base. This is the spider area. Slice a little trap door into which you can place a spider (and then tape it closed).



Make a total of four chambers.

Vary the four chambers as follows:

- Chamber 1, the control chamber, includes a spider, fruit, and access for fruit flies to enter (two small holes cut into the feet of bottle #2).
- Chamber 2 contains a spider and access for fruit flies, but no fruit.
- Chamber 3 contains a spider and fruit but no access for fruit flies.
- Chamber 4 contains fruit and access for fruit flies, but no spider.



Control Chamber 1

Scientists have a variety of terms to describe and represent these relationships, food chains, food webs, commensalism, parasitism, mutualism, predation)

1. Introducing vocabulary terms related to ecological interactions

You will watch a series of videos and identify and discuss examples of ecological relationships in the ocean ecosystem. These include: *competition, predation, symbiosis, mutualism, commensalism,* and *parasitism*. Identify the root words and brainstorm what types of ecological relationships the terms describe. Then, review the definitions of the terms.

- **competition**—when two or more organisms rely on the same environmental resource
- **predation**—behaviour of one animal feeding on another
- **symbiosis**—the close relationship of two dissimilar organisms
- **mutualism**—a symbiotic relationship where both organisms benefit
- **commensalism**—a symbiotic relationship where one organism benefits and one does not benefit but is unharmed
- **parasitism**—a symbiotic relationship where one organism benefits and one is harmed

2. National Geographic Crittercam

Watch footage from a National Geographic project called Crittercam. Crittercam's goal is to help researchers understand the day-to-day lives and ecological relationships of different species. Scientists fit wild animals with a GPS tracker and a combination video and audio recorder with environmental data instruments to measure such things as depth, temperature, and acceleration—which allow the study of animal behaviour without interference by human observers.

http://education.nationalgeographic.com/education/activity/ecological-relationships/?ar_a=1

Watch the National Geographic video "Fish Thieves Take Rare Seals' Prey" (3.5 minutes), in which an endangered Hawaiian monk seal preys upon and competes for fish and invertebrates on the seafloor at 80 meters (262 feet) deep.

What is the ecological relationship between the monk seal and the octopus/eel/trigger fish?

What is the ecological relationship between the monk seal and the jacks/sharks?

4. Watch videos to identify symbiotic relationships.
You are going to watch three videos of different marine species interactions. After each video, identify and discuss the symbiotic relationships they observed.

- "Caribbean Cleaners" (2.5 minutes)—mutualism

http://education.nationalgeographic.com/education/activity/ecological-relationships/?ar_a=1

- "Giving Fish a Bath" (5.5 minutes)—parasitism

http://education.nationalgeographic.com/education/activity/ecological-relationships/?ar_a=1

- "Clownfish and Sea Anemone Partnership" (1.5 minutes)—mutualism

http://education.nationalgeographic.com/education/activity/ecological-relationships/?ar_a=1

Further Relationships:

Watch the following videos. Describe and identify the types of relationships shown in each.

Relationships: http://www.youtube.com/watch?v=zSmL2F1t81Q

Animal Partnerships: http://www.youtube.com/watch?v=Qqa0OPbdvjw

Predator Prey Africa: http://www.youtube.com/watch?v=GFTBFDPfMh8

Predator Prey Oceans: http://www.youtube.com/watch?v=o7UehqroFtY

There is a close relationship amongst organisms in an ecosystem. Changes to one thing can cause changes to another.

HOW MANY BEARS CAN LIVE IN THIS FOREST?

Introduction: The purpose of this activity is to understand the parts of an animal's habitat and the factors that limit an animal's population in this habitat. In this activity you become a 'bear' to find out more about their needs for survival and how changes in one condition can affect bears.

Start by looking at these video links.

Grizzly Bear Predator: http://www.youtube.com/watch?v=aBBmdays-c4

Monitoring Black Bears: http://www.youtube.com/watch?v=gak-dhhUh4Y

Monitoring Polar Bears: http://www.youtube.com/watch?v=VFybPFix1ys

Black Bear Feeding: http://www.youtube.com/watch?v=g3vUCGGjYBo

Black Bear Feeding: http://www.youtube.com/watch?v=ZJjR4N2dPpk

What is the main feeding difference between polar bears and black bears?

Materials & Procedure

- 6 colors of construction paper (red, yellow, green, purple, blue and brown) cut into 2" x 2" squares. You need a handful of each color.
- Paper bags, 1 per student
- 4 blindfolds

1. The pieces of paper represent various kinds of bear food. Since black bears are omnivores and like a wide assortment of food, students should gather different colored squares to represent a variety of food.

2. Each student will get a paper bag. This will represent the student's "cache". Have them hide it nearby.

3. In a fairly large open area (e.g., classroom) scatter the colored pieces of paper. This is the "forest"

4. Have the students gather in a large circle and organize them into teams of 6. Give them the following instructions:

“You are now all bears. All bears are not alike, just as you and I are not exactly alike. Among your team is is a young male bear that has not yet found his own territory. Last week he met up with a larger male bear and before he could get away, he was hurt. He has a broken leg. (Assign one student as the injured ear. He must hunt while hopping on one leg. Place a blindfold on his leg as a reminder.). Another bear is a young female who investigated a porcupine too closely and was blinded by the quills. (Assign one student as the blind raccoon. She must hunt blindfolded). The third special bear is a mother bear with two fairly small cubs. She must gather twice as much food as the other raccoons. (Assign one student as the mother cubs, and two students as her young. The young follow by holding onto blindfolds held by mother bear.
Young cannot gather food; only mother!!)” . The final bear is a normal bear and feeds normally.

5. Students must walk into the “forest” and gather their food. When students find a colored square, they should pick it up (one at a time) and take it to their “cache” (bag) before picking up another colored square. Students may steal from each other but don’t announce this.

6. When all the colored squares have been picked up, the food gathering is over. Have students pick up their bags containing the food they gathered and return to their group.

7. Explain what the colors represent. Each color is a kind of food.

The color of the card determines the type of food it represents. Each type of food is listed below as well as **how much is needed every 10 days**:

BROWN – nuts (acorns, walnuts, hickory nuts) (25% of diet) (10 kg required)
PURPLE - berries and fruit (wild strawberries and grapes) (15% of diet) (6 kg)
YELLOW – insects (grub worms, larvae, ants, termites) (15% of diet) (6 kg)
RED – meat (rodents, amphibians, reptiles, birds) (20% of diet) (8 kg)
GREEN – plants (leaves, grasses, herbs) (20% of diet) (8 kg)
BLUE – water

Ask each student to count each color of food he or she gathered – whether it is nuts, meat, insects, berries or plant materials. Without being obvious, try to find out the lowest and highest numbers and assign a # number for each color; remember to have higher #s for brown, purple, and green. Each bear should have at least 2 blue squares representing a water source. Complete the chart below. **Each piece of paper is a kg.**

Type of Food	Number of Cards	Amount in Food
Nuts		
Berries		
Insects		
Meat		
Plants		
Water		

8. Complete the chart below to **compare** how much food the bears collected:

Bear	Total Amount of Food Gathered	Amount of Food Needed	Did this bear get enough food?
Normal			
Blind			
Mother			
Injured			

Did the normal bear get enough kg of food? Ask the blind bear how much food she got. Ask the injured bear and the mother bear how much they got. With 2 young, shouldn't the mother have to get double the food? Ask each of the other students to tell how much food they found. Which bears survived? Was there enough to feed all the bears?

9. A habitat can only hold a given number of individual species; this is called its **carrying capacity**. Bad weather and other environmental conditions may result in the lack of available and shelter. Something which affects the survival of an animal or population of animals is called a limiting factor.

10. What do you think is the carrying capacity for this "forest"? What were the limiting factors affecting bear survival?

The Lynx Hare Complex

Introduction

This activity demonstrates interspecific interaction between a predator population and that of its primary prey. The lynx is a carnivore and its primary diet in the north is the rabbit. This is evident because of how the population size of the two is so closely related.

Materials (for each group)

Flat surface, at least two feet square
Colored tape or masking tape
100 small flat discs (100 – one cm paper squares (snowshoe hares), 1 large disc (three-cm cardboard square) (Canadian lynx), Graph paper, Population data table (see last page).

Preparation

1. Use tape to mark off a square, 40 cm x 40 cm, on a tabletop or other flat surface. The square represents the area inhabited by a population of snowshoe hares.
2. Cut out and decorate with appropriate images, 100 one-inch paper hares and a three-inch cardboard lynx (these numbers are for each group conducting the simulation). A paper cutter is an indispensable asset at this stage.
3. Prepare a data table to record the population tallies by following the example below. Allow enough space for 20 to 25 generations. (see last page)

Procedure

4. Begin the simulation by populating the habitat with three hares—spatially dispersed within the square.

5. Toss the cardboard lynx into the square in an effort to capture (i.e., land on any portion of) as many hares as possible. In order to survive and reproduce, the lynx must capture at least three hares when tossed. With the hare population at this stage, lynx survival is virtually impossible. Remove any hares captured and enter the tallies for the first generation.

6. The hare population doubles between generations—multiply "Hares Remaining" by two and enter the resulting number in the "Number of Hares" column for the second generation. Place the required number of hares in the square. If no lynx survived the previous generation another moves into the area. Toss the newly recruited lynx—repeating step 2. Remove any captured hares and enter the new tallies.

7. By generation 5, the lynx should be able to capture three hares when tossed. If successful, the lynx survives until the next generation and produces offspring—(one per each three hares captured.) Toss the lynx square once for each lynx.

8. As the population builds, it is important to separately tally each lynx's kills, removing captured hares after each lynx is tossed. Determine lynx survival and reproduction using individual lynx capture numbers. Remember, lynx produce one offspring for each three hares captured. If a lynx captures seven hares, three lynx enter the next generation—the original lynx and two offspring. Individual lynx capture numbers should be tallied on a separate sheet of paper and only totals entered in the table.

9. Between generations 9 and 11, the populations will probably crash back to, or near, zero. If and when this happens, be sure to begin subsequent generations with at least three hares. Carry the simulation through 18–20 generations, by which time the cycle will be well on its way to repeating and the next few generations can be (relatively accurately) predicted.

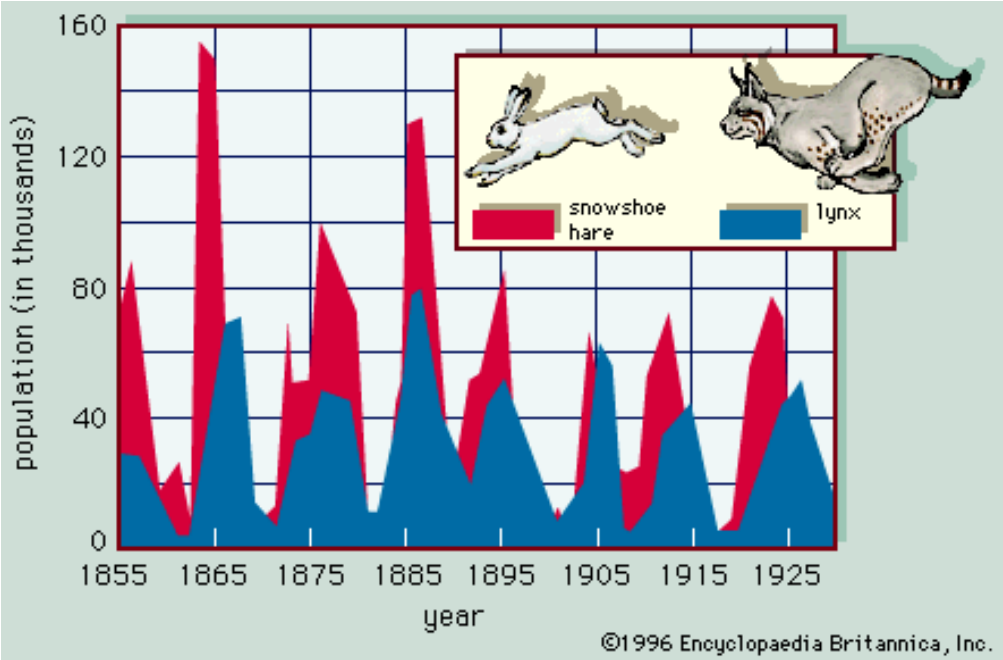
Discussion

1. The data is best analyzed graphically. For each animal, make a plot of population totals (the first two columns) versus generation number. By plotting the hare population and the lynx population side by side on the same graph, the relationship between the two becomes abundantly clear.

