Forests for the Future

Unit 1

Two Ways of Knowing: Traditional Ecological Knowledge and Scientific Knowledge

by Veronica Ignas

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Forests for the Future, Unit 1

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INTRODUCTION

Curriculum Area
Science and Traditional Ecological Knowledge

Grade Level
Science 8; Biology 11

Rational

Students are increasingly required to understand the nature of knowledge construction. In particular, students need to understand that both scientific and traditional ecological knowledge, like all knowledge, is created within a cultural setting. The setting influences the nature of the knowledge that is created. Effective science instruction recognizes that there are many interpretations of natural phenomena, just as there are many interpretations of religion, politics, economics and art. Thus, a central theme of the unit plan is the recognition of the many different ways that people create meaning.

Over many generations indigenous people have developed a holistic traditional ecological knowledge of their lands, natural resources and environment. This knowledge has been recorded within oral traditions. The oral tradition must be respected and viewed by the teacher as a distinctive intellectual tradition, not simply as myths and legends. Too often attempts to contrast traditional ecological knowledge (TEK) with scientific knowledge creates a sense with aboriginal students that their way of knowing is inadequate or inferior. In contrast scientific knowledge is presented as paradigmatic of knowledge itself (Heyd 1995). The implication being that only science is fully epistemologically adequate. To address this problem this unit plan explores and focuses on the common themes that emerge in the way that TEK and scientific knowledge are acquired and communicated.

This unit plan emphasizes that differences between scientific and traditional ecological knowledge are not of a fundamental kind. For example, although TEK does not lend itself as readily to the control of nature nor does it appear to be organized in the same manner as scientific knowledge tends to be (i.e. yields general and theoretical principles) and it is not usually subject to formal verification procedures as scientific knowledge claim, this does not mean that TEK cannot be (or is not) used to control nature. Students will be encouraged to understand that TEK is founded on general principles of reliable applicability and that its claims usually are verifiable. Towards this end the central foci of instruction will be that 1) TEK is made up of reliable, usually practically verified, frequently tacit beliefs and 2) it arises in distinctive i.e. indigenous socio-cultural contexts.

Increasingly TEK is sought out precisely because of the expectation that it may lead to principles of general interest and applicability that are useful for development and environmental management purposes. The growing interest in TEK has coincided with settlement of land claims, the introduction of co-management regions and the rise of First Nations power and influence in the formal decision-making processes. Governing bodies recommend the recognition of the values, TEK and resource management practices of indigenous cultures with a view to promoting environmentally sound and sustainable development. This unit plan will help students to explore some of the issues associated with the inevitable tensions and implications that arise over issues of intellectual property rights as they relate to TEK.

There is a growing recognition that indigenous people frequently have extensive knowledge of plants with pharmaceutical properties. Thus, TEK is often sought because of its potential to provide information about wild species that might lead to new pharmaceuticals or pest resistant crop strains. Business interests are increasingly realizing that indigenous people may know about potentially lucrative natural species. This unit plan encourages students to explore the economic implications of resource ownership as it relates to both knowledge of and location of pharmaceutical plants.

Nature of Students

Science 8 is a required course for all BC high school students. It is designed for general enrollment and is a preparatory course for Science 9. Biology 11 is an elective course for students interested in life sciences.

It is anticipated that

- students will present with a range of academic abilities and interests.
- students will have multi-cultural backgrounds. Approximately 15% of the students will have English as a Second Language students.
- the female students will feel alienated by science. Science is typically understood to be “masculine, competitive, objective, impersonal-qualities that are at odds with our image with what girls are” (Jones 2000:180). In light of the above research findings, namely that females and males have different interests and

Prescribed Learning Outcomes and Lesson Topics

Table 1: This unit plan corresponds with the prescribed learning outcomes for Science 8 in the following areas: 1. Applications of Science; 2. Life Science (Diversity); 3. Life Science (Social Issues); and 4. Life Science (Global Ecosystems).

Prescribed Learning Outcome	Lesson/ Case Study /Topic
Applications of Science: "use models to demonstrate how systems operate."	Lesson 1: Ways of Knowing: TEK and Scientific Knowledge-case study – The process of knowledge construction. Hunters and Gathers compared with farmers.
Applications of Science. "Describe how scientific principles are applied in technology."	Lesson 2: Traditional Ecological Knowledge and Scientific knowledge-How do people use this knowledge-Aboriginal Technologies. Lesson 4: Case Study - Indigenous Plant Classification.
Life Sciences (Diversity): "describe the environmental conditions in the major biomes"	Lesson 3: Case Study 1-"Indigenous Plant Classification"- 3 geoclimatic zones of the BC coast. Students will learn about 1) the dominant animal and plant forms found in each of the zones; 2) the climate of each of the zones; and 3) the dominant land forms of each of the zones.
Life Science (Social Issues): "Assess different impacts of using renewable and non-renewable natural resources"; "relate the extraction and harvest of earth's resources to sustainability and reduction of waste"	Lesson 4: Case Study 2 Reconceptualizing Ecological Knowledge as a Dynamic Process-The Case of the Pine Mushroom Industry in Northwestern British Columbia
Life Science (Global Ecosystems): "evaluate how major natural events and human activity can affect local and global environments and climate change.	Lesson 5: Case Study 3 The Smallpox Epidemic of 1862 on the North Coast of British Columbia. Lesson 6: Case Study 4 Aids and Its Impact on Canada's Indigenous Populations

attitudes towards studying science and different perceptions of scientists and science careers this unit will have a special focus on learning that both encourages engagement with peers in a cooperative learning setting.

- It is expected that students will have little background knowledge or theoretical understanding that 1) science is understood to be one way of learning about and describing the natural world and 2) all knowledge is created, used and modified within distinct social and cultural contexts.

Purpose of Unit

The unit plan introduces students to two different ways of knowing about the natural world, TEK and science. The focus will be developing an understanding that both science and Traditional Ecological Knowledge are two ways of knowing about the natural world. This unit plan explores and focuses on the common themes that emerge in the way that western scientific knowledge and TEK is acquired and communicated.

The purpose of the unit plan is to facilitate students understanding of the nature of TEK and scientific knowledge. Thus, students will explore TEK and scientific knowledge with a goal to understanding how each is 1) created; 2) modified; 3) used; and 4) the limitations of each of these forms of knowledge and meaning. Students will learn how both of these approaches have been used to learn about and make meaning of the natural world. Students will participate in a series of activities and explore various case studies designed to highlight how indigenous people know and understand their environment and world. The central focus is how do people come to understand the space that they live in and use

Traditional ecological knowledge represents a unique way of understanding and learning about the natural world. Special focus will be on developing an awareness that Traditional Ecological Knowledge is the outcome of complex interactions between culture and the natural environment.

A key focus will be exploring how the concern for stability which underpins much of TEK parallels the contemporary global debate on sustainability and apparent philosophical alignment between the environmental movement and the indigenous perspectives on resource management.

Overview:

The following Major understandings will be addressed in this unit:

- Students will explore the relationship between science and traditional ecological knowledge. In so doing students will develop a conceptual understanding that there are many ways in which societies create meaning. Science and traditional ecological knowledge are two of these ways. The scientist observes, and from observing attempts to form a set of principles that explains the observations. Principles are then gathered in to a theory which can give rise to a pattern to a part of nature, a meaning to part of the universe.
- While scientists search for meaning, they do not necessarily search for truth (at least in the absolute sense). Rather, the scientist looks on scientific theories as tools, which are used to make increasingly larger generalizations. A scientific theory is truth only as long as it is an effective tool.
- Students will understand that traditional ecological knowledge is a cumulative body of knowledge, practice and belief that changes with time in accordance with the usefulness and relevancy of the information for each successive generation that both created and used this traditional ecological knowledge.
- Traditional ecological knowledge is an integral part of the local culture and management prescriptions that are adapted to the local area.
- Traditional ecological knowledge tends to have a large moral and ethical context-there is no separation between nature and culture.
- In many traditional cultures nature is imbued with sacredness.

References

Heyd, Thomas. (1995). Indigenous Knowledge, Emancipation and Alienation. Knowledge and Policy, Spring 1995, Volume 8, Issue 1.

Traditional Ecological Knowledge	Western Science
Begins with empirical or practical knowledge: local knowledge of animals, plants, soils and landscapes	Uses classification to keep track of living things. Biologists place things into groups-members of the same group are alike in certain key ways.
Local ecological knowledge is interpreted and placed into a local context. Management practices are based on this knowledge.	Uses the scientific method which is skill-based: measuring, inferring, classifying etc.
The local empirical observations are embedded in social institutions, that is religious beliefs about and ritual uses of plants and animals and a code of ethics governing appropriate human-environmental relationships.	
Qualitative	Quantitative
Intuitive components	Purely rational
Holistic=mind + matter are considered together	Reductionist=separation of mind and matter
Moral	Value-free
Spiritual	Mechanistic
Based on empirical observations and accumulation of facts by trial and error	Based on experimentation and systematic deliberate accumulation of fact
Based on data generated by resources users themselves	Based on data generated by a specialized cadre of researchers
Based on data gathered over a long time series in one locality	Based on data gathered over a long time series in one locality
Does not aim to control nature and is not primarily concerned with principles of general interest and applicability.	
TEK is limited in its capacity to verify predictions. TEK claims are not generally subject to formal verification procedures such as crucial experiments under controlled conditions. Yet, many traditional ecological practices have survived long periods of implicit testing by those who have to rely for their welfare for their cogency.	
TEK is integrated in a social context that implies a) a dimension of symbolic meaning for various environmental features; b) a direct cosmology or world view; c) relations based on reciprocity and obligations towards both community members and other beings and communal resource management institutions based on shared knowledge and meanings.	

Traditional Ecological Knowledge and Science Unit Outline

Lesson	Topic
1	Introduction: Opening Activity "Are you a hunter-gather or a farmer?" Mapping the space that you know and use.
2	Traditional Ecological Knowledge and Scientific Knowledge: How do people create TEK? How do people change or update this knowledge? How do people use this knowledge? What are the limitations of this knowledge? Science How do people create scientific knowledge? How do people change or modernize this knowledge? How do people use this knowledge? What are the limitations of this knowledge?
3	Case Study 1: Indigenous Plant Classification and Nomenclature-material culture (food, medicine and plant technologies). Folk and scientific taxonomies-compare and contrast. Themes: Traditional taxonomies are informed by the understanding that plants are interconnected with each other as well as with animals. It is an artificial distinction to break plants into small compartments. A more functional understanding of plants is to recognize that in fact plants exist in a set of relationships with other plants and animals. It is critical to work to preserve the link between plants and animals since if you destroy the link you destroy plants and animals.
4	Case Study 2: Reconceptualizing Ecological Knowledge as a Dynamic Process – The Case of the Pine Mushroom Industry in North West British Columbia. In this case study students are presented with information from a contemporary ecological and economic practice and asked to compare it with traditional ecological practices. A key theme is that 'traditional' ecological knowledge is constantly changing and developing in response to change, in this particular instance economic factors.
5	Case Study 3: The Smallpox Epidemic of 1862 on the North Coast of British Columbia. This unit present data and case material so that students can understand the social consequences of global environmental events, such as viral epidemics.
6	Case Study 4: AIDS and its impact on Canada's Indigenous Populations. This case study compares the smallpox epidemics of the late 1880s and the HIV pandemic tin Canada and Africa.