2. Clearly indicate on your graph where exponential (rapid) growth occurs. Also, indicate where the lag-time affect occurs between the two populations. Explain why this affect exists

3. To understand how the population of lynx and hares changes year to year, we need to collect information about the number of individuals in a population. Unfortunately, it is impossible to count the exact number of hares in Canada in any given year. Therefore, this information must be

gained by capturing a small number of individuals and then estimating the actual number out in the wild. For over 300 years, the Hudson Bay Company has been involved in the fur trade in Canada. Detailed company records list the number of snowshoe hare pelts and the number of lynx pelts collected by hunters and trappers every year since the late 1700's.



4. On a separate graph, use one color of pencil to graph the number of hares trapped each year between 1900 and 1920. Using another color, graph the number of lynx trapped on the same graph.

   i. What patterns do you notice? Describe at least 3 patterns.

   ii. On your graph, **label** the periods of hardship for both the hare and lynx with arrows and a short description of what is happening that would cause this decline in population sizes. Be sure to include what might be occurring with their respective food sources (primarily grass for hare).

   iii. On your graph, **label** the periods of prosperity for both hare and lynx with arrows and a short description of what is happening that would cause this increase in population sizes. Be sure to include what might be occurring with their respective food sources.

   iv. In general, are there more lynx or more hares? Why?

   v. Look at 1903 and 1904. Think about what is happening to the hares at this time. Is the presence of more lynx helping the hares or hurting them? Why?

5. You should keep in mind that, as in any simulation (even sophisticated computer models), certain assumptions are made and many variables overlooked. Natural populations are subject to myriad pressures and disturbances such as immigration, emigration, overgrazing, disease, floods, droughts, fires, and extreme cold spells—to name a few. Many of these factors compound each other. Where would you expect to see the greatest impact on either population if an extremely contagious disease were to attack the populations? What about a fire or natural disaster? Explain your answers.

6. As you can see from the above data table, humans also play a role in this intricate balance between predator and prey. How do humans affect the dynamic and how could we minimize that impact to insure stable populations and still satisfy our need for furs? In short, how would you suggest to sustainably manage these two populations?

References

Flinn Scientific, *BioFax: The Lynx Eats the Hare*, Publication # 10109, Flinn Scientific Inc. 2005

Green, N. P. O.; Stout, G. W.; Taylor, D. J.; Soper, R. *Biological Science 1: Organisms, Energy, and the Environment,* 2nd ed.; Cambridge University Press, Cambridge, 1990.

Purves, W. K.; Orians, G. H.; Heller, H. C. *Life: The Science of Biology,* 3rd ed.; Sinauer Associates, Sunderland, MA, 1992.

Acknowledgment

Adapted from the Woodrow Wilson National Fellowship Foundation Biology Team 1/2 1994 binder.

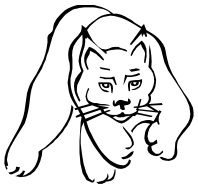
Adapted from Flinn Scientific BioFax: The Lynx Eats the Hare, Publication # 10109 (Free Biology Activities)

Generation	Number of Hares	Number of Lynx	Hares Eaten (Total)	Hares Remaining	Lynx Starved	Lynx Surviving	Lynx Offspring
1	3	1					
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

Survival Game

The survival game is intended as an active and experiential way for students to develop an understanding of the interrelationship of animals, natural elements and humans.

Each student takes on the role of an animal that may be found in the Yukon region. As that animal the student must find food, water and a mate while avoiding predators and dangerous elements such as pollution and disease. Humans play a mixed role in this game arbitrarily helping and hindering animals.



1) Review vocabulary and key concepts that will be highlighted in the game.

   a) Food chains b) Carnivore c) Omnivore
   d) Consumer/Producer e) Predator/Prey f) Herbivore
   g) Habitat h) Ecosystem

2) Assign or have students choose the animals they will role-play during the game.
   Use the chart below when dividing the class in various roles.

Students	Carnivores	Omnivores	Lg. Herbivores	Small Herbivores
18-22	2	4	4	6-10
23-26	2	6	4	10-12
27-32	4	6	8	12-14
33-38	4	6	8	12-18
40-50	4-6	8-10	8-10	Half

Below is a list of possible species for each category. If you wish to

Carnivores	Omnivores	Lg. Herbivores	Small Herbivores	
Timber Wolf	Skunk	White-tailed Deer	Snowshoe Hare	Cottontail Rabbit
Lynx	Fox	Moose	Beaver	Groundhog
Grizzly Bear	Black Bear	Porcupine	Chipmunk	Meadow Vole
Wolverine		Elk	Ruffed Grouse	Mallard
Eagle		Caribou	Deer Mouse	Muskrat
Coyote			Ptarmigan	Squirrel
Cougar				

To include mating in the game there must be one pair per species.

Survival Game

1. To survive, each animal must end the game with enough food, water and at least one life left.
2. Food and Water:
    a. Vegetable food, represented by signs on trees that look like berries, leaves or nuts. To record this food the 'animals' must use the punch to make a unique mark on their food/water card.
        i. Each food punch must come from a different station
    b. Meat food, represented by the life rings of tagged animals. To catch another animal as food requires a single hand tag. Both animals are on time out while the life ring is exchanged. Both animals have a free 10-second get-a-way after the exchange. No immediate tag-backs, the meat eater must catch another animal before tagging the same one again.
    c. Water, represented by signs on the trees that look like a large water drop. Same rules as vegetable food.
3. Survival Requirements
    a. Carnivores need: 10 meat food rings and 3 water punches
    b. Omnivores need: 8 food units, any combination of meat rings and vegetable punches and 4 water punches.
    c. Large Herbivores need: 5 food punches and 4 water punches.
    d. Small Herbivores need: 4 food punches and 3 water punches.
4. Identification
    a. Each animal type has a different armband.
    b. Armbands must be visible from the front and back.
    c. No tying around neck.
5. Food Chain
    a. Carnivores can eat any animal but another carnivore.
    b. Omnivores can eat only **small** herbivores and vegetable food.
    c. Small and Large Herbivores can eat only food punches.
    d. No animal can eat elements, disease, humans, Mac Trucks, etc.
    e. Animals cannot use any special defenses (e.g. quills, scent, flight, tree climbing)
    f. Animals punching cards at water and vegetable food stations are **not** on time out and may be caught, just like real life.
6. Elements
    a. Represented by coloured rings (the actual colour varies depending on supplies).

   b. When caught/called by an element the animal is on time out until the ring is on.
   c. Elements cause stress on an animal and will weaken it, the ultimate result to be revealed at the end.
   d. Examples of elements are: loss of habitat, pollution, fire, flood, drought, and deep snow.
7. Disease
   a. Represented by coloured rings (the actual colour varies depending on supplies).
   b. When caught/called by disease the animal is on time out until the ring is on.
   c. Diseases cause stress on an animal and will weaken it, the ultimate result to be revealed at the end.
   d. Examples of diseases are: west Nile, ticks, rabies, cancer, arthritis, worms, and pneumonia.
   e. Some people use the rule that an animal that eats another animal with a disease, takes that disease on. However, I find that the herbivores use the disease as a defense to ward off carnivores or omnivores and I don't use that rule. Your choice.
8. Spare lives
   a. Represented by coloured rings (the actual colour varies depending on supplies).
   b. When called by the life giver the animal is on time out until the ring is on.
   c. Yellow rings may be used as spare lives, or food for carnivores and omnivores, but not both at once.
   d. Examples of good things that happen to animals that extend their lives are: creation of protected areas, removal of pollution, good weather, and first-aid by humans, breeding programs.
9. Adults can also cure disease. Humans do this by spreading vaccinated bait to animals (e.g. to reduce the spread of raccoon rabies into Ontario)
   a. Any adult can call an 'animal' over and give him/her a spare life.
   b. This can be done to reward and encourage students who are behaving like animals.
10. Poaching
   a. Although hunters kill individual animals, if they follow the law they do not have a negative impact on animal populations. However, if hunters break the rules by hunting too many animals, the wrong kind of animal or at the wrong time of year hunting can have a very negative impact on animal populations. This is called poaching.
   b. The poacher can call/catch an animal and take a life. The same time out rules apply as for animals taking lives from other animals.
11. Mac Truck

a. You may choose to have counsellors patrol the boarders of the survival game. Should any campers be caught outside the boarders they have been 'hit by a Mac Truck' and a life is taken away. Usual rules.

12. Premature endings
    a. Should an animal loose all of his/her lives well before the end of the game, the staff member at the beginning place has the option of handing out more lives.
    b. Animals that meet all their survival requirements well before the end of the game may be equipped as another animal and begin again, or just hide and survive.
13. Safety rules
    a. Never, ever, ever cross the orange boundary rope.
    b. Do not climb trees.
    c. Yellow rope marks poison ivy.
    d. If you get hurt or lost, stay where you are and shout. Do not try to find your own way back to camp. If you are not present at the end of the game, a search will be run.
    e. When the game end signal is sounded, return immediately to the beginning place.
    f. Some staff member will be at the game beginning at all times to provide first aid. This staff member should have plenty of extra cards, rings and armbands ready for animals that loose theirs.
    g. Take it easy, this is a game and it would be a shame for someone to miss out on the rest of camp because of a twisted ankle or other injury. Staff should be generous with extra lives for animals that stopped running because they felt unsafe.
14. The End
    a. Sound the ending signal.
    b. Wait until you count all the campers present.
    c. Have the animals with enough food and water and at least one life or spare life left raise their hands.
    d. These animals should add up how many black and green rings they have all together. A score of three or more is too much stress and they are dead. The remaining animals survived.

Instincts for Survival

What animal will you be for the game? _____

Describe what you look like include colour, markings, shape, size and fur.

_____
_____
_____
_____
_____

Draw your animal here.

Where would you go for shelter?

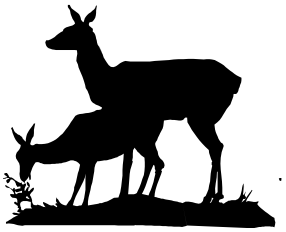
_____
_____

What type of food do you eat? List some examples.

_____
_____
_____

What animals hunt you?

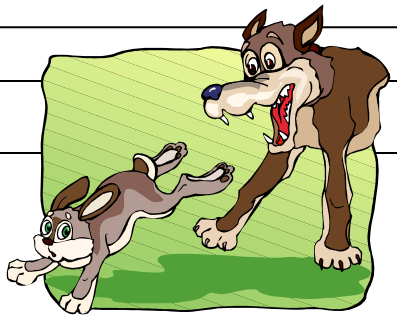
_____
_____
_____
_____



How do you protect yourself from danger?

_____
_____
_____
_____
_____

Survival Success



I in the chart and calculate your score:

Number of your own lives left	
Add number of water punches	
Add number of food punches	
Add number of animals you killed	
Add 2 points for mating	
Subtract 2 points for each element	
Subtract 2 points for each disease	
Total =	

Best possible for Small Herbivore = 13 (11)
Best possible for Large Herbivore = 14 (12)
Best possible for Omnivore = 17 (15)
Best possible for Carnivore = 17 (15)

() Indicates best score without mating station

Survival Status

Dead	Very poor	Struggling	Strong	Outstanding
No lives or No water or No food or Greater than 2 elements/disease	Less than ¼ of your lives or Very little water or Very little food or 2 elements/disease	Less than ½ of your lives Missing one water Missing one food One element/disease No mate	More than ½ of your lives Enough water Enough food No element/disease Mated	More than ¾ of your lives Extra water Extra food No element/disease Mated

What would you do differently to bring your score closer to the best possible?

List two mistakes and two successful strategies you used.

What were some of your feelings as you played the game?

Describe three ways playing the game is different from really surviving as an animal.

Bioaccumulation in the Food Chain

Concerns about pollution: *An adaptation of a conversation with Tommy Taylor of Dawson City*

There have been stories for a long time from elders that if things such as poisons or toxins are dumped into the water then it will come back to be in the food we eat. We were told that as a child (in the 1930s). If We were filling a petrol tank we were told not to it near water. If you had to dump sewage, you dumped it a long way from the water and put it in a hole and buried it. If you had a pail of soapy water you dumped it on land, not into the water.

When they started to drill for oil in the MacKenzie and Eagle Plains we were concerned. We said that the oil can't get into the water supply. We were concerned about oil spills. When they talked about the pipeline being built we were concerned about what would happen if there was a pipeline rupture. We knew this. When they built mines were concerned about the waste from the mine. At Viceroy near South Fork of the Klondike, they were using chemicals for leaching the gold and we were concerned if this was to get in the Klondike water supply.

Then in the 1980s we started to hear about these things. We started to hear that if things got in the water supply, they would get in the plants and then into the small fish and then in the salmon. The more that the salmon would eat, the more it would collect in them. It would get in their meat.

Same with caribou. Biologists said not to eat too many caribou because the nuclear explosions from Chernobyl would get in the air and then drop down onto the ground. It would then get in the lichens and then the more caribou ate lichen, the more bad waste it would have. It would all add up.

We knew all of this. You have to respect the land. We provide offerings for what we take. You don't give back to the land bad things.

Student Activity – Bio accumulation

Background:

Caribou are herbivores. By eating the plants, especially moss and lichens, they receive energy that was stored in the plants. This energy originally came from the sun. It was captured by the plants through the process of photosynthesis. Caribou are primary consumers in this food chain. They eat the producers to obtain energy. Eagles and wolves are secondary consumers because they eat the primary consumers. Eagles and hawks may also be called top carnivores, often attacking young wolves or scavenging wolves, as they are meat eaters and nothing "eats" them.

When pesticides or herbicides enter the food chain they sometimes have long reaching and unintentional effects. Some (such as contaminants from nuclear industries) do not decompose in nature. Thus, their effects can be cumulative as you move up the food chain. This is the process of biological magnification. A caribou may eat a non-lethal dose of a pesticide and then get eaten by a wolf. Because the chemical does not decompose it is stored in the caribou's body. An eagle may them eat a wolf. Every contaminated caribou that the wolf eats adds more pollution to its body. It is unknown the effects this pollution will have on the wolves or eagles but sterility, birth defects, or shortened life span are likely outcomes. Wolves eat several caribou. And it is likely an eagle might feed on several wolves, maybe as scavengers. Therefore, the chemicals accumulate greatly in their body tissue. This has been known to cause the thinning of egg shells and thus reduced ability to reproduce. Some birds may also be born with crossed bills drastically reducing their ability to feed and death is a likely result.

https://www.youtube.com/watch?v=TItHEUOXCeI

Materials:

- Small tokens, poker chips, dry beans, or candy* in at least three different colors (approximately 30 for each caribou).
- Some convenient way of telling the wolves and the eagles from grass-caribou. They could role play (caribou=have horns, wolves=show teeth, and hawks= “fly” with outstretched arms).
- Paper or plastic bags. One is needed for each caribou.

  *For candy, instead of three colors, use three kinds (Skittles, plain M&Ms, and peanut M&Ms and choose one as the pesticide).

Procedure:

1) For a class of 15 students, divide them into 12 caribou, 2 wolves, and 1 eagle. The exact numbers do not matter but the approximate ratio is important.

2) Explain the food chain to the students. Tell them that the tokens represent food. All animals must eat enough food to survive. Caribou "eat" the tokens by placing them in their bags. Wolves eat caribou by catching them and taking the caribou's collection of bags, the eagles eat the wolves by catching them and taking their bags.

3) Spread the food tokens around in an area about 25 meters square – a classroom will do. This activity can be done in a gym but is safer to do outside.

4) Send the caribou to feed. Let them feed until most of the food is collected (the last time you run this activity, let them feed until all food is collected, it helps in the cleanup).

5) Now release the wolves to feed on caribou for one minute.

6) Now release the eagles to feed on the eagles for one minute.

7) Have all surviving organisms count the number of food tokens that they have. Caribou need 20 tokens to survive, wolves need 50 and eagles need 100 (adjust these numbers as necessary).

8) Pick a color of token to represent pesticide molecules. Have the surviving organism count the number of these tokens they have ingested. Record these numbers (later in the classroom the students can average the amount of pesticide at each level and graph these averages. This will reinforce the concept of biological magnification).

	Caribou		**Wolves**		**Eagles**	
	Number Collected	Number for Survival	Number Collected	Number for Survival	Number Collected	Number for Survival
Game 1		20		50		100
Game 2						
Game 3						
Game 4						

9) If an eagle has eaten more than 25, it will die but if it has eaten more than 10 it will not be able to reproduce.

10) Change student roles and play again. In a one hour period you can play 2-3 rounds.

Questions for Answering;

1. Give 3 examples of other food chains involving humans in which pesticides may enter. Discuss the consequences of these pesticides entering these food chains. Look at the following websites for examples:

   Mercury biomagnification:

   https://www.youtube.com/watch?v=ihFkyPv1jtU

   https://www.youtube.com/watch?v=xRqAS4Eow-c

   DDT biomagnification: https://www.youtube.com/watch?v=-UiCSvQvVys

   https://www.youtube.com/watch?v=R7M02vNhzwE

   Thalidamide https://www.youtube.com/watch?v=41n3mDoVbvk

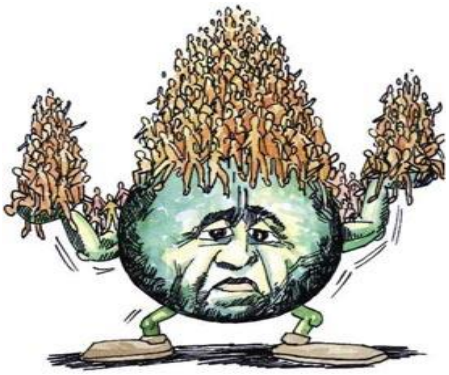
2. Who would have a greater concentration of mercury in their body- a person eating fish daily? A person who eats fish weekly? A person who eats fish only every now and then?
3. Why is it recommended that you eat salmon, sardines, and smelt, but not swordfish, shark, or pickerel?
4. Listen to the story about Rachel Carson and her efforts to influence practices that would see less DDT released into the ecosystem.

References:

Adapted from Project Wild for secondary students, Western Regional Environmental Education Council.

We have a variety of traditional and scientific ways we can monitor ecosystems

Estimating Population Size



Background

How do scientists know how many caribou are in the Forty Mile herd? A population is a local group of organisms of the same species that normally interbreed. The most fundamental task in population ecology is to determine or estimate population size. Although there have traditional ways of estimating numbers, scientific techniques have been developed which can provide much more accurate estimations.

One way to estimate the size of a population is the **Sampling Technique** described below. Another method to estimate the size of a population is to **Capture and Mark** individuals from the population, release them, and then resample to see what fraction of the individuals carry marks. Various techniques with accompanying mathematics are then used to approximate population size.

Objective

You will be expected to estimate the size of a sample population using the mark-recapture technique. Be able to apply the technique to new population problems and compare the mark and recapture technique to other methods of population estimating.

Materials

Paper, pencil, calculator, masking tape, brown-paper bag of “organisms” (for example, beans, beads, pasta, toys, pennies, etc.)

Technique 1: Sampling

A technique called sampling is sometimes used to estimate population size. In this procedure, the organisms in a few small areas are counted and projected to

the entire area. For instance, if a biologist counts 10 caribou living in a one square kilometre foot area, she could predict that there are 100 caribou living in a 10 square kilometer area.

Tasks

1. If you were in charge of a team given the responsibility to determine the number of caribou in the Fort Mile herd, discuss with your partner(s) how would you accomplish this task and describe in detail below.

2. A biologist collected 1 litre of pond water and counted 50 water insects in 1 L. Based on the sampling technique, how many insects could be found in the pond if the pond 20,000 litres.

3. What are some problems with this technique? What could affect its accuracy?

Technique 2 - Mark and Recapture

In this procedure, biologists use syringes fired from guns to capture the animals alive and then place a collar or tag on them. The animals are returned unharmed to their environment. Over a long time period, the animals from the population are continued to be captured or monitored and data is taken on how many are captured with tags. A mathematical formula is then used to estimate population size.

Procedure:

1. You will receive a bag that represents your population (examples: beans, pennies, chips, beads)
2. Capture 10 “animals” by removing them randomly from the bag.
3. Place a mark on them using tape or string
4. Return the 10 marked “animals” to the container
5. With your eyes closed, select 15 “animals” from the contain one at a time. This is the **recapture** step. Record the number of “animals” recaptured that have a mark on the data table.
6. Return the “animals” to the bag and repeat. Do 10 recaptures.
7. When the ten recaptures are completed, enter the total number captured on the data table
8. Also enter the total number of recaptured that have a mark

Data Table

Trial Number	Number Captured	Number Recaptured with Mark
1	15	
2	15	
3	15	
4	15	
5	15	
6	15	
7	15	
8	15	
9	15	
10	15	
Total:	150	

Questions and Calculations

In order to estimate your population size, follow this formula:

Estimate of Total Population = (total number captured) x (number marked) / (total number recaptured with mark)

1. What is the estimation of your population? (**Show** your calculations below)

   Estimated Size _____

2. Use the code name on your bag to check with the teacher about how many "animals" are really in your population.

   Name on Bag _____ Actual Size _____

3. Compare the actual size to the estimated size. Did you overestimate or underestimate?

Repeat the experiment and this time add 10 more data fields to the ten trials you already have.

4. Recalculate your estimate using the formula. (**Show** below)

5. What does this say about the number of trials that should be conducted in a real mark & recapture?

Trial Number	Number Captured	Number Recaptured with mark
11	15	
12	15	
13	15	
14	15	
15	15	
16	15	
17	15	
18	15	
19	15	
20	15	
Total:	300	(add original data + new data)

Given the following data, what would be the estimated size of a butterfly population in a local marsh.

6. A biologist originally marked 40 butterflies in the marsh. Over a month long period butterfly traps caught 200 butterflies. Of those 200, 80 were found to have tags. Based on this information, what is the estimated population size of the butterflies in the marsh?

7. In what situations would sampling work best for estimating population size, in what situations would mark & recapture work best. You'll probably have to think about this one. Justify your answer.