Lesson 1

Starting With What You Know: The Search for Meaning

Materials

- Video Clips of TV survival shows
- Blackline Master 1-1, The Search for Meaning: Hunters and Gathers, page 14
- Maps—school, community, city and global
- Colour flags to attach to push pins
- Atlases

Major Understandings

1. Traditional Ecological knowledge (TEK) is the product of a society's interaction with its environment.
2. Aboriginal people rely upon TEK to provide food, medicine and shelter as well as an understanding of the natural world.
3. Hunter-gatherers commit to memory vast numbers of facts about their territories and the creatures in those territories.
4. Elders are of special importance in these societies. Elders have the responsibility of passing on their knowledge and experience to the next generation.
5. TEK and science share and make use of long-term observations of natural phenomena in order to draw conclusions about how nature works.
6. While scientists search for meaning, they do not necessarily search for truth (at least in the absolute sense). Rather, the scientist looks on scientific theories as tools, which are increasingly larger generalizations. A scientific tool is truth only as long as it is an effective tool.

Introduction

In your everyday life, whether you like it or not you are involved with making decisions, with perception, with logic. By becoming aware of the basic assumptions of each of these areas, you're better prepared to get along in your community.

There are many ways in which people look at the world around them and try to give meaning to it. Science and traditional ecological knowledge are two examples of ways of knowing. For example, the scientist has a unique aim and goal to his or her work, a unique way of gathering data, and a unique way of checking the data.

Members of a community have distinctive types of knowledge about natural phenomena and resources found within their land base. For example, some people know how to use the resource (application), others know where to find the resource (setting), and still others may have wider knowledge about the resource. Each of these types of knowledge about the resource and natural phenomena can be thought of as a particular way of knowing.

Suggested Activities

1. Are you a hunter-gather or a farmer? How much territory do you occupy and know?

- Begin with video footage of two popular survival game shows-Earthquest and Survivor 2. Make explicit to students the two contexts in which these two survival games function: hunter-gatherers and farmers. For example, in the Earthquest competition, four people attempted to survive for a year as farmers. In contrast, Survivor 2 had 16 contestants attempting to function as hunter-gathers for three months.

- Ask students to speculate how well these two game show competitions and contestants would get along with each other and function if they had to co-exist in the same space. Some questions to ask students are
  - How would the hunter-gathers respond to the presence of livestock (chickens and pig) kept by the farmers?
  - How would the farmers secure the necessary space to plant their crops and gardens if the hunter-gatherers are using the space for harvesting and hunting?
- Provide students with 3 maps: school, community and city. Have students trace and outline the route that they travel as they go about their daily activities. Some of these activities should be educational, cultural, spiritual and recreational. Have students mark on all the maps all of the resources that they use. Remind students to include the educational and community resources that they use, for example libraries, computer labs, bookstores, and sport facilities.
  - Prior to beginning the mapping activity brainstorm with students to help them start thinking of their resource use patterns. In a think, pair and share activity have students discuss some of their ideas with a classmate and then share their thinking with the entire class. Discuss with students the following questions: 1) what are their various needs? and 2) how are their needs met? Have students record on their maps the answers to those questions. Have students think about what their resource needs will be in 10 years time. Using different colored pens, have students record the community resources that they anticipate using in the future.
- Students should present their finding back to the class. As students present their findings, encourage students to evaluate how well the environment meets their spiritual, physical, educational and emotional needs.

2. Global and Local Resources—Mapping

   <u>Gathering the data</u>:

   Have students inspect the garment-care tags found in their clothes, book-bags, backpacks, shoes etc. Have students record the country where the various items were manufactured. Using an atlas, have students note the distance the item in question had to be transported, i.e. from the site of manufacturing to the student. Have students record the country on a pin with a small flag attached to it, next attach the pin onto a global map (all students should mark on the same map) the location where the item was made. Tabulate the data for the class. Have students calculate what percentage of the material they use is made in Canada and what percentage is made outside of Canada. Have students make special note of any items or clothing that were made at home or within their community. Discuss with students the change in consumption patterns over a three-generation time span. Changes in use patterns between the generations should be highlighted and the reasons for change noted. Point out to students that on average the food that they eat, such as soft drinks, potato chips, apples etc., has traveled approximately 2000 km from the point of manufacture to the point of consumption.

- Have students interview their parents and grandparents with the goal of determining where the items their parents and grandparents wore and used as children were made. Students should present their findings to the class. Again, have students mark on a map, use a different color of flagged pins, the information gathered for their parents' and grandparents' generations.

<u>Understanding the data:</u>

Lead a class discussion that focuses on the change in resource use between current and past generations. See Blackline Master 1-1.

<u>Sharing and presenting the data:</u>

Have students map on a community map the areas where local food and cultural materials are gathered. For example, students could indicate if their families have gardens, gather berries and/or harvest food resources. Encourage students to pay particular attention to energy, water, aesthetic and spiritual resources that are used in their environment. For example, students could question their families about what they find pleasing or spiritually significant in their environment.

- Students should present their finding in a pamphlet or poster format. Alternately have the class create a montage of images that illustrate and highlight the locally available resources. In addition, have students create a key or legend that provides the following information: when and to whom the resource is available, restriction on use of the resource, ceremonial purposes, how the resource is harvested and distributed.
- Together with the teacher, have students generate the criteria for an assessment rubric.

The Search for Meaning: Hunters and Gatherers

- For hunter-gatherers the hunt is something other than just hunting; hunting is part of a vitally important relationship.

- Hunter-gatherers depend on the animals and the animals allow themselves to be killed. An animal's agreement to become food is secured through the respect that hunters and their families show to the land in general and to the animals in particular.

- In the immense landscape of their territory, the hunter-gatherer carries knowledge and techniques that they have accumulated over many, many generations.

- They also accumulated information about hunting and gathering techniques and about events that throw light on the applications of these techniques.

- Hunter-gatherers must store a vast number of facts about their territories and the creatures in those territories.

- They use songs and stories to make the memorizing of all this knowledge possible.

- Elders are of special importance in these societies, if only because it takes a lifetime to learn all that needs to be known. "Elders have the task of passing on their knowledge and experience with the necessary attention to detail, variety and overall coherence" (Hugh Brody, *Other Side of Eden: Hunters, Farmers and the Shaping of the World,* Douglas & McIntyre, 2000, Vancouver).

Lesson 2

Two Ways of Knowing
Traditional Ecological Knowledge and Scientific Knowledge

Materials
- Blackline Master 1-2, Traditional Ecological Knowledge, pages 17-18.
- Blackline Master 1-3, Scientific Knowledge, pages 19-21.
- Blackline Master 1-4, Understanding TEK, page 22.
- Blackline Master 1-5, Understanding Western Science, page 23.
- Blackline Master 1-6, Scientific Models, pages 24-25.

Reference
Berkes, Fikret. (1999). Sacred Ecology Traditional Ecological Knowledge and Resource Management. Taylor& Francis, Ann Arbor MI.

Major understandings
1. TEK can be understood as a code of ethics governing appropriate human and environmental relationships.
2. TEK is important for biological and ecological insights, environmental assessments as well as resource management.
3. TEK is a cumulative and dynamic body of knowledge, practice and belief.
4. TEK plays an important role in cultural sustainability.
5. TEK and science are created, modified and communicated according to distinct cultural and historical principles.
6. In many traditional cultures nature is imbued with sacredness.

Suggested Activities
Students will read, discuss and investigate how different types of knowledge, TEK and science, are created, changed, and shared.

1. Opening Activity: "Broken Telephone"
   Have students stand in a semi-circle. Select one student at the end of the line to invent and then whisper a 'secret' message to the person beside them. In turn, have each student receive and transmit the message, until every student has heard the message. Compare the final message with the original. As a class brainstorm and list how and why the message may have changed. Have students consider the following questions:
   - How was the message transmitted?
   - Were there any checks on the message to make sure that it was not being changed?
   - Is it a problem if the message changes?

   Point out to students that all information, be it casual hallway conversations, science or TEK, is shared, modified and used according to a unique set of principles.
2. Divide the students into groups of 3 or 4. Assign each group a research topic in either the TEK or science categories. See Blackline Masters 1-4 and 1-5. Provide each group with one section of information on either TEK or science. Have students research (using print, video, and electronic resources) and prepare a brief report on TEK or science.
   - Each report should be presented back to the class. Students should be prepared to answer questions from their classmates. Each report should include both the strengths and potential drawbacks of their topic. As students report back, have the rest of the class use the outline pages to note a brief summary for the sections that they did not report on. In this

way students make notes of the information being presented back to them. Students should post the finding so that the reports are available to all of their classmates.

3. As a class, brainstorm about all of the meanings of the word "model." For example, have students compare and contrast a toy with a scientific model. Have students, complete the 'Scientific Models' sheet, and see Blackline Master 1-6. For suggested responses, see page 26.

Traditional Ecological Knowledge

TEK begins with local knowledge at the level of the taxonomic systems, that is, specific environmental knowledge.

→

This then proceeds to an understanding of the processes or functional relationships, that is, knowledge of ecosystem relationships.

→

This in turn leads to institutional knowledge, that is, a code of ethics governing appropriated human/environmental relationships.

1. Overview:

TEK is increasingly studied by western science since it is understood that an understanding of TEK is critical for:

- Biological information and ecological insights
- Resource management
- Conservation of protected areas
- Biodiversity and conservation
- Environmental assessment
- Social development
- Environmental ethics

Finally, TEK is consistent with major concern of our times—how human beings can develop a more acceptable relationship with the environment that supports them.

2. What is TEK?

- TEK can be understood as a cumulative body of knowledge, practice and belief.
- TEK is the outcome of complex interactions between a culture and a natural environment.
- TEK both directs the relationship of indigenous people with the natural environment and is enhanced by this relationship through traditional practices.
- TEK is more than empirical local observations of land and landscape. TEK includes a system to organize observations and initiate action.

3. How do people create TEK?

- Local knowledge is gained from astute observations of local environments and the internalization of detailed local knowledge about local topography, climate and resources, biotic and abiotic characteristics, animal and plant life cycles and other environmental features.
- Knowledge is developed through everyday experience in activities such as harvesting, traveling, searching and hunting and through individual observation and training. Knowledge is consolidated and communicated through historical sharing of stories song and dance.
- Information and knowledge is passed on from generation to generation and the critical role of elders in first nations societies in maintaining and communicating TEK is a recurrent theme.

4. How do people change or modify TEK?

- TEK is transformed as it is removed from its original context.
- TEK may be co-opted in the name of resource and land management decisions that do not necessarily serve first nations interest.
- Over time knowledge encoded in various forms is communicated from generation to generation and is augmented with new contemporary information.
- This results in detailed images of land, descriptions of changes in the environment over time and explanation of such changes.

5. How do people use TEK?

An understanding of TEK is critical for:

- Biological information and ecological insights
- Resource management
- Conservation of protected areas
- Biodiversity conservation
- Environmental Assessment
- Social Development
- Environmental ethics

An initial application of TEK is the survival of culture. TEK plays a critical role in cultural sustainability.

Indigenous people implement the principles of sustainability for their survival and local knowledge accumulates as a culture strives to meet goals of survival in a particular ecological setting.

Local knowledge often describes symbiotic relationships between people and animals and the ability to make life-sustaining decisions about how to relate to the environment.

TEK informs peoples understanding of their place.

TEK encompasses spiritual relationships with the natural environment and the understanding that the elements of matter have a life force.

The relationship (of the people and their land) is not one of stewardship, which implies a certain inequality of the participating parties, but is one of mutualism. The land takes care of the people, who in turn, through their respect and use of the resources, take care of the land and enable the cycle to continue.

6. What are the limitations of TEK?

While there may be the knowledge of how to use a specific plant, there is no specific knowledge about nutrient content and specific active ingredients.

TEK is based on experience and is therefore local knowledge. Thus, TEK is most insightful and potentially useful in resource management applications at the local site.

TEK includes systems of classification and systems of self-management and thus is like any other knowledge system, inseparable from a cultural and philosophical basis.

The body of knowledge is reflective of where people go on the land and the subsequent sharing of information within the community to provide a synthesis describing the environment.

Scientific Knowledge

1. What is scientific knowledge?

Man creates scientific theories, he does not find them like a prospector finds gold.
A scientist makes a number of basic assumptions when he creates a theory.
From observations comes laws, hypotheses or theories, using the logic of induction.
From laws, hypotheses or theories comes predictions of what should happen, using the logic of deduction.

- Logic of induction:
  Observations give rise to laws and hypothesis and theories give rise to predictions
- Logic of deduction
  The aim of science is different from other areas like technology, logic and religion.

2. How do people create scientific knowledge?

The mental tools of the scientist:
Doing science like a scientist is like playing a game. You 'win' at the game of science when you further satisfy your own curiosity and the curiosity of other scientists. Satisfying their curiosity about any part of the universe is the major aim of science. In other words you 'win' at the science game by:

- Proposing an imaginative theory
- Proposing a new law about some part of the universe.
- Or creating a hypothesis, which leads to new kinds of experiments.

Like all games, you have to know a lot of details. In science the details are 1) facts 2) theories 3) laws and 4) problems. You have to know the facts/theories/laws/details before you can expect to win.
To learn many of the details a person usually studies science for several years at a university.
However, there is something else about games. Games have general rules, which every player must follow. So does science. But it is not true that you have to know lots of facts/theories/laws/problems before you can learn the rules to the game called science.

Many of the main/important ideas you learn in a science class are simply the rules of science.

- The scientist observes and from the process of observing attempts to form principles that can explain the observation.
- Principles are sometimes gathered into a theory, which can give a pattern to a part of nature, a meaning to part of the universe.
- The scientist searches for meaning but not necessarily the truth, at least in the absolute sense.

Scientific models

- Are a mental picture or a physical representation of a theory.
- Models behave in ways like we imagine the real thing behaves.
- The model does not duplicate objective reality.

Objective reality→[perception]→observations→[imagination]→theory→[imagination]→model

3. How do people change or modify scientific knowledge

Scientific Theory: A concise explanation of a scientist's view of some part of the universe.

After a hypothesis has been tested and has been shown to be very useful it is considered to be a theory. A theory is a hypothesis in which scientists have high degrees of faith.

Hypotheses and theories are similar kinds of statements.

Theories:

- Try to explain things-those things scientists are curious about, and in a way that shows cause/effect relationships.
- Are created by a scientists' imagination based on the result from repeated experiments.
- Have several assumptions, often not mentioned in the statement of the theory.
- Are useful in: 1) explaining what you have already observed; 2) suggesting further experiments you never thought of doing before; 3) making predictions about future observations and events; 4) will be changed (altered or replaced when new observations cannot be explained by them).

In science you do not "prove" theories to be true. After all, theories (as well as hypotheses and laws) will always change.

Scientific ideas are tentative.

Theories can be useful in explaining, in suggesting further experiments and in making predictions.

The better the theory the make useful it is.

The scientist looks at a theory as a tool with which s/he may be able to make increasingly larger generalizations.

A theory is truth only as long as it is an effective tool.

Most scientific theories replaced earlier theories and they in their turn will likely be replaced by other theories that give a more complete picture of nature.

3. How do people use scientific knowledge?

Scientific Observation:

Scientific observations are usually reported in a scientific journal.

Other scientists interested in the observations always verify them.

The original observations are not accepted by a group of scientists unless these observations have been independently verified.

In science, an observation is not an observation unless a group of scientists agrees with it.

4. What are the limitations of scientific knowledge?

When you observe something happens - you perceive it.

A scientific observation is not necessarily any better than a personal observation.
Both have their own meaning. But you must remember to use both in a different way, that is, in a different way of knowing (toward different aims).

From the way of knowing called science, one of the rules of the game is that observations must be verified (repeated and agreed upon).

Remember, scientific observations describe what you see, hear, taste smell or feel.
Scientific observations do not explain anything. When a scientist creates a hypothesis to explain something s/he suggests a cause (a reason for why something came about or occurred) for what events s/he observed.

His/her basic assumption is that all events have causes. Therefore, in science to explain something you suggest a cause for it.

Outline for Understanding Traditional Ecological Knowledge

Name:____

Names of group members: ____

Date: ____

After reading the section assigned to your group work together to complete each section of the form. Each person in the group must contribute information to the outline. Be prepared to share your findings with the rest of the class.

HOW DO PEOPLE CREATE TEK?	HOW DO PEOPLE CHANGE OR MODIFY TEK?
HOW DO PEOPLE USE TEK?	WHAT ARE THE LIMITATIONS OF TEK?

Outline for Understanding Western Science

Name:____

Names of group members: ____

Date: ____

After reading the section assigned to your group work together to complete each section of the form. Each person in the group must contribute information to the outline. Be prepared to share your findings with the rest of the class.

HOW DO PEOPLE CREATE SCIENTIFIC KNOWLEDGE?	HOW DO PEOPLE CHANGE OR MODIFY SCIENTIFIC KNOWLEDGE?
HOW DO PEOPLE USE SCIENTIFIC KNOWLEDGE?	WHAT ARE THE LIMITATIONS OF SCIENTIFIC KNOWLEDGE?

Scientific Models

Name: ____________________

Date: _____________________ Subject: ____________________________

1. If scientists change a theory about how something in the natural world works or operates what happens to their model?

2. If we were to compare a scientist with an artist, in what ways is the scientist more limited when using his imagination in creating a theory than the artist when he uses his imagination in creating a sculpture?

3. Briefly explain how each of the following is a mental tool for the scientist:

OBSERVATION:

SCIENTIFIC QUESTION:

HYPOTHESIS:

THEORY:

MODEL:

4. What is a scientific theory?

5. Describe the process whereby scientific theories come into existence?

6. What human trait or characteristics are most helpful to someone creating a scientific theory?

7. What must a scientist base his theoretical ideas on?

8. List 3 different ways in which a scientist uses his or her theory.

9. List 3 things about a scientific theory that are used when deciding if the theory is a useful one.

Scientific Models: Suggested Responses

1. If scientists change a theory about how something in the natural world works or operates what happens to their model? *Models change because models are mental pictures or physical representations of a theory. The model behaves like we imagine the real thing behaves. If ideas about how the world operate change so do the models.*
2. If we were to compare a scientist with an artist, in what ways is the scientist more limited when using his imagination in creating a theory than the artist when he uses his imagination in creating a sculpture? *Artist-anything goes. Scientist-theory has to bear some relationship to reality.*
3. Briefly explain how each of the following is a mental tool for the scientist:

Observation: *Careful observation leads to scientific questions.*

Scientific question: *A question that can be answered using scientific problem-solving; a scientific questions may suggest a hypothesis, which can be tested.*

Hypothesis: *Observing, questioning, predicting and experimentation leads to an explanation for observations that can be tested with an experiment.*

Theory: S*cientists construct and propose theories to explain what they have observed. Because these theories rely on experimental evidence, it is not unusual for the theories to change as more evidence is gathered.*

Model: *Is an object, diagram or idea that helps understanding*

4. What is a scientific theory? *Useful mental tool for a scientist*
5. Describe the process whereby scientific theories come into existence.
Theories are created to explain how nature works and is organized. Scientific problem- solving typically begins with a question. Recall that careful observation lead to scientific questions. Questions help the scientist make predictions about what will happen in similar situations. Predictions from scientific questions can be tested with experiments. If the prediction is supported by the experiment, the scientist will attempt an explanation. If this proposed explanation has wide ranging applicability and utility it may become a theory.
6. What human trait or characteristics are most helpful to someone creating a scientific theory?
Curiosity and imagination about how nature works are two important traits that help scientists develop scientific theories.
7. What must a scientist base his theoretical ideas on?
Data, gathered from scientific experiments supports a theory. Data do not prove a theory.
8. List 3 different ways in which a scientist uses his or her theory.
a. For explaining observations; b. For suggesting further experiments; c. for predicting future observations
9. List 3 things about a scientific theory that are used when deciding if the theory is a useful one.
a. How limited or valid is/was the scientific knowledge on which the theory is based?
b. What are the limitations on the theory due to a scientists imagination or background?
c. Was only a limited amount of data used to create the theory?

Lesson 3

Case Study 1: Indigenous Plant Classification and Nomenclature

Materials

- Blackline Master 1-7, Why Classify? page 30.
- Blackline Master 1-8, Biological Classification, page 31.
- Blackline Master 1-9, Aboriginal Plant Use, page 32
- Blackline Master 1-10, Vegetation Zones, page 33.
- Blackline Master 1-11,Gitxsan Classification, page 34.
- Blackline Master 1-12,Gitxsan Dominant Life Form Groupings, page 35.

References:

Johnson, Leslie Main. (1999). Gitxsan Plant Classification and Nomenclature. Journal of Ethnobiology19(2): 179-218.

Schiebinger, Londa. (1996). The Loves of Plants. Scientific American February 1996.

Turner, Nancy, J. (1995). Royal British Columbia Museum Handbook Food Plants of Coastal First Peoples UBC Press. Vancouver BC.