BBC and Interdependence:
http://www.bbc.co.uk/schools/scienceclips/ages/10_11/interdependence.shtml

Monitoring Caribou Numbers: *How we know the numbers of caribou. An adaptation of a story from Alfred Kendi of Fort McPherson*

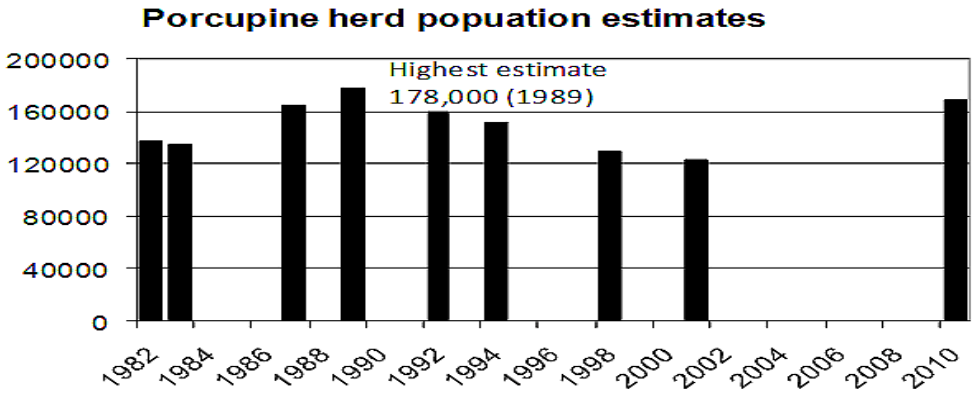
You could never predict what the hunting season was going to be like from year to year. Some people would say they knew the caribou would be travelling and how many there would be. This was usually young people, like me, but the elders would always tell us we could not be certain of those things.

The elders taught us not to speak too much. Not to be too talking and know everything. That was not a good thing. I notice now, looking back that the elders were rather quiet. You would ask them about something and they would always start by saying, “I don’t know that much about that, but I tell you what I know.” Then they would talk for an hour about it and you knew they *did* know lots but they kept it too themselves and shared that knowledge when necessary.

With the caribou I think the elders knew about all the things that affected the caribou. They knew the inter-relationships and they could make predications based on this.

If there was a bad ice storm in the fall, they knew that would not be good for caribou survival. Of if there was really deep snow. Both of these would make caribou weak and vulnerable to wolves.

If there was a really cold spring with blizzards when the calves were being born, you had an idea this would be bad for the herd.



If there was a really wet spring, there would be more mosquitoes and this would be bad, or if there was never a wind, this was bad.

In the winter if there were lots of wolves and wolf tracks, you knew the caribou would be low. All of things were signs of what the caribou [numbers] would be like. All of this together helped to make an idea.

But you couldn’t be sure. Today we have lots of ways to make better ideas and these are helpful. But you still have to know traditional ways.

STUDENT ACTIVITY SHEET

NATURAL MORTALITY

Find the words taken from the following paragraph.
Words can go horizontally, vertically and diagonally in all eight directions.

Golden eagles, wolves and grizzly bears are the most common predators of Porcupine Caribou calves. When caribou are abundant on the coastal plain (May and June), most wolves are probably confined to the mountains where they are denning. Wolves that were not involved with denning follow the caribou. Grizzly bears are quite common on the Porcupine calving grounds and at times appear to be gathered where calving activity is most concentrated. However studies have shown that golden eagles, particularly the non-nesting sub-adults, are the most important predator on the calving and post-calving grounds. Golden Eagles were involved in 50% of the total mortality either as the probable predator or as a predator / scavenger. While in order of importance, the major calving ground predators are eagles, grizzlies and wolves respectively, neither eagles nor grizzlies are likely to be very significant predators of adult caribou whereas wolves are.

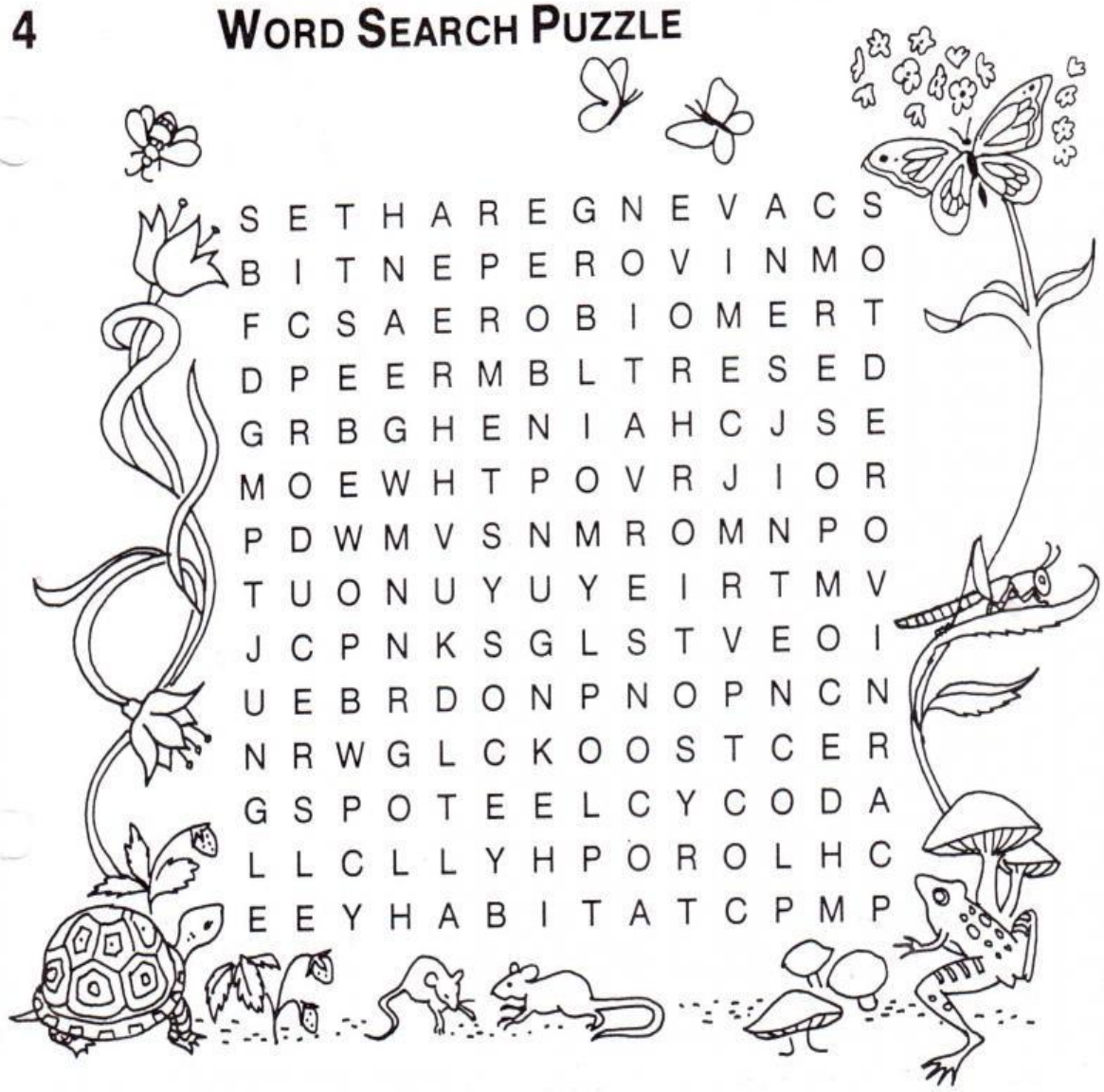
V	E	R	Y	N	D	P	T	S	E	L	G	A	E	W	R	K	R	I
N	B	D	I	B	K	N	D	N	S	N	I	A	T	N	U	O	M	M
Y	G	A	W	O	L	V	E	S	P	W	T	T	K	C	T	R	Y	P
G	L	F	M	K	W	D	R	R	R	M	N	J	N	H	L	R	K	O
P	X	E	C	J	L	M	E	G	O	S	A	W	E	X	B	L	F	R
S	H	R	V	O	J	W	H	R	B	T	D	Y	Y	X	A	Q	Y	T
C	I	R	G	I	M	V	T	J	A	U	N	C	J	T	D	G	L	A
N	R	G	E	L	T	A	A	Z	B	D	U	M	O	E	X	C	R	N
G	N	K	N	H	L	C	G	L	L	I	B	T	N	R	K	V	A	C
N	R	V	D	I	T	W	E	M	Y	E	A	N	C	G	M	W	L	E
I	T	O	T	E	F	I	G	P	F	S	I	M	O	N	K	P	U	R
T	R	Y	U	T	W	I	E	T	S	N	K	N	A	M	X	R	C	M
S	R	Y	C	N	P	O	C	N	G	E	M	J	S	W	F	E	I	D
E	B	G	D	A	D	C	L	A	F	V	R	Q	T	T	Q	D	T	T
N	V	L	L	X	L	S	K	L	N	R	P	J	A	Y	T	A	R	B
C	S	E	M	I	T	V	C	J	O	T	L	G	L	L	R	T	A	X
D	G	R	I	Z	Z	L	I	E	S	F	L	V	U	N	P	O	P	X
F	Y	Q	B	E	A	R	S	N	R	R	Q	D	L	L	C	R	K	M
S	C	A	V	E	N	G	E	R	G	X	A	V	G	R	Q	S	F	R

ABUNDANT
CALVING
EAGLES
GOLDEN
IMPORTANCE
NEITHER
PLAIN
SCAVENGER
THEY
VERY

ADULT
COASTAL
FOLLOWED
GRIZZLIES
MORTALITY
NESTING
PREDATORS
SIGNIFICANT
TIMES
WOLVES

BEARS
DENNING
GATHERED
GROUNDS
MOUNTAINS
PARTICULARLY
PROBABLY RESPECTIVELY
STUDIES
TOTAL

WORD SEARCH PUZZLE



S	E	T	H	A	R	E	G	N	E	V	A	C	S
B	I	T	N	E	P	E	R	O	V	I	N	M	O
F	C	S	A	E	R	O	B	I	O	M	E	R	T
D	P	E	E	R	M	B	L	T	R	E	S	E	D
G	R	B	G	H	E	N	I	A	H	C	J	S	E
M	O	E	W	H	T	P	O	V	R	J	I	O	R
P	D	W	M	V	S	N	M	R	O	M	N	P	O
T	U	O	N	U	Y	U	Y	E	I	R	T	M	V
J	C	P	N	K	S	G	L	S	T	V	E	O	I
U	E	B	R	D	O	N	P	N	O	P	N	C	N
N	R	W	G	L	C	K	O	O	S	T	C	E	R
G	S	P	O	T	E	E	L	C	Y	C	O	D	A
L	L	C	L	L	Y	H	P	O	R	O	L	H	C
E	E	Y	H	A	B	I	T	A	T	C	P	M	P

Find and circle these words in the puzzle. The words read up, down, forward, backward, and on a diagonal.

BIOME
CARNIVORE
CHAIN
CHLOROPHYLL
CONSERVATION
CONSUMER
CYCLE
DECOMPOSER
DESERT
ECOLOGY
ECOSYSTEM
ENVIRONMENT
HABITAT
HERBIVORE
JUNGLE
OMNIVORE
PHOTOSYNTHESIS
POLAR
PRODUCER
SCAVENGER
TEMPERATE
WEB

STUDENT ACTIVITY SHEET

This sheet gives you descriptions of some of the enemies of caribou. They are clues. Can you guess what they are?