Major Understandings

1. Gitxsan plant classification makes use of both how the plant looks and is used.
2. Gitxsan classification is hierarchal.
3. Three main life form groupings are used, (trees, plants, berries). There is overlap between the plant and berry groups.
4. Aboriginal classifications do not create divisions. Because plants are interconnected, it is an artificial distinction to break plants into groups.
5. Plants exist in a set of relationships with other plants and animals.
6. TEK tends to have a large moral and ethical context—there is no separation between nature and culture.

Introduction

- Aboriginal classification systems are not a "unified abstract whole, but a mixture of partial classifications built for different purposes and using a diverse criteria, prominently including utility" (Johnson 1999:212).
- Binomial terms and sub generic taxa are very weakly developed as is common in classification systems of foraging cultures (Johnson 1999).
- Plant taxonomy is shallow, that is plants are not grouped according to Kingdom, phylum, class, order etc. The Gitxsan have no equivalent label to the broad categories of Kingdom and flora forms.
- Some of the major plant groupings are utilitarian.
- Plant grouping overlap, for example 'plants' and 'fruit' bearing species.
- There is not a focus on reproductive parts for classification .
- Small and undifferentiated life forms (mosses, fungi, lichens, and graminoid plants) are under differentiated in comparison to scientific taxonomies. "This results in so called "empty life forms". These are taxonomically diverse groups (in scientific classification) of ecological importance and distinctive habitat, but which contain few or no named subdivisions in the indigenous taxonomy" (Johnson 1999:211).
- Morphology is a fundamental basis of classification.

Suggested Activities

1. Have students work in groups to make a transect survey study of the living material in their schoolyard, local park or nearby field.

- In a transect study, a particular habitat is investigated to find out what animals and plants live in the habitat. A transect survey is one way of quantifying and qualifying the types of flora and fauna that live in a specific habitat or ecosystem. For example, the type and number of plants and animals living along the edge of a drainage ditch can be determined using a transect study. To begin, the boundaries for the transect are decided upon and laid out. For example, one type of transect uses a small square frame, approximately 30 cm by 30 cm, to define the boundaries of the area to be surveyed. The square frame is placed at set intervals along a determined transect route. Any plant or animal that falls within the square frame is classified and counted. Finally, species are collected, identified and counted.

2. Have the class compile a list of the animals and plants that were found using the transect survey. Have students use field guides and taxonomic keys to identify the flora and fauna. Have students record and share their finding with interested community members, nature club members, or scientists.

- The findings of this exercise can form the basis of an analysis of the biodiversity of the area and region. Furthermore, survey results can be used as a benchmark for comparison with subsequent survey data. Transect survey data can be compared with results from previous class studies. In this way, it is possible to track and monitor changes in species composition in a particular habitat. Finally, this information can provide researchers and people living in an area with valuable information about the type of plants and animals they can anticipate finding in similar habitats within their region, see Blackline Master 1-10 Vegetation Zones, Northwest Coast.

3. Discuss with students how their findings relate to their bio-geo-climatic zone. Transect survey results are an ideal way to assist students to focus on the changes in species composition as it relates to forest age, old growth versus disturbed, and resulting ecosystem complexity.
4. Discuss the reliability of the data collected via transect survey methodologies. Consider how useful the gathered information is for making projections about the total number of species in an ecosystem. Discuss with students and brainstorm solutions to problems such as clumped or patchy distribution of organisms. Remind students that transect studies may overlook certain organisms and over-collect others. Remind students of the

need to take care to gather sufficient data to ensure the reliability of survey results; science is repeatable. Discuss with students the tradeoff between time available for collecting data and the subsequent reliability of the sample; this highlights how science involves tradeoffs between time and research costs.

4. Provide students with a copy of 'Gitxsan Dominant Life Form Groupings', see Blackline Master 1-11. Using pictures or plant samples, model for students how the Gitxsan classify plants. Review with students how Gitxsan and taxonomic classification is done. Have students work together to classify different plant samples according to the principles of Gitxsan and taxonomic classification. Discuss with students the similarities and differences between these two methods of classification.
5. Have students interview a family or a community member about the plants and animals that they know and use either for food, medicine, spiritual or cultural purposes. Have students research how the plants discussed, their type and number, vary depending on time of year and location.
6. Have students prepare a taxonomic chart of the classification scheme used by the person they interviewed. Have students defend the choices they made and orally describe the basis on which they organized the interview data for the purpose of constructing the taxonomic chart. Students' charts may focus on the diversity of the plants found in the environment, or the relationships between the person, plant and environment. Have students record and describe the basis on which the relationships between the plant/animal and environment was established, i.e. harvesting, hunting, cultural or aesthetic use. For example, what was the rationale used for each category and what criteria was used to differentiate among categories? Was form or function more important? Were other criteria used?
   - Compile the charts into a booklet and share the information with community members. Discuss with students the strengths, difficulties and differences in classifying plants and animals using folk and scientific classification methodologies.
7. As a concluding activity, have students compare and contrast the transect study and interview data results as a means of learning about ecosystems and habitats.
   - Have students compare their own knowledge about the plants and animals in their environment with a family or community member that belongs to a different generation.

Scientific Classification: Why Classify?

- Taxonomy is the system of naming living things and classifying them into groups.
- Classification is done to keep track of living things. To work with the diversity of life we need a system of biological classification that names and orders organisms in a logical manner.
- Biologists classify things into groups. More than 2.5 million kinds of organisms have been classified.
- Biological classification systems have two important features: 1) they assign universally accepted names to each organism; 2) they place organisms into groups that have real biological meaning. For example, scientists expect members of each group to share important traits.
- Members of the same group are alike in certain important ways.
- Linnaeus (in 1735) developed the first taxonomy system that is still used today. He grouped organisms according to structures or what they looked like. Now taxonomists (scientists who classify living things) consider other things as well. For example, taxonomists consider cell organization, chemical make-up and ancestors.
- Today taxonomists identify species on the basis of a common gene pool.
- Taxonomy and evolutionary relationships highlight that living species evolved from earlier ones. Species shown to be closely related are classified together. Other species that may look alike but possess analogous structures only are classified in different groups.
- Biological classification uses binomial nomenclature. Each organism is given a two part scientific name. The first part of the name is the genus name. This is the group name. It is Latin and therefore italicized. The second part of the name is the species. For example: *Tricholoma magnivelare* (pine mushroom)
- Plants and animals are sorted into three main groups that are called kingdoms.
- The three kingdoms are animals, plants and protists (members of the protists are considered to be an odd-ball group since they are not clearly plants nor animals).
- Linnaean classification is hierarchical. Plants and animals are grouped into to increasingly similar groups.
    - Kingdom
    - Phylum
    - Class
    - Order
    - Family
    - Genus
    - Species
- As one travels down the groups the members will have more traits in common, that is, the plants and animals begin to look more alike.

BIOLOGICAL CLASSIFICATION

Name:___________________________

Date:____________________________ Subject:_________________

1. What are two important features of biological classification?

2. What is binomial nomenclature?

3. What is the function of classificatory schemes?

4. What feature of organisms did Linnaeus use to group organisms into groups?

5. Today what feature of organisms do taxonomists use to classify organisms?

6. Linnaean classification is _________________________. Plants and animals are groups into

_____________________________similar groups.

7. Make up a mnemonic device (a memory aid) to remember the order for placing organisms into groups. Kingdom, Phylum, Class, Order, Family and Genus.

Plant Use: Northwest Coast Cultural Area-Aboriginal Classification (Gitxsan)

The Role of Plants in aboriginal cultures. The information on plant use is from the people of the northwest coast. These people have in common many cultural characteristics such as 1) a fishing and water-oriented economy and 2) the use of Pacific Red Salmon and Western Red Cedar trees.

- That aboriginal people were able to survive and in most cases thrive on a diet of wild plants as well as animals is a "tribute to their ingenuity and industry" (Turner 1995:1).
- Indigenous people had a detailed knowledge of local flora. Increasingly there are fewer and fewer people alive today in aboriginal communities who retain detailed knowledge of plant usage, for either food or medicine.
- Aboriginal people used over 200 species of plans for food, medicine and other purposes.
- The basic food groups include fruits (typically berries), green vegetables (sprouts, leaves and seaweeds), underground parts of plants (especially roots, bulbs, tubers, rhizomes and cambium from the inner bark tissues of certain trees. Today berries and seaweeds are still consumed by Northwest coast nations. Other foods are not used because they are time-consuming to harvest; thus they are not as convenient as commercially available vegetables.
- The traditional diet of the Northwest Coast people was mainly fish, shellfish and sea mammals. Therefore, none of the plants consumed were considered dietary staples; however, during critical times of the year certain plants were an important part of the diet. Furthermore, the "nutritional diversity provided by native plants was an important factor in determining the population size of the northwest coast peoples (prior to European contact). Prior to European contact the population of the northwest coast region was estimated to be 100,000. This was "the densest aboriginal population of any region in Canada" (Turner 1995:9).
- In early spring, aboriginals made extensive use of bulbs and shoots because at this time of year these were the only foods available. These foods were also a change from the monotony of the winter diet.
- Interest in traditional plant use has increased as a result of: 1)growing concern for and interest in the health of the environment of the province; 2) a greater concern for using native species in gardening and landscaping. Native species typically require less water and are better adapted to the local growing conditions; 3) wild plant foods have potential value as non-timber forest products and as wild edibles; and growing interest in outdoor survival skills.

Vegetation Zones, Northwest Coast

The major vegetation zones (biogeoclimatic zones) of the aboriginal people of the northwest coast

Coastal Douglas Fir Zone

Location of	East ward side of Vancouver Island, the Gulf Islands and the lowland areas the adjoining mainland
Climate the	Relatively dry, especially during July and August . Precipitation is mostly in form of rain-65 to 150 centimetres per year.
Major Land Forms	Mountains and Valleys
Typical Plant Life Forms	Trees: Douglas-Fir, Pacific Madrone (Arbutus Menziesii), Garry Oak, Lodgepole Pine, Grand Fir, Broad Leafed Maple and Red Alder. Plants: Blue Camus, acorns (Garry Oak), Chocolate Lily bulbs, Sticky Gooseberries, Red-flowering Currents and Blue Elderberries.
Typical Animal Life Forms Northern	Mammals - mule deer, marmots, cougars, coyotes, harbour seals and and Californian Sea Lions; reptiles and amphibians and birds. This region sup ports the largest diversity of birds in B.C.

Coastal Western Hemlock Zone

Location	Western side of Vancouver Island, the Queen Charlotte Islands, the main land of the Strait of Georgia-above 90 meters elevation-i.e. the area above the Coastal Douglas Fir Zone; and northward along the entire mainland coast below a range of about 1000 meters in the south and 300 meters in the north.
Climate	Average annual precipitation of 165 to 665 centimetres.
Major Land Forms	Mountains and valleys
Typical Plant Life Forms	Trees: Western Hemlock, Western Red Cedar, Sitka Spruce, Silver Fir and Red Alder. Plants: High-brush Cranberries, Indian Rice (Rice Root), Bunchberries, Oval leafed and Alaska blueberries.
Typical Animal Life Forms moun-	Water birds, such as sooty shearwater, jaegers, Mammals: mule deer, tain goats, black bears, wolves, cougars and sea otters.