I am the biggest enemy of caribou. I eat caribou. Caribou skin keeps me warm. I disturb caribou with noise, mines and roads. I cause fires. Who am I? _____	I am hot. I do not like water. I am difficult to stop. I destroy caribou feeding places. What am I? _____
We fly and we buzz. We drink blood. We breed in warm weather. We follow caribou. We do not let caribou rest. We are very small, but we are very hungry. What are we? _____	In winter I freeze. In summer I run. Caribou cross me. When I run fast, caribou get tired. Sometimes I carry away weak caribou. What am I? _____
I am so small you cannot see me. I can attack caribou and kill them. I can make caribou weak. Weak animals cannot feed. What am I? _____	I am a member of a pack. I follow caribou. I hunt with friends. I kill caribou. Sometimes I eat a lot. Sometimes I eat only the caribou tongue. What am I? _____
Trees are like matches. When I strike them they burn. I can cause many fires. My fires destroy parts of forests where caribou live and feed in winter. Who am I? _____	I am hot, warm and cool. I change every season. When I am very cold, weak caribou die. I make snow turn to ice. Then it is difficult for caribou to find food. Who am I? _____

There are a variety of ways nature and people can influence these relationships, positively and negatively. Many of the negative impacts have resulted because we haven't recognized our place in the natural world

There are many examples of ways in which human beings have influenced ecosystems, some of these have been mentioned in this unit. Choose one of the ecosystems below and research how human activity has affected the ecosystem.

Examples include:

- The deforestation of rainforests and its effect on mammal populations such as baboon, lemur, and gorilla
- The deforestation of BC forests and its impact on salmon populations
- Drift-net commercial fishing practices on fish, such as tuna and mammals such as whales and dolphins
- Salmon farming and its effect on wild salmon populations
- Sugar Cane farming and its effect on the Great Barrier Reef in Australia
- Poaching of animals such elephants and rhinoceros for ivory
- Impact of agriculture and urban development practices on wolf, cougar, or bear populations.

Your research project requires you to:

- **select a relevant problem or issue** for inquiry use comparison, classification, inference, imagination, verification, analogies, and relations hip identification to clarify and define an issue or problem
- **compare a range of points of view** on an issue, consider competing positions from various perspectives
- **draw conclusions** about an issue or problem
- **use various modes** such as types of graphs, tables, timelines, and maps to obtain or **communicate information**
- **select an appropriate graphic form of communication for a specific purpose**
- **compile a body of information from a range of sources**
- **cite information sources** (e.g., respecting others' intellectual property, keeping track of where they acquired the information, distinguishing between fact and opinion, helping readers identify sources of additional information)
- **deliver a formal presentation** on a selected issue or inquiry using two or more forms of representation
- organize researched information to prepare a presentation
- select appropriate forms of presentation suitable for the

Project Caribou

An Educator's Guide to Wild Caribou of North America

Project manager:

Remy Rodden, Yukon Renewable Resources

Consultants:

Darielle Talarico, Arctic Vision, Whitehorse, Yukon

Principal writer:

Kirsten Madsen, Whitehorse, Yukon

Original illustrations:

Jennifer Staniforth Doug Urquhart Tanya Handley

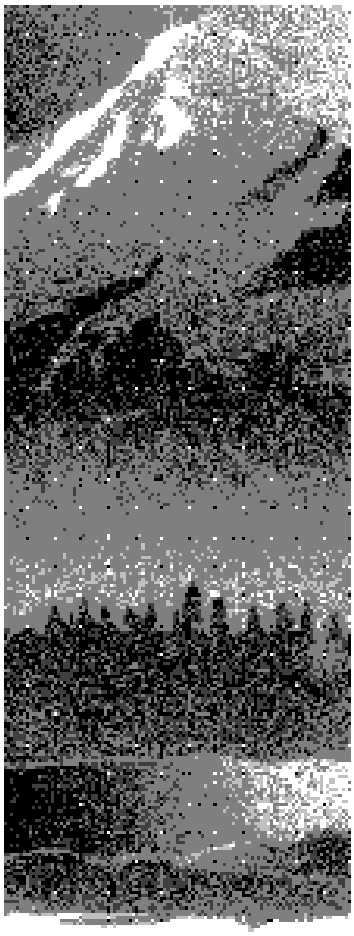
Cover: Joyce Majiski

Editing and production:

Walker LeBrun Creative Services, Whitehorse, Yukon

For more info: **www.projectcaribou.org**

Conservation Education Coordinator
Yukon Department of Environment
Conservation, Protection and Public Education Branch
Box 2703, Whitehorse, Yukon Y1A 2C6
(867) 667-3675 or 1-800-661-0408
fax (867) 393-6206
remy.rodden@gov.yk.ca



Environment Canada (Canadian Wildlife Service—Yukon)

Beverly and Qamanirjuaq Caribou Management Board

Age
Grades 8 – 12

Subjects
Science, Mathematics, Vocational Agriculture, Social Studies

Skills
Analysis, computation (calculating percentages), evaluation

Duration
Two 45-minute periods

Group size
Any

Setting
Indoors

Materials

- Paper and pencils
- Condition, reproduction and management cards (photocopy masters on pages 69 to 72)
- Dice: one per student

Checks and balances

(Adapted from *Project WILD Activity Guide*)

Objectives

Students will be able to:

1. Evaluate hypothetical wildlife management decisions.
2. Identify at least four factors that can affect the size of a wildlife population.

Method

Students become managers of a herd of animals in a paper-and-pencil and discussion-based game.

Background

Wildlife managers attempt to maintain healthy populations of wild animals, while factors—both avoidable and unavoidable—affect the populations. Some of these factors are loss of habitat, weather conditions, pollution of food and water sources, development of other natural resources, poaching and recreation pressures. Many people are unaware of how such pressures can affect wildlife.

In Canada, provincial and territorial wildlife agencies manage wildlife populations within their respective boundaries. The Canadian Wildlife Service, under Environment Canada, is responsible for some policies and programs affecting migratory species of animals (principally birds), as well as the import and export of animals and animal products, inter-provincial transportation of all species, and additional wildlife-related responsibilities.

Wildlife management is based on the best scientific and technical knowledge available. Such knowledge is growing; however, it is still limited and is continually affected by changes in the complex relationships between wildlife, human beings, and their shared environments.

In a sense, everyone shares responsibility for wildlife management. Although there are legally responsible agencies, their work requires the thoughtful and informed co-operation of citizens. There are frequently differences of opinion about the most appropriate policies and programs affecting wildlife. Individual citizens, private conservation groups, private industry, community groups and others all make important contributions to the overall conservation and protection of wildlife and its habitat.

In the Yukon, caribou are managed by the Yukon Department of Renewable Resources. There are 24 caribou herds in the Yukon. Three of the herds (Porcupine, Nelchina/Mentasta and 40 Mile) are barren-land caribou; the rest are woodland caribou. Barren-land caribou are smaller than their woodland cousins and engage in long-distance migrations between their calving and wintering grounds.

Two herds that have received a lot of attention are the Porcupine and Aishihik herds. The Porcupine is a barren-ground herd, and the Aishihik is a woodland caribou herd. U.S. interest in oil and gas development in the heart of the calving area for the Porcupine Caribou Herd, has spawned a public outcry. Predator control has been used as a management strategy to offset the rapid decline of the Aishihik herd.

The major purpose of this activity is for students hypothetically to assume the role of wildlife managers in a game situation and thus gain insight into some of the complex variables that influence stewardship of the wildlife resource.

Procedure

1. Each student is the manager of a caribou population. The carrying capacity of the habitat is 100 animals. The point of the activity is to end up with a viable population after nine rounds, representing nine years. If at any time the student's population of caribou reaches less than 10 or more than 200 individual animals, that student no longer has a viable herd and observes the other students until the conclusion of the activity.

2. Each student has a starting population of 100 animals. The cards are separated into three decks totaling 36 cards: a condition deck (18 cards), a reproduction deck (9 cards), and a management deck (9 cards). Shuffle the cards within each deck. Explain that cards will be drawn in the following sequence: condition card, reproduction card, condition card, management card. This sequence of draw will be repeated, each repetition representing an annual cycle. (The students may think of each draw as representing a different season, e.g., autumn, winter, spring, summer.) As each card is drawn, it is read aloud to the entire class. Each student then rolls his or her die and follows the instructions on the card to determine his or her herd population's new size. Some computations will result in fractions; numbers may be rounded to the nearest whole.

   Note: Students may object to the use of dice to determine the impact of decisions made for wildlife management purposes. Their concerns are appropriate; wildlife management is based on more than the chance elements reflected in the use of dice. However, chance has an impact on caribou as well, as in the case of weather conditions in a given year. Encourage the students to discuss and consider what is realistic and what is unrealistic about the impact of dice in this activity, and to recognize that wildlife management is far more complex than can be represented through this activity.

3. Wrap up the activity with a class discussion. Include topics such as:

- The apparent impacts of the condition, reproduction and management cards.
- The benefits and disadvantages of the management decisions made.

- Outcomes of the different management strategies used by different students. (Ask students to discuss how they might manage their herds differently given a second chance.)
- Realistic and unrealistic aspects of the activity.
- Examples of ways in which habitat can be improved in the short and long term.
- The necessity, benefits and disadvantages of human management of wildlife populations for both people and animals.

Variations

1. Add a monetary aspect to the activity. For example, students allowing hunting might have more revenue available for projects like habitat enhancement based on income from sale of hunting licences. Expenses might include salaries of wildlife managers, funds for research, feeding animals in severe conditions, relocation, etc.
2. After using the given cards once, students may want to experiment with changing some of the parameters on the supplied cards or making additional cards. Students may also want to make additional complete sets of cards for use by small groups or individual students.

Extensions

1. Have the students do a research project on the management of a specific caribou herd, such as the Porcupine or Southern Lakes herds.
2. Invite a wildlife manager from a local government to talk to the class about wildlife management.

Evaluation

Discuss with students:

1. Four factors that can affect the size of a wildlife population.
2. The idea that wildlife management may involve more management of people than of wildlife.

Reproduction Cards

Reproduction card: excellent year

This has been an excellent reproduction year. Increase your herd by (100/your current population size) times five times your roll, if your population is over 50 individuals. If your population is between 50 and 10, increase your population by the number equal to three times your roll. If your population is under 10, you may not reproduce.

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Reproduction card: average year

This has been an average reproduction year. Increase your herd by (100/your current population size) times three times your roll, if your current population is over 50 individuals. If your population is between 50 and 10, increase your population by the number equal to two times your roll. If your population is under 10, you may not reproduce.

Reproduction card: average year

This has been an average reproduction year. Increase your herd by (100/your current population size) times three times your roll, if your current population is over 50 individuals. If your population is between 50 and 10, increase your population by the number equal to two times your roll. If your population is under 10, you may not reproduce.

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Condition Cards

HABITAT LOSS CARD

The construction of a mine and connecting roads have occurred, destroying critical habitat. Decrease herd size by five times your roll.

WEATHER CARD

A cold, wet calving season has had a serious negative impact on the survival of the newborn calves. Decrease your herd by the percentage equal to five times your roll.

HABITAT LOSS CARD

Oil and gas development of calving grounds have disrupted the herd at a critical time. Decrease herd size by five times your roll.

WEATHER CARD

Swollen rivers caused by torrential rain have had a negative impact on the survival of the herd. Decrease your herd by the percentage equal to five times your roll.

HABITAT DEGRADATION CARD

An increase in roads for oil and mineral development have occurred, providing greater access for both local and non-local hunters. Decrease herd by three times your roll.

WEATHER CARD

A mild winter with little snow has had a dramatic positive impact on the survival of the herd. Increase your herd by the percentage equal to five times your roll.

HABITAT DEGRADATION CARD

There has been an increase in the number of planes flying over the herd's calving grounds during the calving season, stressing the mothers and their newborn young. Decrease herd by three times your roll.

WEATHER CARD

A dry summer has lessened insect harassment and had a positive impact on the herd. Increase your herd by the percentage equal to five times your roll.

HABITAT DEGRADATION CARD

Construction of a pipeline has occurred, disrupting normal migration routes. Decrease herd by three times your roll.

HABITAT DEGRADATION CARD

Mineral exploration has occurred, damaging critical habitat. Decrease herd by three times your roll.

HABITAT LOSS CARD

Oil and gas development has occurred within the traditional calving grounds. Decrease herd by three times your roll.

HABITAT LOSS CARD

A tundra and forest fire has resulted in a loss of critical habitat. Decrease herd by three times your roll.

PREDATOR CARD

An increase in the wolf population has occurred, affecting the herd size. Decrease herd size by the percentage equal to your roll.

HABITAT LOSS CARD

An oil spill has resulted in a loss of critical habitat. Decrease herd by three times your roll.

TOXINS CARD

Some animals in the herd are showing symtoms of heavy metals accumulating in their organs. Decrease herd by the percentage equal to your roll.

HABITAT LOSS CARD

A new road and increased traffic across a traditional migration route has resulted in disruption on the migration. Decrease herd by three times your roll.

UNUSED MEAT CARD

People shooting more animals than they need has reduced the size of the herd. Decrease herd by two times your roll.

HABITAT LOSS CARD

Incremental construction of roads and pipelines has fragmented the habitat and range of the herd. Decrease herd by three times your roll.

Management Cards

EDUCATION CARD

The teachings of Elders, Caribou Trails newsletter, and other education activities, have led to an increased understanding about the importance of habitat, and villagers are becoming involved in decisions that affect their caribou. Increase herd by the percentage equal to two times your roll.

HABITAT PROTECTION CARD

People have convinced the government that oil and gas exploration should not be allowed on the herd's calving grounds, protecting this critical habitat. Increase herd by five times your roll.

SELF REGULATION CARD

Local people have listened to the advice of their Elders and only take as much game as they can eat. Increase herd by the percentage equal to two times your roll.

HABITAT ACQUISITION CARD

A wildlife refuge has been created in the herd's calving grounds. Increase herd by the percentage equal to five times your roll.

HABITAT PROTECTION CARD

The Regional Native Corporation has decided against opening a mine in the heart of the caribou range, protecting an area of valuable habitat. Increase the herd by five times your roll.

RESEARCH CARD

Local villagers have given their support to a plan to have additional radio and satellite collars placed on animals in the herd, and to continue having blood samples taken to test for disease. Increase or decrease herd (students decide which before rolling the die) by the percentage equal to two times your roll.

HUNTING CARD

An increase in the bag limit for caribou has been proposed. Do you wish to allow increase the bag limit in your area? If yes, decrease your herd by the percentage equal to five times your roll. If no, record no change in the size of your herd.

RESEARCH CARD

A long-term study documenting the amount of lichen available on the herd's winter range has been successfully accomplished. Increase or decrease herd (students decide which before rolling the die) by two times your roll.

PREDATOR CONTROL CARD

An aerial wolf kill has been requested to combat the recent and rapid decline of the caribou herd population. Do you wish to allow predator control in your area? If yes, increase your herd by the percentage equal to five times your roll. If no, record no change in the size of your herd.

We need to make decisions wisely and based upon both scientific and traditional ecological knowledge to conserve and protect our ecosystems. Increasingly, TEK is being applied to contemporary life.

One of the most important decisions facing the Yukon is whether to develop the Peel River watershed. It has been the focus of debate for a decade as is likely to be so for years to come. On the side of protection and conservation are First Nations with traditional hunting grounds in the Peel, backed by tour operators and environmental organizations, such as the Yukon Conservation Society and the Yukon chapter of the Canadian Parks and Wilderness Society. On the side of exploitation is the Yukon's traditional economic engine — the mining and oil and gas industries — intent on preserving leases that have been staked on uranium, iron and oil and gas deposits. A land-use planning process involving an arm's length commission of stakeholders has been under way for seven years.

As a class you are going to explore the issues associated with the Peel River Watershed development.

Look at the issues from the perspective of one of the following:

- Environmental organization
- Tour operator (game hunter)
- Tour operator (canoeing company)
- Yukon government (Economic Development)
- Yukon government (Mines and Resources)
- Tr'ondëk Hwëch'in First Nation

https://www.youtube.com/watch?v=J1_wTQh1fRg

http://protectpeel.ca/peel_campaign_action.html

Your group's requirement is to select one of the stakeholders and develop a model for development based upon scientific and traditional knowledge. Your physical model can be in whatever for you should decide.

Use the following to inform your efforts:

Create a model that helps to explain scientific concepts and hypotheses

- observe a problem situation associated with the Peel Watershed , and formulate a plan for investigating a solution
- plan in detail all of the steps necessary to build or make a product, and prepare a written outline showing the order of events
- identify key components of the system or process being modelled.
- develop a testable question that considers the variables involved
- build a relevant and appropriate model based on the available materials and constraints of the problem
- apply all appropriate safety measures when building a model

There is an abundance of information on the internet and available through local resource people. Many people in the Dawson City are engaged with the Peel River process.

Peel elders renew calls for watershed protection

CACHE CREEK, YUKON

Tr'ondek Hwech'in elder Percy Henry wants the Peel River watershed protected, and he's wearing the T-shirt to prove it.

His mouth curling up in a mischievous grin, Henry proudly unzips his leather jacket to reveal the bright, white shirt that calls for Peel protection in bold, black letters.

Almost 85 years ago to the day, Henry was born south of here, somewhere between the Wind and Hart rivers. His parents, the legendary Joe and Annie Henry, spent much of their lives in the western Peel, known for its abundance of caribou.

Mary Walden Wednesday May 30, 2012

Mary Walden/Yukon News

A special gathering to give Peel River watershed elders a chance to talk about the region was held Saturday at a Tr'ondek Hwech'in camp near the Dempster Highway.

Despite his age, Henry said he's primed to go another round with the Yukon government to conserve this vast wilderness region, as recommended by the Peel Watershed Planning Commission.

This is not a new fight for the former chief. It's merely an extension of the one he and other Yukon First Nation leaders started nearly 40 years ago.

Henry was part of the group that went to Ottawa in 1973. They presented the historic document, Together Today for Our Children Tomorrow, which kickstarted land claim talks and ultimately the land use planning process.

"This is the same thing - together today for our children tomorrow," he said, waving his hand toward the campfire, ringed by spruce boughs, as dozens of people gathered to hear what the Peel elders had to say.

They came from Dawson, Mayo, Whitehorse, Old Crow and Fort McPherson to the May 26 gathering, hosted by the Tr'ondek Hwech'in at its camp beside the Dempster Highway.

It's a natural meeting place. Nestled in the lee of the Ogilvie Mountains and sheltered by tall, thick spruce, this traditional camp sits near the confluence of Cache Creek and the Blackstone River, a major Peel tributary famous for its grayling. To the south lie the treeless plains of the Blackstone Uplands, an area noted for its unusual convergence of caribou from both the Porcupine and Hart river herds.

For Tetlit Gwich'in sisters, Dorothy Alexie, Elizabeth Collins and Mary Jane Moses, this camp holds even more significance because it's where their grandmother is buried.

Alexie now lives on the lower Peel at Fort McPherson, a mostly Gwich'in community still closely tied to the river for food, water and transportation. Just to get here Alexie's group had to cross the river in a small boat because the ferry hadn't started running yet, then pile into a vehicle strategically left on this side to make the long drive down.

Getting together to talk about the Peel is important, she said.

"For us to do something, we all have to work together - the Yukon and the Northwest Territories," she told the gathering. "We can't fight. We all have to work together."

Na-cho Nyak Dun elder Jimmy Johnny has spent more than 50 years travelling through the upper Wind, Snake and Bonnet Plume regions, mostly by horseback.

He knows only too well the people downriver in Fort McPherson and beyond, like Alexie, are counting on the Yukon to protect the Peel's headwaters.

He also knows that's easier said than done. For years he's been riding past the debris of abandoned mineral exploration camps.

"One of the biggest messes I've seen is up by where Goz and Duo Creek runs into the Bonnet Plume River," he said.

"I've been there. There's a huge, huge mess. Lots of barrels left behind. Lots of old stuff that needs to be cleaned up."

Although Yukon government leaders were invited to this meeting, none showed up to hear what the dozen or so elders had to tell. Not one official was sent to take notes.

NDP leader Liz Hanson, four of her MLAs and the Liberal's Klondike representative, Sandy Silver, did accept the invitation.

They not only listened to the elders, they found out that the Northern Tutchone Council, which includes the Na-cho Nyak Dun, passed a resolution on the Peel watershed last week in Pelly Crossing.

It calls on the government to halt work on its separate Peel land use plan because it has "no legal status" under the Umbrella Final Agreement.

It urges the government to endorse the "legal plan," which was prepared by the planning commission and supported by a majority of the public.

It also asks the government to get on with the final round of public consultations, which have yet to be announced.

In the meantime, First Nations are preparing to take the Peel dispute to court if they need to go that route, Tr'ondek Hwech'in Chief Eddie Taylor told the gathering.

up here
LIFE IN CANADA'S FAR NORTH

Story by Genesee Keevil. Photography by Peter Mather

<u>The State of The Hunt</u>

Most years the Porcupine Caribou cross the Dempster. When they do, there's a harvest. Is this a healthy continuation of the old ways, or hi-tech slaughter?

It sounds like snoring: air sucking in and out of a ragged slash in the caribou's throat. The animal struggles to stand, then falls back onto the snow, legs still running, like a dreaming dog.

There's a pop. Another caribou leaps, twirls, and then stumbles, a bullet wedged somewhere in its back end. It gets up, wobbles, drops. Pulls itself up. Another pop. Another silent dance. Pop. Another.

In less than an hour, James Firth has dropped six Porcupine caribou. It's a small take. There were years when the Tetlit Gwich'in hunter, from Fort McPherson, NWT, saw hundreds of the animals, stacked like cordwood on the side of the highway.

"We just take what we need," says Firth, placing his rubber boot on the antler of a thrashing caribou, running his buck knife through its throat. The animal struggles to stand as Firth moves to the next. "Bullets are expensive," he says, plunging his knife.

Firth's ancestors have been harvesting caribou in this vast landscape for centuries, long before bullets, buck knives, snowmobiles and freezers. New technology means more meat, faster. But better science has also made Firth realize his free meat supply is no longer a given.

The Porcupine herd, shorly after calving, muster for their migration to the Yukon

IN SPRING, Firth's hometown smells like death. Frozen caribou heads—tossed on roofs to foil dogs—begin to rot. Piles of legs, with fur still attached, thaw, while hides turn soft and stinky. "We used to use all parts of the caribou," says Gwich'in community elder Mary Snowshoe. "We never wasted meat, not even the guts—those fed our dogs." Snowshoe, her grey hair swept back under a colourful flowered kerchief, points to beaded mukluks on her feet. "The caribou legs, we used the skin to make mukluks," she says. "Even the caribou hair, we used to burn it to make fire."

Snowshoe didn't go to school. She learned from days spent hiking in the mountains, hunting caribou with her parents, cold winter nights running a dog team on the trapline, and from sitting with village elders as a girl, learning to scrape fat from caribou hide.

There are still caribou fences up here, scattered like bleached bones across high alpine plateaus, marking long-ago hunts when hundreds of caribou were funneled by Snowshoe's ancestors into makeshift corrals and killed with arrows and spears. Hides became clothes and sleds, bones turned into tools, and meat dried for winter. "In the past, the elders made us use everything," she says. "We never took more than we needed. Now you see meat misused."

A cow gathers her energy for the long trek

Snowshoe has witnessed freezers full of caribou meat left to rot, piles of viscera attracting flies and grizzlies by the highway, heads and legs tossed in the local dump. “We used to make a delicious soup from the brains,” she says.