Mountain Hemlock Zone

Location	Occurs above the Coastal Western Hemlock Zone at the sub-alpine elevations (between 900 and 1,700 meters in the south and between 300 and 600 meters on the Alaskan Panhandle).
Climate	Average annual precipitation of 180 to 430 centimetres; this is mostly in the form of snow. At the higher elevations snow cover lasts until mid summer.
Major Land Forms	Mountainous Terrain and Valleys
Typical Plant Life Forms	Trees: Mountain Hemlock; Yellow Cedar and Silver Fir. Plants:
Typical Animal Life Forms	Mammals- mountain goats, moose, black bears, river otters, marmots, mink, and weasel. Reptiles – newts and salamanders. Amphibians – red-legged frog.

Gitxsan Classification

The Gitxsan use a hierarchical classification of plants. The broad categories equivalent to kingdom and flora forms, are not labelled. Several broad groupings of the "life form sort" are recognized.

There are three dominant life-form groupings. Each of these life-form groups is made up of labeled plant types (refer to Blackline Master 1-12):

1) *gin* 'trees' (approximately 15 types)

2) *sgan* 'plants' (approximately 26 types)

3) *maa'y* 'berry' or 'fruit plant' (approximately 26 types)

Plant types are understood to represent or correspond to the species and /or genera of the scientific botanical classification system. They include a diverse mixture of forms ranging from small trees to some perennial herbs and prostrate sub-shrubs. Note that the 'plant' and 'berry' groups overlap extensively.

There are also residual taxa which have few or no named subtypes. Note that these include morphologically and taxonomically diverse forms:

4) *habasxw* 'grass' or 'hay';

5) *yens* 'leaves' or 'herbaceous plants'-small and inconspicuous plants, typically describes herbaceous ground cover or undergrowth. Many herbaceous plants are not differentiated, but are unnamed or subsumed in broad categories like 'flower' and 'grass' and 'hay'.

6) *majagalee* 'flowers'-conspicuous in season

7) *umhlw* 'moss'-includes all the terrestrial and aquatic or wetland mosses

8) *gaydats'uuts* 'fungi'-includes the fleshy fruiting bodies of basidiomycetes and some ascomycetes and "conks" (bracket or shelf fungi).

"The empty major plant categories are ecologically important groupings of plants of distinctive morphology which are of little economic importance." (Main Johnson 1999;190).

Fungi seem to be peripheral to the concept of 'plant' and are not similar to any other types of plant. This reflects an understanding of the distinct biology of fungi. Note that this is similar to the scientific classification of fungi as a separate kingdom, of equal rank with 'plant' and 'animal'

Binomial names like 'red alder' are extremely rare.

" A mixture of morphological and utilitarian characters seem to underlie the system of plant classification" (Main Johnson 1999:179).

Morphology in all ethnobiological classification systems is a fundamental basis of classification. Morphology and utility are thus intertwined.

Aboriginal classifications do not create divisions which are seen as being artificial. Plants are seen as somewhat interconnected; therefore, it is an artificial distinction to break plants into groups.

Aboriginal people recognize that plants exist in a set of relationships with other plants and animals. To break the link between these relationships is to work against their understanding that you must preserve the link. If the link is destroyed the rest is destroyed.

Researchers who catalogue TEK must work with a "small speech community and memory ethnography. In such instances the "possibility of idiosyncratic terms or referents cannot be ruled out" (Johnson 1999:204). This is because TEK is held within the memories of elders. The information is known in the native language. This results in variation in TEK.

Gitxsan Dominant Life Form Groupings

Plant Group	Trees-'trees'	Sgan-'plants'	Maa'y-'fruit-bearing species'
Description	Plant types that are tall and woody	Plant types that range from small trees to both large and small shrubs. Taxa in this grouping overlap extensively with the 'berry group'. For example, most or perhaps all 'berries' are all plants.	Plant types that all have (edible) fleshy fruits, "berries".
Characteristics	Taller than people, large size and quality of woodiness		Berries are a key identifying characteristic of plants which are not trees. Edibility or inedibility of the berries is of high cultural significance.
Uses	Food, medicine and technologies	Food, medicine and technologies	Food, medicine and dyes (pigment source).
Naming of sub-types	Many tree names take the form 'good for _____'. An example is, cottonwood is *am mal* 'good for canoe.'		The berry grouping has the largest number of named types. This group is focused on edible fruits; plants with inedible berries are peripheral members of the class.
Additional Information			The importance of berries in the diet of indigenous people is evident in the classification system. Fruit bearing plants are important enough to warrant their own group.

Lesson 4
Case Study 2: Reconceptualizing Ecological Knowledge: The Pine Mushroom Industry in Northwestern British Columbia

Materials

- Blackline Master 1-13, The Pine Mushroom Industry, Northern BC, page 39.
- Blackline Master 1-14, Local Ecological Knowledge of Mushrooms, page 40.
- Blackline Master 1-15, Summary of the Pine Mushroom Industry and TEK, page 41.

Major Understandings

1. TEK is a fluid body of knowledge that is changed and modified according to the needs of its users.
2. TEK is an integral part of the local culture and management prescriptions that are adapted to the local area.
3. Pine Mushroom harvesting is an example of how TEK changes. TEK is not static and locked in the past. Rather, it is dynamic knowledge. This knowledge has potential economic value.
4. TEK is created from locally specific interactions between people and their surrounding environment in the context of their everyday subsistence and livelihood practices.
5. TEK is the knowledge that hunters, fishers, and gatherers use to locate, collect and where markets and exchange networks exist, to sell, trade and/or barter their products.

Background

North West British Columbia Pine Mushrooms

- A better understanding of the fluid nature of TEK is gained by exploring the British Columbia pine mushroom commercial harvest. The pine mushroom industry highlights how the pine mushrooms have switched from a minor plant item (noted but rarely consumed) to a major cash harvest.
- The Nisg̲a'a treaty (signed in August of 1999) explicitly mentions mushroom picking areas and the Nisga'a Liisms Government has been engaged in establishing management policies governing Nisga'a Treaty Lands and surrounding territories.
- The pine mushroom harvest demonstrates how local ecological knowledge has altered and changed as the Gitx̲san and Nisga'a adapted to new economic conditions. This has occurred in the setting of customary land use patterns.
- The pine mushroom industry in the Gitx̲san territory highlights TEK as a culturally specific product that results from real material process by which actual communities and individuals derive their sustenance and livelihood.
- It is important to point out that despite the Nisg̲a'a's ability to regulate harvesting practices within their treaty lands, the effective economic control of the pine mushroom industry is maintained by a small group of industrial resource processing firms.
- The pine mushroom case study highlights the changing nature of TEK. TEK is not static and locked into the past. Rather, it is dynamic knowledge. It has economic value.

- TEK is created from locally specific interactions between people and their surrounding environment in the context of their everyday subsistence and livelihood practices.
- The pine mushroom industry provides an example of how ecological knowledge is transformed in the context of changing socio-economic practices.
- TEK is not a straight forward process of accumulated facts waiting to be mined and translated by trained scientific specialists.
- TEK must have a cultural framework in which knowledge of the environment is transmitted. TEK is a linked to wider social processes.
- To understand the actual ecological knowledge one must participate in the real processes of hunting, fishing and gathering. TEK is the real knowledge that hunters, fishers and gathers use to locate, collect and where markets and exchange networks exist, to sell, trade and/or barter their products.
- TEK is a form of practical, hands-on knowledge that is dynamic and responsive to change.
- TEK is responsive to changes in subsistence and livelihood practices.

Suggested Activities

1. Have students explore, using print, electronic and interview sources, the emergence of the pine mushroom harvest as an important source of seasonal employment and community income, see Blackline Masters 1-13, 1-14, and 1-15. Have students research, and make comparisons and contrasts with similar industries in Asia. Students should pay particular attention to the following issues:
   - How and why the harvest of mushrooms is best supported by healthy forest ecosystems.
   - What are appropriate harvesting methods?
   - How has a new source of harvestable forest botanicals occurred in the setting of customary land use patterns?
   - What are the necessary growing conditions for mushrooms?
   - What role does TEK play in the management of ecosystem health?
2. Discuss with students how TEK, as a body of knowledge, is not static and locked in the past. Rather, TEK is changed by the knowledge held by the community.
3. Demonstrate, and then have students prepare a set of spore prints of locally available wild mushrooms. Mushroom spores

are an important feature in mushroom identification. For example, the size, shape and color of spores are valuable identification aids.

- Remember that while many wild mushrooms are edible, others are toxic. Ensure that you are completely certain about the safety of the mushroom species that you gather for this purpose.
- Gather mushrooms that are mature but not yet in a state of decay. While gathering the wild mushrooms, have students carefully observe where the mushrooms are growing. Depending on the growing conditions and vegetative cover it may be possible to see mushroom spores that have settled onto leaves or other mushrooms growing directly underneath the mushroom. Released spores may appear as a dusty coating.
- To make the spore print first remove the stem from the mushroom. Next, place the mushroom cap, gill side down, on heavy white paper. Then, cover the mushroom with a cup or other large glass container. Leave the mushroom in a draft free area for approximately 1 to 3 days. Carefully remove the glass cover and mushroom cap.
- Examine the spore print and note the color of the spores. Mushroom spores that remain may be gently sprayed with an adhesive to keep them in place. Be careful to handle the print gently, since spores are fragile and easily disturbed.

4. Have students review the life cycle of mushrooms. Review key vocabulary terms such as alternation of generations, spore, fruiting body and hyphal network.
5. Have students carefully examine the spore print to determine the color of the spores. This is best done by holding up the paper, in a good light source, and look across the surface of the spores. Have students use the color of the spore to definitively identify the mushroom. Warn students that determining the exact shade of the spore is difficult and subjective. For example, some guides ask students to note the difference between white versus creamy colored spores,
6. Have students estimate the number of spores deposited by the mushroom. Note that one mushroom cap can produce millions of spores. Each of these spores is able to germinate and grow a hyphal network in the soil. Very few of these spores are able to produce new mushrooms because the necessary growing conditions for completing the life cycle are not available, i.e. light and moisture requirements.

The Pine Mushroom Industry, Northern BC

- TEK is not necessarily cumulative nor unchanging.
- TEK is tied directly to the material conditions under which individuals and communities make their living
- TEK shifts and changes in accordance with changes in economic activities. There are jumps and breaks fragmentations and coalescences.
- Changing attitudes toward industrial logging have created a space for non-timber forest products, such as pine mushrooms, to become a more appealing commercial target of exploitation in British Columbia's forest lands.
- Beginning in the 1970's, companies began experimenting with the commercial harvest of mushrooms. Eventually a flexible yet tightly controlled industry emerged.
- Contemporary pine mushroom ecological knowledge can be understood to include specific ecological knowledge relating to:
  1) the location of pine mushrooms
  2) appropriate harvesting methods
  3) economic knowledge concerning local and global market prices, selling techniques
  4) local knowledge regarding the behaviour and attributes of local field buyers and brokers.
- This contemporary knowledge parallels but it is not the same as traditional ecological knowledge of pine mushrooms previously held by indigenous people. (Refer to the Blackline Master 1-14, "Local ecological knowledge of Mushrooms: Past and Present").