Snowshoe still gets plenty of caribou. The young guys always shoot extra, for elders, single mothers, community members stuck working desk jobs. Too much, according to Snowshoe. Especially when trucks haul into town loaded full of females. “We never killed the cows,” she says. The more females in a herd, the more calves, ensuring an end- less supply of meat. “My parents shared this knowledge,” she says. “But nowadays nobody is teaching the young people, and they just shoot whatever they see.”

Vuntut Gwitchin Paul and William Josie from Old Crow, during the annual hunt on the Porcupine River

People aren't necessarily killing more Caribou now. A couple centuries ago they also shot hundreds of caribou, in caribou fences or while the herd swam rivers. They're still doing it. Not much has changed. - Mike Suitor, Biologist

EVERYONE'S HEARD gory stories of the slaughter, relayed by hunters, highway crew, conservation officers, even long-haul truckers passing through when the caribou crossed the highway. For the unaware driver, coming across the Dempster Highway caribou harvest can be a blood-soaked, disturbing experience.

Mike Suitor doesn't want to talk about this. Instead, the regional Yukon government biologist stresses the importance of a well-sighted gun, of taking animals from the herd only when there's a clear shot, not harvesting bulls in rut, and not wasting meat. "Harvest is not just shooting: it's the whole process, ensuring meat is put away and used properly," he says.

Suitor, who works in jeans and button-downs more often than suits, spends a lot of time watching caribou. Like any good scientist, he's immersed in population models, calving studies, body conditioning research. But he's also a bit of a caribou cowboy. He knows what it looks like when you crest a hill in a helicopter

and see 60,000 caribou running across the tundra like waves in an ocean. He knows how to tell a fat female from a pregnant cow, what it means when the peach fuzz starts dripping off antlers in the fall.

The Porcupine herd is, arguably, the most studied herd in North America, and Suitor spends a lot of time running the data through computer models, but he also spends days on the land with hunters, checking fat ratios, stomach contents, even radiation levels in the meat. In the evening, he sits around campfires talking with First Nations families who have been living on caribou for generations.

People aren't necessarily killing more caribou now, he says. A couple centuries ago they also killed hundreds of caribou at a time, in caribou fences, or while the herd swam rivers. "They're still doing it," he says. "Not much has changed." Except technology.

Hank Able, 10, helps deliver caribou to elders, single women and those tied to their Old Crow office jobs

Suitor appreciates traditional knowledge shared around campfires, but for him, real science means hanging out of helicopters with high-tech net guns, tangling up unsuspecting ungulates in order to collar them for future studies. "Sometimes they die of heart attacks," he says. "Or sometimes they break a leg or a neck when they go down. But that is the exception." It's easier to tranquilize caribou than net them, but then the drugs would contaminate the meat.

FIRTH IS ON his hands and knees sniffing yellow snow. A big bull just urinated here. If he's in rut, his pee will stink. The meat's contaminated during rut, he says. No one eats it. Firth is in jeans, rubbers, a hoodie and a ball cap. It's not what he normally wears hunting, but then this wasn't supposed to be a hunting trip. Firth, his son and a buddy were making a quick run to Whitehorse, Yukon and back—14 hours each way—to get a new snow machine. They were about six hours from home, the new sled loaded in the back of one of the trucks, when Firth spotted the caribou.

There were just a couple beside the highway. Firth glanced up into the trees. At first all he saw was sparse black spruce and snow. Then, suddenly, the hillside was moving—a steady stream of caribou several thousand strong sweeping through the trees.

The snow didn't stink. Firth pulled out his gun and fired a single shot from the highway. The bull danced, stumbled, twirled and fell. He saw another bull, a little smaller. Firth took aim. Pop. The little bull stumbled.

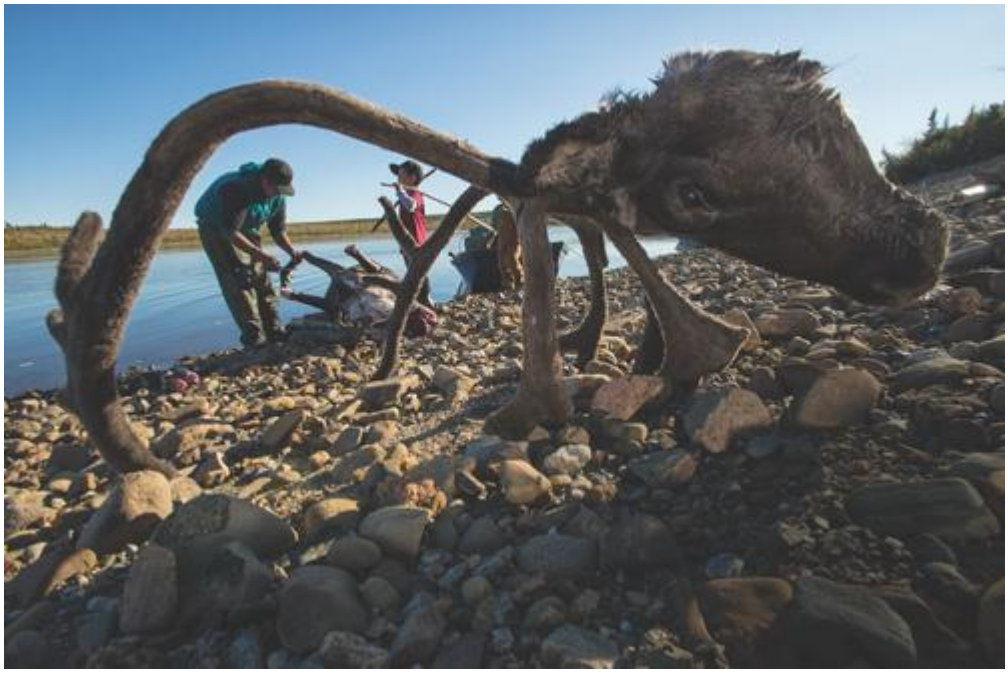
Cleaning caribou: The Vuntut Gwichin use most of the animal—heart, lungs, guts, head

He was planning to stop at two. He gutted them, sawed off the heads. Then his son cut them in half, just below gaping ruby ribs, and muscled them into the truck. At this rate, they might still make it home in time for dinner.

A few kilometres up the road, they spotted hundreds more caribou trickling through the trees. Firth slowed. Sped up, then slowed again. It was impossible to keep driving with all that meat in his sights

THERE WASN'T always a highway here. Until the late 1950s, there was only a dogsled trail cutting across the tundra and brush between Dawson City, Yukon, and Fort McPherson. The RCMP travelled this route, along- side trappers, First Nations hunters and the odd prospector. A bunch of oil and gas exploration crews made their way up the trail too, and struck black gold in 1959. Highway construction crews were not far behind.

Today, oil tankers make the run south, while gas and grocery trucks lumber North to fuel tiny towns like Fort McPherson and Inuvik, NWT. Tourists sometimes drive into the Tombstone Mountains to camp or hike, and outfitters ferry clients to outlying camps and airstrips, but the Dempster Highway still only sees an average of 50 vehicles a day—until the caribou cross.



Butchering is a family event on the river banks, with children playing, watching and learning

It used to be predictable. The caribou came every fall, like clockwork. Then, about 20 years ago, something changed. “It’s a mystery why the caribou are not going to their traditional winter range anymore,” says Joe Tetlichi. “It’s a mystery for the elders.”

Tetlichi is James Firth’s uncle, and like him, grew up on the land. “In 1970, 47 dog teams went out to hunt from Fort McPherson,” he says. “It took one week. Now, you jump in a truck and it takes 1.5 hours.”

Tetlichi has been chair of the Porcupine Caribou Management Board for close to 20 years, a position he’s learned requires an appreciation for both scientific data and traditional First Nations teachings.

When he started, back when caribou science was still finding its feet, Porcupine numbers were shaky. Elders assured Tetlichi the herd was strong. “But we looked at other herds across Canada and they were all in dramatic decline,” he says.

Travelling much the same tundra as the Porcupine, the 40-Mile caribou herd once numbered more than 240,000. In the 1930s, its numbers began to drop. But people kept hunting. Back then, caribou biologists thought a little differently than guys like Suitor do today. They figured if the herd was already in decline, hunting restrictions wouldn’t make much difference. By the 1970s, the herd was down to 6,500 animals. Conservation efforts finally kicked in, though there were concerns it was too late.

James Itsi watches for caribou on the Porcupine

The NWT's Bluenose herd is a more recent casualty. After its numbers dropped drastically from more than 110,000 animals in the early '90s to less than 18,000 in 2009, hunters turned their attention toward the Porcupine.

"We thought, what happens if the Porkies start declining dramatically?" says Tetlichi.

The herd was estimated to be at around 123,000 animals in 2001, but nothing was certain. Between 2001 and 2010, bad weather, paired with unusual migration patterns, foiled aerial counts of the herd, raising fears it could have dropped as low as 30,000 animals.

Elders argued that the herd was healthy, but biologists weren't so sure. Just in case, Tetlichi's management board created a Harvest Management Plan—the first of its kind in North America—and some First Nations started taking precautions, urging members not to over- hunt the herd. In an attempt to make it harder to hunt from the road, the Yukon government created a no-hunting corridor, extending 500 metres on either side of the Dempster. But it was short-lived. Land-claim rights trump territorial hunting regulations. So First Nations kept shooting from the highway, their bullets whizzing over the heads of the non-

native hunters, perilously hunkered down 500 metres in. The regs were quickly scrapped.

A few years later, in 2009, the government tried again, placing hunting restrictions on the herd—bulls only, with some regions off limits completely. Non-native hunters, allowed one or two caribou a year, were forced to abide by the ban. But First Nations, facing no limits on the number of caribou they can kill, continued hunting—a right enshrined in those land claim agreements.

***

FIRTH IS NURSING a rum and Coke in the Eagle Plains lounge, the only hotel on this 590-kilometre stretch of highway. Butchering took longer than expected. The aging grandpa had to slice through thick fur, dropping steaming stomachs onto the snow. Despite a recent kidney operation he downplays, Firth worked fast. But took time to gently coax lacy webs of fat from the squiggly slime of guts.

A bull killed by a collision on the Dempster provides food for wolves, foxes and wolverines

“The elders love this part,” he says. “We bring it back for them.” In his 60s, Firth is an elder himself, and well aware of his responsibilities. “One of my little grandsons really wants to come caribou hunting,” he says, tipping back in his

chair and looking around a lounge full of dusty taxidermy: a fox, a lynx, a sheep. His grandson is nine and shot his first caribou this year. Firth wants to teach him how to sight a gun, how to choose the best animals; the stink of pee when a bull is in rut. “Six caribou is more than enough,” he says. “We’ll give some to the elders.”

But he’s still thinking of going out again. Taking the little boy.

Firth’s son Brad didn’t spend much time in the bush. “One generation was missed,” Brad says. He’s not going to make the same mistake with his son: “He’s six and I’m bringing him in the bush with me this winter,” he says.

Brad is uploading a picture of the day’s take on Facebook from the lounge. “It’ll be all over town by tonight,” he says, grinning. That means more trucks pouring down the highway in the morning. “There will be lots of guys coming out,” he says. When it was only dog teams, things were different. “There used to be caribou everywhere when I was a kid,” he says. “They were just behind town. Every week we had fresh meat.” Now, he says, with better guns, ATVs, snow machines, GPS, two-way radios, the highway, and ever-expanding oil and gas development, the caribou don’t stand much of a chance. “They’re all disappearing.