Local Ecological Knowledge of Mushrooms

Past	Present
Very limited observations on the use of mushrooms as either a food or medicine. Unlike other plants, such as salmon berries, roots and tubers, the use of mushrooms is poorly documented. Community members acknowledge that mushrooms were a minor food or medicine (if used at all) in their traditional practices. Contemporary Nisg̱a'a mushroom pickers and brokers confirm that mushrooms were rarely, if ever eaten in the past. However, although the resource was not actively harvested, Nisg̱a'a mushroom pickers drew upon their local knowledge of lands near their villagers within their traditional hunting and food gathering territories in order to locate pine mushrooms. Observations of potential mushroom habitat was accumulated.	Local awareness of mushrooms while gathering other plant materials or during hunting trips. As the mushroom industry grew Nisg̱a'a community members applied their knowledge of the land (i.e. what habitats and growing conditions supported mushroom growth) and developed highly effective harvesting strategies. For example, pine mushrooms are more likely to grow under certain species of conifers. They grow best under a mossy cover. They are detected by noticing small bumps in the mossy forest floor. By replacing the moss after removing the pine mushroom the crop is more likely to grow back in subsequent years. In this way a sustainable harvest is guaranteed. Mushroom pickers are discouraged from using rakes to remove the mossy covering off of the forest floor. Although raking makes it easy to see and harvest the mushrooms, this raking destroys the mossy forest floor (the habitat under which mushrooms grow best).

- Note that some groups did use mushrooms. For example, people of the interior plateau used as many as 6 different species of mushrooms as food and / or medicine.

Summary of the Pine Mushroom Industry and TEK

Changing attitudes toward industrial logging have created a space for non-timber forest products.

Starting in the early 1970's firms began experimenting with the commercial harvest of mushrooms, eventually a flexible yet highly controlled industry emerges.

Government agencies become more aware of the growing economic importance of non-timber forest products. Attempts to define a social and economic space so that the pine mushroom harvest would remain under government (that is, non-aboriginal economic development) control and not First Nations control.

Many of the prime pine mushroom picking areas fall within so called crown lands; crown lands = unceded First Nations traditional territories.

The Nisg̱a'a Treaty, for example, explicitly mentions mushroom picking areas.

Despite the Nisg̱a'a's ability to regulate harvesting practices within their treaty lands, the effective economic control of the pine mushroom industry is maintained by a small group of industrial resource processing firms.

Export of pine mushrooms is tightly controlled by four or five major firms. All but one of which is tied to the fish processing industry.

Commoditization of pine mushrooms with the global economy has created a new context within which First Nations now operate.

During the initial stages of the resource extraction industry (fishing, forestry and mining) indigenous peoples were excluded from active control over harvesting. The emergence of the new forest resource commodities, such as pine mushrooms, has occurred within a very different socio-economic context.

This opens up the possibility of a return to a more direct control over natural resources and land by first nations in their home territories.

Lesson 5

Case Study 3: The Smallpox Epidemic of 1862 on the North Coast of British Columbia

Materials

- Blackline Master 1-16, The Smallpox Epidemic of 1862, pages 44-49.
- Additional Resource: "The Victoria Small Pox Crisis of 1862." The First Westcoast Nations in British Columbia. Greater Victoria School District, (Victoria: 1994), pages 159-170.

Major Understandings

1. The smallpox epidemic that struck the west coast of British Columbia resulted in steep declines in First Nation populations.
2. Depopulation, due to smallpox, had serious implications for the social, cultural and economic well being of the First Nations populations.
3. Viruses cause smallpox and AIDS.

Background

The smallpox epidemic that struck the North Coast in 1862 is consistent with other viral epidemics throughout history. The smallpox epidemic that decimated the Coastal First Nations population on the North Coast in the 1700 and 1800's is an example of an epidemic viral migration. The smallpox epidemic is best understood from the vantage point of social and medical history. From this dual perspective, the smallpox virus has been the source of many tragic and predictable depopulations throughout history. The social consequences of the depopulation had unique and tragic consequences due to the social and material conditions that make up North coast people.

Students will be better prepared to deal with viral epidemics, like HIV, if they are able to recognize 1) the features of viral diseases; and 2) effective solutions to minimize the effects of viral diseases.

Suggested Activities

1. Provide students with background notes on smallpox epidemics.
2. Reading and Creation of a time line. Students read about the forcible expulsion from Victoria Harbour and their subsequent attempts to return home. Use navigation charts and time lines to chart the passage of the residents as they attempt to return to their home territories.
   - Create a time line of the passage home that runs parallel to the time line of the disease cycle (viral).

Historical Supplement/Research Opportunity

1. Have students select other viral disease and prepare a report (see the list in Blackline Master 1-16, page 49.). Have students research, prepare and present a report, project or presentation on their selected disease. Student need to pay careful attention to how people came into contact with the various viral diseases as well as how the viral disease is controlled and/or eradicated.

2. Have students interview members of their community about the historical impact of the small pox epidemic. Have students prepare family genealogies. Students should list the location of family members on their genealogies. Have students pay close attention to where their family lived prior to and after the smallpox epidemic occurred.
3. Have students select one or more of the consequences of depopulation (associated with the small pox epidemic) and research the long term changes to aboriginal traditions that are tied to this event (see point 6 for specific examples). For example, what are some changes that came about because of a reduction in fur trade activity? Help students to recognize that disease is a potentially powerful agent of cultural change.
4. Have students prepare a proposal for presentation to members of their local Band Council that outlines the steps to take when lobbying the provincial government to erect a memorial to mark the location of the Northern encampments in the Victoria harbor. Students should consult books on the history of the city of Victoria. Students could present the proposal to students at a school assembly.
5. Have students investigate one of the persistent accounts associated with the smallpox epidemic—for example, the notion that viral infested blankets were used by white colonists to barter with the aboriginal people-furs and foods in exchange for infectious blankets.
6. For additional lesson ideas and source materials, see "The Victoria Small Pox Crisis of 1862" in The First Westcoast Nations in British Columbia, Greater Victoria School District, (Victoria: 1994), pages 159-170.

The Smallpox Epidemic of 1862

Origins of the Smallpox Virus

Today smallpox is all be eraditcated from the planet, but in the past it was one of the most virulent of diseases, especially for First Nations people who had no immunity to the disease when it was brought from Europe.

Smallpox is caused by the virus *variola*, which is passed from person to person by what is called "droplet infection." When people sneeze or cough, droplets of moisture shoot out from their nose and mouth at speeds of up to 160 km/hr, for distances as far as four metres. they into the air. Just one sneeze by an infected person can carry up to 5000 droplets, and all of them could carry the virus.

The virus can also be spread by physical contact, especially on items like clothing or blankets that may have been touched by an infected person. The virus can remain active on corpses for up to three weeks, and it can live for up to a year on damp clothing or blankets.

The symptoms of smallpox are frightening. After an incubation period of up to 18 days, where there are no visible signs of illness, the person suffers headache, fever and body aching. Then a rash of red spots slowly covers the whole body, which develop into blister-llike pustules. Eventually a hard scab grows over the blisters. In some people, the lucky ones, this was the final stage, and the scabs dried and fell off, leaving scars or pock-marks. For others, it was the beginning of the end. The sores moved into the mouth and throat, making it nearly impossible to eat or drink, and those on the skin would join to create large bleeding wounds. If it reached this stage, there was little hope of survival.

Smallpox is a called a parasitic disease because it often kills the person it infects. But it needs large groups of people living close together to survive. It spreads from person to person in crowded areas, and moves outwards into less populated areas. Once there are no more people to infect, it dies out. Sometimes people manage to fight off the virus and survive. if this is the case, their bodies develop an immunity and they won't catch it again.

Scientists think that the virus has been around for about 3000 years, probably originating in either Egypt or India. It began as cowpox, a virus which infected cattle, but through the domestication of cows, it mutated into a form which is lethal to humans. Similar animal viruses have mutated in this way as a result of domestication of animals in Europe and Asia.

People discovered that if someone became infected through a scratch on the skin, they usually only developed a mild case of smallpox. By the early 1700s, some doctors kept samples of infected pus or scabs and used this to intenionally infect someone through a cut on the arm, and although the person did become ill, they survived and did not contract the full-blown illness. This method became known as “variolation” or innoculation. It was improved upon by Edward Jenner in 1797, when he use the cowpox virus rather than smallpox. He learned that innoculations with cowpox produced an immunity to small pox. Thus vaccination programs greatly reduced the number of outbreaks in Europe.

However, First Nations people in North America had no immunity and were decimated by the disease. In British Columbia in the 1800s, missionaries and government workers sometimes used vaccinations to help First Nations people, but often they wre too late or the people distrusted their actions.

Indigenous North/South American Diseases

1. dysentery
2. viral pneumonia
3. non-ventral; syphilis + pinta
4. American leishmanisis (Forest Yaws)
5. American trypanosomiasis (Chagas)
6. localized rickettsial diseases (Rocky Mountain Spotted Fever)
7. streptococcus + staphylococcus (Strep throat), Rheumatic Fever. Etc).
8. salmonella + other food poisons

Diseases Introduced to North/South America

9. smallpox
10. malaria
11. viral influenza
12. yellow fever
13. measles
14. typhus
15. bubonic plague
16. typhoid fever
17. cholera
18. pertussis (whopping cough)
19. diphtheria
20. scarlatina (scarlet fever)
21. polio

The Epidemic of 1862

Smallpox, measles, influenza and other diseases which killed so many First Nations people after European contact typically broke out in epidemics. Most often whole villages came down with the disease. Occasionally the entire coastal population of British Columbia was affected. By the late 1800s, about eighty percent of BC's Aboriginal population had died from disease-causing germs.

One of the worst smallpox epidemics in British Columbia began in the colony's capital city of Victoria in 1862. At that time, First Nations from the North Coast frequently travelled by canoe to Victoria, where they traded and found employment with the settlers. The lived at a large camp across the harbour from town, next to the Songhees village. This camp, known as the Northerner's encampment was home to people from Tsimshian, Haida, Tlingit, Heiltsuk, and Kwakkwakaw'waka tribes. In 1859 the camps population was 2235. Of these people, approximately 45 % were Tsimshian and 25 % Haida.

On March 13, 1862 the ship *Brother John* arrived in Victoria harbour from San Francisco, with 150 passengers. One of the passengers had smallpox. That's all it took. By April the dreaded disease had taken hold in the Northerners' camps. Some ministers of the church tried to help as best they could. A small hospital, described as "two rough buildings," was operated by the Anglican missionaries. No one else would go there. They gave vaccine to those who would take it, but many would not. A local minister, Bishop Hills,described his visit to the Tsimshian camp on April 25, 1862:

> I visited the Chymsean camp to-day, and found the poor people in a great panic. The small-pox was raging with virulence; twenty had already died; I saw eleven more cases in various stages of the-dis

ease. These patients were mostly removed to little tents or huts by themselves, and shut in as if left to die. There seemed readiness to do what was direct ed, and great patience in the sufferers; one dead body was lying, left because there were no friends; another in a coffin was also unburied.

Officials in the city did not know how to deal with the epidemic. They were unable to put into place any plans or actions to care for the sick. If organized quarantine areas and consistent medical help had been given, events may have turned out quite differently.

Instead, officials only responded with what might conisdered as racist actions. On April 28 the head of the colonial police, Augustus Pemberton, gave the First Nations from the north one day to get out of town. They were forced to leave, even though this was a very serious and contagious disease. A naval ship, loaded with cannons, was anchored in front of the camp. Guards were put on the bridge leading to town so no First Nations people could enter. By May 1st most of the Tsimshian people left the harbour and began the long journey back to their villages.

Here is a report about the situation from one Victoria newspaper:

> The Tshimpseans burnt their houses and blankets and other "iktas" [Chinook word for 'things'] with out any compulsions from the police, and left this morning in their canoes. Only three huts remain standing, which are occupied by those of the tribe who have remained as nurses. Numbers of the Stikine and Hydah have also left in canoes, and those that remain have moved their huts to a greater distance from the camp of the Tshimpseans. (Daily Press, 1 May, 1862).

The officials were unable to cope with the overwhelming number of dead bodies. Dead bodies were found throughout the encampment. The camps were burned. Newspaper reports of the day tell of between 1000 to 1200 bodies were left piled on open ground near the camps.

The Virus Spreads Northwards

As the northerners left Victoria, those too sick to travel camped on islands near Victoria. Others, not yet affected by the virus, headed for home.

Many Tsimshian Fort Simpson returned to Fort Simpson, where their winter homes were located. Here is a entry from a fort journal, written on May 17, 1862 the following entry was made in the fort journals:

> Four or five Canoes arrived from Victoria and report that the Small Pox was raging at that place and that some of their party dies on the way here, and that some of the canoes had but two people well enough to paddle them.

This was typical for all the northern tribes members who were forced out of Victoria. People traveling on the coast during this time report of seeing rotting dead bodies all along the coastal beaches, as in this news report:

> Forty out of sixty Hydahs who left Victoria for the North about one month ago had died. The sick and dead with their canoes, blankets, guns etc. were left along the coast. In one encampment, about twelve miles above Nanaimo, Capt. Osgood counted twelve dead Indians-the bodies festering in the noonday sun. (Daily British Colonist, 12 June 1862).(Campbell, 2000:87).

Fort Simpson fort officials took no steps to prevent the spread of the virus. For example, they might have 1) isolated and imposed a quarantine on those tribe members returning from Victoria; 2) turned away Haida and Nisga'a visitors; and 3) vaccinated the inhabitants.

Over the ensuing fall and winter, the virus spread steadily into the interior of the province, travelling with people as they journeyed between the coast and the interior on their traditional trading trips. Few areas of the province did not feel the chilling touch of the smallpox virus. Only areas in Southern B.C. Catholic and Methodist missionaries vaccinated hundreds of First Nations people, so they were not as severely impacted by the virus as others who had no access to the vaccine.

Social Responses

When the Northern tribes people returned in a sickened and weakened state panic and desperation set in. Sickness took hold of the community. By the time the disease had run its course in August of 1862, more than 500 people were dead. People prepared to leave Fort Simpson. Shamans were called upon to cure the sick. Their traditional methods of healing were not effective against the smallpox virus. People believed that if poles with a red medicine painted on them were erected on top of the homes they were be protected from the disease. Most homes had a red pole mounted on top of the house.

The effects of this epidemic on First Nations people were almost unimaginable. It was as if a terrible wound that wiped out their leaders, their workers and their children. The economic and social devastation caused by smallpox is incomprehensible to us today.

First Nations people collect and preserve food, medicine and plant products at seasonally intervals throughout the year. The smallpox epidemic of 1862 struck at the height of the plant and berry harvest seasons. When the salmon season began in late July and August most of the people were still too ill and coping with the devastation caused by the disease to fully participate in the traditional harvest routines. If the necessary berry and fish resources were not collected and preserved the necessary vitamin supplies would not be available to the First Nations people during the winter months. The would go hungry and suffer from malnutrition.

Because of the timing of the smallpox epidemic, the entire population was not able to fully participate in the necessary harvest routines. People were still too sick, depressed and fearful about the epidemic. The devastating effects of smallpox were made even worse by lack of nutrition and starvation.

Extent of Depopulation

Population Size before European Contact in 1774: 200,000 people

Population size after European contact-1884: 40,000

Percentage change over 100 years:
Decline of 80 %

In 1862 fourteen thousand people died.

Implications of Depopulation

The idea of disease-induced depopulation runs counter to the long-held conviction that Europeans brought enlightenment and civilization to “savage” peoples. Depopulation had many implications:

- Reduction in fur trade activity.
- Reduction in food.
- Lost key providers (Lost Wealth).
- Tribes lost political and economic power.
- Redistribution of populations.
- Political Instability.
- Some groups were vulnerable.
- Some groups were invisible in their territory
- Natives had no voice.
- Early explorers found deserted villages.
- The country appeared to be uninhabited- desire to believe Europeans were taking over unoccupied land.

Traditional healing practices involved community members gathering around the sick person's bed singing, praying, among other things, to provide spiritual assistance. While this collective process worked successfuly before contact, ironically it served to spread disease more quickly when people gathered together.

Similary, medical practices such as cleansing sweats and cold morning baths in rivers and lakes, while appropriate for many pre-contact illnesses, only made smallpox symptoms much worse.

The loss of elders was another serious result. The smallpox epidemic had a dramatic social and cultural impact. The loss of elders means the loss of cultural information. The elderly were more likely to die from smallpox. They were unlikely to have passed on the cultural knowledge to the younger generation since their deaths were untimely.

References:

Carlson, Keith Thor. (1996). You are Asked to Witness: The Sto:lo in Canada's Pacific Coast History. Chilliwack B.C.: Sto´:lo Heritage Trust

First Nations Education Services SD 52 Prince Rupert (2003). Persistence and Change: First Nations Studies 9/10 Resource Book. Prince Rupert: School District 52 Prince Rupert.

Wolf, Eric R. (1999) Chapter 3. In Envisioning Power: Ideologies of Dominance and Crisis. Berkeley: University of California Press, pages 69-131.

Lesson 6

Case Study 4: AIDS and its impact on Canada's Indigenous populations

Materials

- Blackline Master 1-17, AIDS and Its Impact on Canada's Indigenous Populations, pages 52-56.

Major Understandings

1. There are important parallels between the smallpox epidemics of the late 1800's and the HIV pandemic that is currently threatening populations in Canada and Africa.
2. Poverty and substandard housing are significant factors that contribute to the likelihood of contracting the virus that causes AIDS.

Lesson Introduction: "AIDS–is this the modern equivalent of smallpox?"

1. Through a whole class discussion summarize students' knowledge about the smallpox virus. Use this information to explore the commonalities between an historic viral epidemic and the modern day equivalent, the AIDS virus.
2. The smallpox epidemic indiscriminately affected the entire First nNations population. Yet, the elders and very young were less likely to recover and survive the infection. In contrast, certain groups of Aboriginal people are more likely to be infected with HIV. For example, Health Canada reports that Aboriginal injections drug users and gay men are more likely to contract the AIDS virus. Thus, while the smallpox virus was responsible for the loss of elders, the AIDS virus is responsible for the death of younger First Nation people.

Instructional Strategy/Teaching Suggestions

1. Invite the community's medical doctor and/or public health nurse into the classroom to discuss the impact of AIDS within the community. Help students explore the emotional and social context in which this virus is viewed and dealt with. What implications do the community's response to persons living with the AIDS virus have for treatment options available to community members?
2. Have students read "The Plague at 20-Didn't someone say the war was over" (Globe and Mail, Saturday June 30, 2001: Section F, Special Globe Focus). Students should explore the local phenomena of the AIDS virus and relate their communities experience with this viral disease to the larger global phenomena.

Historical Supplement/Research Opportunity

1. Have students investigate and research and prepare a report on the origin of the AIDS virus. Using the information provided from the smallpox data and Brody's hunter-gatherer/farmer

divide (2000) have students analyze whether the spread of the AIDS virus is consistent with other historical precedents of viral pandemics.

2. Have students research and synthesize the available information on treatment methods and options for the AIDS virus. Students should explore the ethical issues associated with the relatively high costs of medication to treat the AIDS virus.
3. Have students prepare a debate as to whether or not pharmaceutical companies have a moral/ethical responsibility to provide the worlds citizenry the research patents and hence access to the formula for producing AIDS medication. Students should be encouraged to explore who 'owns' knowledge. What are the implications of differential access to medical knowledge?
4. Have students prepare a report entitled “The Plague at 40”. Students could write the report from either a local or global perspective.

AIDS and its Impact on Canada's Indigenous Populations

1. Overview-smallpox and the virus that causes AIDS
2. Summaries of current (2000) HIV infection rates
3. Patterns of AIDS is Different among Aboriginal Persons
4. HIV Data
5. Comment
6. References

1. Overview: smallpox and the virus that causes AIDS

The human immune deficiency virus (HIV) has resulted in the disproportionate number of infections and subsequent deaths of first nations people. If more effective and timely measures are nor adopted the HIV virus will continue to spread. This section explores the potential impacts of the AIDS virus on first nations culture.

There are parallels between the smallpox epidemics of the late 1800's and the HIV pandemic that is currently threatening world health. For example, Aboriginal people are more likely to be infected with the HIV virus (at a earlier age and in relatively greater numbers) than are non-aboriginal people. Just as the culture of the First Nations was altered as a result of the smallpox epidemic so to will the culture and quality of life and life expectancy of Aboriginal people be adversely affected by the AIDS virus. The Health Canada data suggests that poverty and substandard housing are factors that increase the likelihood of contracting the AIDS virus.

2. Summaries of current HIV infection rates.

While reading keep in mind the impact of the smallpox epidemic on First Nations people.

The following information summarizes the current rates of infection. (Source: Bureau of HIV/AIDS, STD and TB, Center for Infectious Disease Prevention and Control, Health Canada, May 2001)

At a Glance

- In Canada, 410 AIDS cases and 497 positive HIV tests have been reported among Aboriginal persons up to December 31, 2000.
- The proportion of Aboriginal AIDS cases, after adjusting for reporting delay, increased from 1% before 1990 to 10.8% in 1999 and 8.5% in 2000.
- The proportions of Aboriginal HIV and AIDS cases that are < 30 years old, female, or attributed to injecting drug use are greater than the corresponding proportions among non-Aboriginal cases.
- In 1999, an estimated 370 Aboriginal persons in Canada were newly infected with HIV; at the end of 1999, an estimated 2,740 Aboriginal persons were living with HIV.