THESE DAYS, the Porcupine herd has a hard time disappearing. Little red dots on the map mark the collared caribou. Location, direction, a rough estimate of the number of animals on the move—no need to hike into the mountains looking for the herd; just wait for those little red dots on the computer screen to move close to the highway. But a few years back, the live satellite feed on the Porcupine Caribou Management Board website went dark. Now, the board delays migration movements by weeks, sometimes months, to keep hunters guessing. “It quickly became apparent a live feed of the Porcupine’s migration wasn’t the best idea,” says Suitor, with a chuckle.

It’s the management board’s annual harvest meeting in Dawson City, and Suitor is giving a brief rundown of the last caribou count. It’s good news. The Porcupine are in the green zone, he says. That means no restrictions on killing cows, no hunting bans, no nothing.

“The Yukon government is so pro-development, how do we know they’re not going to say the herd is doing well, so they can start drilling for more oil and gas

in caribou habitat?" interrupts Gwich'in hunter Norman Snow- shoe, one of the more than 20 management board members represented at the meeting.

There are four First Nations, two territorial governments and the feds, all sitting around a big U-shaped formation of collapsible tables at the local community hall, talking caribou. There's a screen at the front for PowerPoints, coffee and homemade muffins in the corner, and a bunch of chairs at the back filled with elders and community members.

Suitor is talking numbers. The government finally managed to tally the herd in 2010. It wasn't in decline. The Porcupine numbered close to 170,000. For the next three years, the herd steered clear of the highway. Now, their numbers have jumped to 197,000.

"But we're not going to go out and kill 40 caribou at a time just because we can," says Tetlichi. "We have a responsibility to make sure there are caribou for future generations."

Tetlichi's heard stories of the slaughter. "There are always a few bad apples in the basket," he says. He thinks it's overblown, sensationalized by tourists who stumble upon a highway hunt, and by photos in the local papers—trucks full of carcasses, piles of animals beside the highway.

When the Porcupine herd crosses the Dempster, 5,000 to 6,000 animals are usually harvested. That's roughly three percent of the herd, within the parameters of what biologists, including Suitor, consider a sustainable harvest. It may seem like a slaughter, says Tetlichi. "But we have a tradition of sharing. Those hunters who take 10 or so animals will be distributing them to more people in the community, single parents, kids, elders."

Tetlichi is leaning back in his seat, relaxed, more like he's at a dinner party with friends than chairing a harvest meeting. But then, the whole meeting feels like one big family reunion. There's laughter, soup, cake, cold hard scientific data, and elders sharing stories.

Mary Snowshoe is sitting at the back of the room in a lacy, flowered parka, her face framed by wolverine fur, listening. "We shouldn't be hunting in July and August when the caribou are eating," she tells Tetlichi during a break. "We have to give the caribou a chance to cross the highway."

If bullets start flying before the leaders cross, they might turn the whole herd around, making it harder to get meat. “That’s what happened last year,” she says. “They turned around. Then everybody had no meat.”

Whether to ban hunting until after the leaders cross the highway, whether to nix restrictions on snowmobiles and ATVs, how to police the waste and gut piles left behind—it’s all on the table, along with a bunch of technical scientific stuff. There are Power- Point slides of mathematical models used to analyze herd size, harvest data, calf survival graphs, body conditions charts. There’s talk of “input data” and “outputs,” and the need for “specific values for variables.”

The elders exchange sidelong glances and grin. The smell of caribou urine in snow, the number of bot flies buried in the hide, the feel of the fur, these are the “specific variables” that they understand.

“It’s important to use traditional knowledge alongside scientific knowledge,” says Tetlichi. “You can have a meeting in a Whitehorse board room about how to manage the caribou, but it’s the locals and elders who have their eyes and ears on the land.”

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THERE'S A SHINY new pickup idling on the side of the highway, just down from where Firth dropped six caribou the day be- fore. A guy in hunting fatigues and a ball cap is sitting watching the caribou, which are still streaming through the trees. Beside him are two little boys, also in ball caps. The man is a member of Dawson City's Tr'ondëk Hwëch'in First Nation, but doesn't want to give his name. There's too much controversy surrounding the caribou, he says, mentioning the slaughter, people shooting into the herd, truckloads of wasted meat.

"We need to educate the youth," he says, nodding toward the boys. "Never shoot the leaders," he tells them, as they watch the caribou. "A big part of it is patience. Don't just shoot the first thing you see." A white pickup pulls up, green and brown stripes down the side, a Yukon Environment logo on the door. Kirby Meister greets the trio in the truck. They're all from Dawson City and know each other. The Yukon conservation officer is expecting it to get busy in the next couple days, as word gets out the caribou are crossing the highway. He's expecting more hunters from Dawson and a handful from Fort McPherson. "The two communities have really different ways of hunting," he says.

The Tr'ondëk Hwëch'in hunt individually, and bring their children out in the fall for a First Hunt program, passing on elders' teachings—everything from fire making and survival skills to learning how to spot the leaders and let them pass.

"The Fort McPherson guys do more of a community hunt, sending one or two hunters to harvest 150 caribou," says Meister. "That can be shocking for people who come along and see 80 animals being butchered in the ditch."

Kirby can charge guys for wasting meat, monitor non-native hunters to ensure they don't exceed quotas, and crack down on common offences like loaded firearms in vehicles. But he has no jurisdiction over the number of animals harvested by First Nations. They can hunt anywhere on their traditional territory, he says. "So if the 40-Mile herd starts mixing with the Porcupine, we might have problems."

AFTER BEING harvested close to extinc- tion, the 40-Mile caribou steered clear of the Dempster. But this year, for the first time in 50 years, they're back. "It's something, as a biologist, you might only dream of," says Suitor. Thanks to a joint conservation initia- tive with First Nations, which saw virtually no hunting of the herd, the 40-Mile is up to 55,000 animals. Suitor was up in a chopper this fall and saw tens of thousands of them pouring through a nearby valley. "It was very

dramatic," he says. "Now we have to make sure they're not harvested like the Porcupine, especially with them so close together."

Suitor and Meister both say it's Porcupine caribou spilling through the spruce beside the highway. That's what Firth and his son think too. But the guy in the truck with the boys isn't so sure. He just passed a big group of 40-mile caribou on the other side of the river, less than 50 kilometres away.

"We're not hunting them," he says. But if the herd crosses the river, and starts mingling with the Porcupine, no one will be able to tell them apart.

"The 40-Mile herd's getting bigger," says the Tr'ondëk hunter, dropping his truck into drive. "And if they end up on this side, across the river, there will likely be another slaughter."

His taillights disappear up the highway, heading north toward Eagle Plains and Fort McPherson. He's not planning on shooting any caribou today. But he's heading further up the highway anyway, to give the boys some perspective. They see more caribou on the drive. They watch a couple of big bulls. Stop to sniff some yellow snow. They spot pregnant cows. They see young caribou growing into their horns. And they notice six faded patches of tomato-soup red in the snow.

Tr'ondëk Hwëch'in

Hunting along the Dempster Highway

If you are a beneficiary of the Tr'ondëk Hwëch'in...

Your rights

- You may hunt the **Porcupine Caribou Herd** for subsistence anywhere* along the Dempster Highway on public land. You must obtain permission before hunting on Vuntut Gwitchin lands.

You have a right to hunt **other wildlife** for subsistence in your own Traditional Territory which includes both sides of the Dempster Highway *south of km 285.*

Your responsibilities

If you want to hunt **other wildlife north of km 285:**

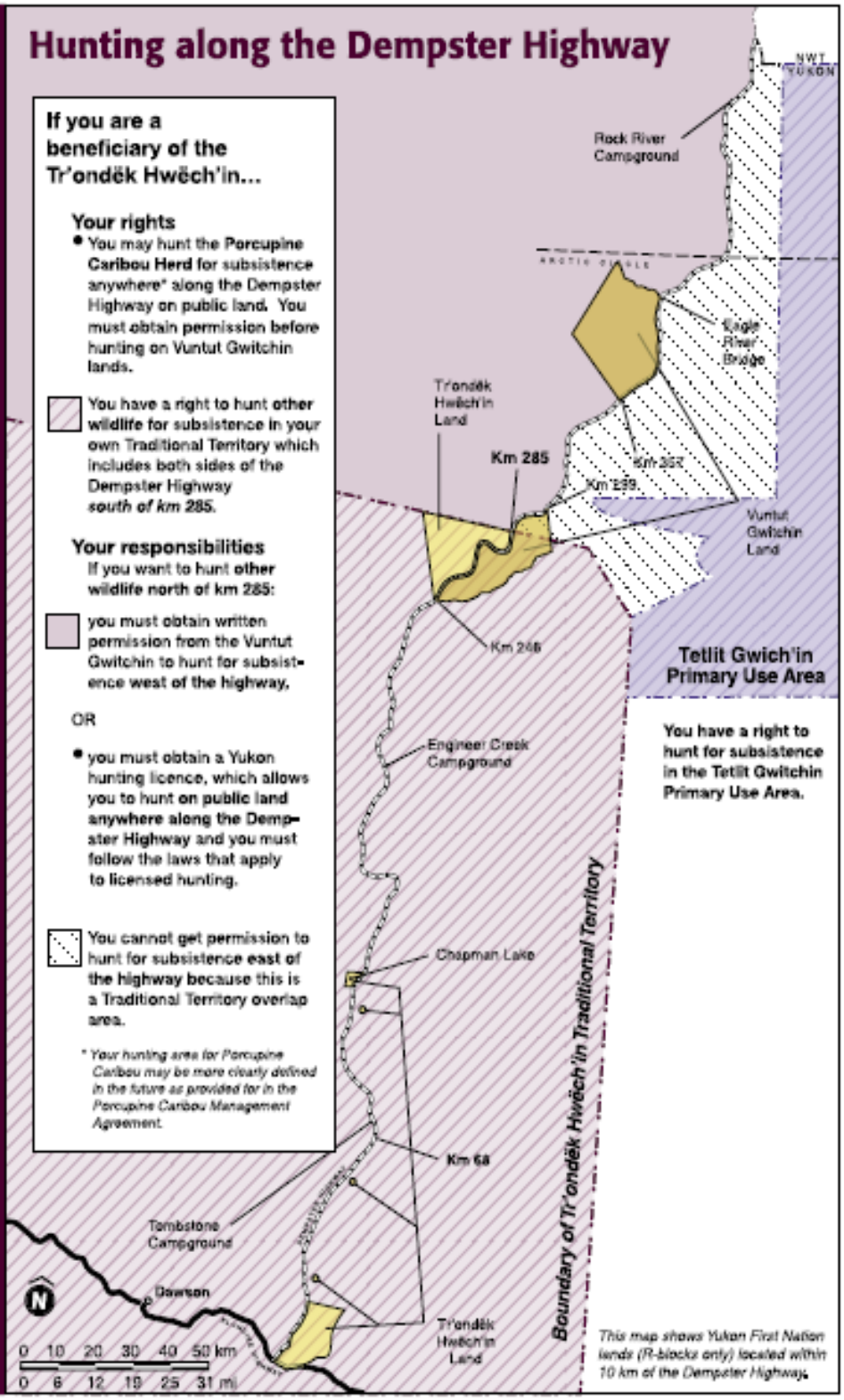
you must obtain written permission from the Vuntut Gwitchin to hunt for subsistence west of the highway,

OR

- you must obtain a Yukon hunting licence, which allows you to hunt **on public land anywhere along the Dempster Highway** and you must follow the laws that apply to licensed hunting.

You cannot get permission to hunt for subsistence **east of the highway** because this is a Traditional Territory overlap area.

** Your hunting area for Porcupine Caribou may be more clearly defined in the future as provided for in the Porcupine Caribou Management Agreement.*



This map shows Yukon First Nation lands (R-blocks only) located within 10 km of the Dempster Highway.

PORCUPINE CARIBOU MANAGEMENT BOARD
ALASKA YUKON N.W.T.

Yukon Environment

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