Introduction

In Canada, the Aboriginal populations are very diverse with many sub-groups (First Nations, Inuit and Metis) that reflect variations in historical backgrounds, language and cultural traditions. These groups represent 2.8% of the Canadian population. However, they are disproportionately affected by many social, economic and behavioural factors (such as high rates of poverty, substance abuse, sexually transmitted diseases, limited access to or use of health care services) which increase their vulnerability to HIV infection. Hence, in recent years, an increase in the HIV/AIDS epidemic has been observed in some Aboriginal communities, particularly those in inner-cities. This report updates current information on the status of the HIV/AIDS epidemic among Aboriginal persons in Canada.

3. Pattern of AIDS is different among Aboriginal Persons

Increasing Trend Over Time:

As of December 31 2000, there have been 17,594 AIDS cases reported to the Centre for Infectious Disease. Of that total, 410 were reported as Aboriginal persons (16 Inuit, 31 Metis, 331 Native Indians (i.e. First Nations), and 32 Aboriginal unspecified).

After adjusting for reporting delay, the annual number of AIDS cases has increased more-or-less steadily since the early 1990s (Figure 1). This trend contrasts with the trend in the overall number of delay-adjusted AIDS cases which declined for most of the 1990s (see HIV and AIDS in Canada: Surveillance Report to December 31, 2000).2 The annual proportion of AIDS cases attributed to Aboriginal persons increased from 1% before 1990 to 10.8% in 1999 and 8.5% in 2000.

Injecting Drug Use - A Major Risk Factor

There have been 316 Aboriginal males with a reported AIDS diagnosis. Of those with known exposure, 49.4% were men who have sex with men (MSM), 26.1% were injecting drug users (IDU), 12.9 were MSM/IDU, 9.4% were at risk through heterosexual contact, 0.6% had received blood/clotting factors and 1.6% were infected though perinatal transmission.

There were 93 Aboriginal women with a reported AIDS diagnosis up to December 31, 2000. Among those with known exposure, 64.7% were IDU, 30.7% heterosexual contact, 2.3% had received blood/clotting factors, 2.3% perinatal transmission.

The proportion of reported Aboriginal AIDS cases attributed to IDU has dramatically increased over time, from 2% prior to 1991 to 15% during 1991-1995 and 34% during 1996-2000.

The proportion of females and the proportion < 30 years old among reported Aboriginal AIDS cases, are higher than among non-Aboriginal AIDS cases. Also, there is a higher proportion of Aboriginal AIDS cases that have

Table 1: Gender, Age and Injecting Drug Use among Aboriginal and Non-Aboriginal Reported AIDS Cases up to December 31, 2000.

	Aboriginal	Non-Aboriginal
Female	22.7%	7.9%
<30 years old	25.9%	6.7%
IDU exposure category	34.3%	5.9%

IDU as an exposure category compared to non-Aboriginal cases (34.3% vs. 5.9%).

4. HIV Data

While AIDS data provide information on HIV infections that occurred about 10 years in the past, HIV data provide a picture of more recent infections.

Positive HIV reports from provinces with ethnicity reporting (British Columbia, Yukon, Alberta, Saskatchewan, Manitoba, Newfoundland and Prince Edward Island) indicate that Aboriginal persons were over-represented among new HIV diagnoses, i.e. 19.5% in 1998, 25.8% in 1999, and 17.7% in 2000.

Comparisons between Aboriginal and non-Aboriginal persons with respect to gender, age and exposure categories within positive HIV tests reported from 1998-2000 show similar patterns to reported AIDS cases (see Table 2). Reported positive HIV tests among Aboriginal persons have a higher proportion of females than do non-Aboriginal persons. They also have a higher proportion in the age group 20-29 years and a higher proportion attributed to IDU.

Aboriginal Women and Children

Infected pregnant women are at risk for transmitting HIV to their unborn child. Recent data from some sites in western Canada have shown that a high proportion of HIV-infected pregnant women who deliver are Aboriginal. Among all pediatric centers across Canada where children and HIV-infected mothers were followed between 1995-1997, 19% (n=259) were Aboriginal women.3 Of 32 HIV-infected women who delivered in Northern Alberta or the NWT in 1996-98, 29 (91%) were Aboriginal.

Despite high numbers of Aboriginal women seen at HIV clinic and pediatric centers, there is encouraging news that pregnant Aboriginal women (62%) were as likely to be on antiretroviral therapy as pregnant Caucasian women (66%) and pregnant Black women (63%).

Table 2: Gender, Age and Exposure Categories among Reported HIV Tests,
Aboriginal vs. Non-Aboriginal Persons in Provinces with Reported Ethnicity**, 1998-2000

	Aboriginal	Non-Aboriginal
Gender	n=371	n=1,373
Male	53.4%	0.3%
Female	46.6%	19.7%
Age (years)	n=369	n=1,382
20-29	33.3%	9.5%
30-39	9.6%	1.0%
Exposure Category	n=365	n=1,299
MSM	9.9%	33.9%
IDU	9.5%	33.6%
Heterosexual	25.8%	27.8%

** BC, YK, AB, MB, SK, PEI, NFLD

Aboriginal Men who Have Sex with Men (MSM)

A study done among MSM in Winnipeg in 1995 found that 17% were Aboriginals.

The proportion of Aboriginal participants was 41% in a recent cross-Canada study (1999-2000) among male street youth who reported having sex only with men.7

In an ongoing study (1996-present) among young MSM in Vancouver, 8% of participants were Aboriginal men. These Aboriginal MSM were more likely than non-Aboriginal MSM to be unemployed, to live in unstable housing, to have higher depression scores, to report non-consensual sex or sexual abuse during their childhood, and to be involved in the sex trade.8

Aboriginal Inmates

Across Canada, 14% of federal inmates are Aboriginal persons, with rates up to 40% in provincial or federal jails in some provinces.9-11

Increasing Proportion of Aboriginal Persons among Estimated HIV Prevalent and Incident Infections at the National Level

According to the latest estimates of HIV prevalence and incidence produced by the Bureau of HIV/AIDS, STD and TB, the number of Aboriginal persons living with HIV has increased from 1,430 in 1996 to 2,740 in 1999 (91% increase during the 3-year period).12 The estimated number of incident infections among Aboriginal persons increased from 310 in 1996 to 370 in 1999. Although Aboriginal persons comprise only 2.8% of the general Canadian population, they accounted for 5.5% (2,740/49,800) of all prevalent infections and 8.8% (370/4,190) of all new infections in Canada in 1999. The estimated exposure category distribution of prevalent and incident infections among Aboriginal persons in 1999 is shown in Table 3.12

6. Comment

Aboriginal HIV and AIDS data are incomplete for several reasons. The major reason is the incomplete ethnic information in current surveillance data; in 2000, 75% of positive HIV test reports and 16% of reported AIDS cases had no ethnic information. Other reasons include inter-provincial variations in reporting ethnicity, misclassification of ethnic status, and delays in reporting.

Table 3: Estimated Exposure Category Distribution Among Prevalent and Incident HIV Infections Among Aboriginals in Canada, 1999.

Exposure category	Prevalent infections (n=2,740)	Incident infections (n=370)
IDU	54%	64%
Heterosexual contact	15%	17%
MSM	23%	11%
MSM/IDU	6%	8%

Source: Bureau of HIV/AIDS, STD and TB, Centre for Infectious Disease Prevention and Control, Health Canada, May 2001.

With respect to positive HIV test reports among Aboriginal persons, they only represent those infected individuals who came forward for testing and are subsequently reported. Therefore, the numbers do not represent the total number of Aboriginal persons infected with HIV.

Despite these limitations, available evidence suggests that Aboriginal persons are infected at a younger age than non-Aboriginal persons, that injecting drug use is the most important mode of transmission, and that the HIV epidemic among the Aboriginal community shows no sign of abating. Furthermore, the mobility of Aboriginal persons between inner cities and rural areas may bring the risk of HIV to even the most remote Aboriginal community. Better data on HIV/AIDS epidemiology and HIV testing among Aboriginal persons in Canada are needed to guide prevention and control strategies.

References

1. Statistics Canada. The Daily. 1996 Census: Aboriginal data. Tuesday, January 13, 1998.
2. Health Canada. HIV and AIDS in Canada. Surveillance report to December 31, 2000, and unpublished data from the Division of HIV/AIDS Epidemiology and Surveillance, Bureau of HIV/AIDS, STD and TB, Centre for Infectious Disease Prevention and Control, Health Canada, April 2001.
3. Forbes JC, Burdge DR, Money D. Pregnancy outcome in HIV infected women in British Columbia; the impact of antiretroviral therapy on maternal-infant HIV transmission. Can J Inf Dis 1997;8:31A {Abstract 235} and personal communication (Forbes J).
4. Birse E, Shokoples S, Houston S. Demographic and clinical features of Aboriginal and non-Aboriginal patients with HIV infection in Northern Alberta. Can J Infect Dis 1999;66B {Abstract C387P}.
5. Lapointe N, Forbes J, Singer J, et al. Antiretroviral therapy in pregnant women in Canada: Access and outcome 1995-97. Can J Inf Dis 1998;9:70A {Abstract 449P}.
6. Myers T, Calzavara L, Morrison K. A report on a National Research Needs Assessment for HIV prevention among gay and bisexual men and a socio-behavioural and epidemiological pilot study in a non-clinical sample of self-identified gay and bisexual men. Final report to the Division of HIV/AIDS Epidemiology and Surveillance, Bureau of HIV/AIDS, STD and TB, Centre for Infectious Disease Prevention and Control, Health Canada, August 1995.
7. Presentation by Wong T. in Proceedings of the MSM/IDU Consultative Meeting (March 8-9, 2001, Ottawa, Canada). Bureau of HIV/AIDS, STD and TB, Health Canada.
8. Heath KV, Cornelisse PGA, Strathdee S. HIV-associated risk factors among young Canadian Aboriginal and non-Aboriginal men who have sex with men. Int J STD and AIDS 1999;10:582-7.
9. Correctional Services Canada (personal communication, Portman J, October 1996).
10. Alberta Justice (personal communication, Harrison S, March 1997).
11. Rothon DA, Strathdee SA, Cook D, Cornelisse PGA. Determinants of high risk behaviours for HIV infection among young offenders in British Columbia detention centres. Can J Infect Dis 1995;6:56B.
12. Geduld J, Archibald CP. National Trends of AIDS and HIV in Canada. CCDR 2000;26(23):193-201.

Forests for the Future, Unit 1
Two Ways of Knowing: Traditional Ecological Knowledge and Scientific Knowledge
by Veronica Ignas

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