Tempered Optimism: Recognising the Barriers to the Use of Traditional Ecological Knowledge in Arctic Canada

By

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Abstract

Traditional ecological knowledge (TEK) is knowledge handed down through generations about the environment. This thesis describes TEK and provides examples of research and the results of an original field study that demonstrate the value of TEK as a source of ecological knowledge. Over the past two decades, many organizations have made commitments to use and respect TEK. However, an examination of the publication record demonstrates that TEK remains marginal to the mainstream of conservation biology and natural resource management. The barriers to the integration of TEK with "scientific" ecological knowledge are discussed and found to be significant. Early expectations for TEK have proven optimistic. In spite of high-level policy statements, TEK remains marginalised from ecosystem management regimes. The barriers described must be recognised before they can be overcome.

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Chapter 1 The Promise of Traditional Ecological Knowledge

Introduction

Traditional ecological knowledge (TEK) is a rich and important resource for understanding the environment. Indigenous peoples who are living on the land, relying on its resources to survive and observing and exchanging information about the natural environment over generations, have deep and extensive knowledge about the land and its ecosystems. This knowledge is linked to survival, harvesting and managing natural resources, but it is not limited to such matters. This knowledge is embedded in the cultural fabric of the community and is integral to the ways of life, systems of understanding and world views of the specific community that holds it.

Many in the academic community have recognized the value of traditional ecological knowledge. Several academic disciplines are involved in TEK related research. Anthropologists, biologists, geographers, development workers and others study the similar research areas called variously traditional knowledge, indigenous knowledge, traditional ecological knowledge, ethnoscience, ethnoecology and folk knowledge. TEK has been applied in many fields including agriculture, rural development, resource management, botany, medicine and ecology.

Researchers and authors have examined TEK from widely varying perspectives. Philosophical stances range from logical positivism, the philosophy closely associated

with western science, to the post modern discourse where there should be no "privileged" point of view. Peet (1998), Johnston (1991), and Cloke *et al.* (1991) describe many of the paradigms active in geography and the social sciences today, including structuralism, humanism, Marxism, realism and feminism.

This thesis is written using a realist approach in the sense of that developed by Roy Bhaskar (Cloke *et al.* 1991). I make the assumption that there is a reality underlying our perceptions. From this point of view both the western science and traditional ecological knowledge systems provide insights into the same reality. This thesis is based on the premise that TEK is a way of understanding the environment, one that is embedded in a specific cultural context. Western science, based on a logical positivist philosophy and with its own cultural biases, also provides a way of understanding the environment.

Clearly the potential conflict between the two knowledge systems is worthy of closer examination. There is also scope for examining TEK from other philosophical points of view. However, it is not the intent of this thesis to examine theories arising from analysis of cross-cultural conflict. The intent of this thesis is to examine the problems of acceptance or integration of TEK by those working on ecological questions within the western scientific framework. My own experience, and that of many other writers, clearly shows that TEK is a valid and important source of ecological information,

knowledge and even wisdom. This knowledge is of the same reality, the same environment, that the conservation biologists and ecologists strive to understand.

As expressed in a Worldwatch paper on indigenous peoples and the health of the land:

> [Indigenous peoples] ".... possess, in their ecological knowledge, an asset of incalculable value: a map to the biological diversity of the earth on which all life depends. Encoded in indigenous languages, customs, and practices may be as much understanding of nature as is stored in the libraries of modern science." (Durning 1992, p. 6-7)

More than twenty years ago, Freeman argued that the use of traditional ecological knowledge could greatly improve knowledge and management of wildlife.

> "However, what I wish to assert, with some emphasis, is both the legitimacy for seeking alternate sources of expert knowledge from the traditional users of the land when establishing a data base for decision-making and the benefit likely to be derived from involving such experts in the actual decision-making itself." (Freeman 1979, p.345)

At the same time he was confident about the growing use of traditional knowledge, and he felt that ". . . an increasing number of individual scientists and agencies are recognizing the value of traditionally qualified local residents actively involved in the formulation and conduct of field research" (Freeman 1979, p.358-359).

Since that time, research on TEK has been accelerating around the world. The number of publications on the subject has increased markedly. The number of disciplines involved has similarly increased. Sillitoe writing about recent changes in anthropology considers this growth of interest an "indigenous-knowledge revolution" (Sillitoe 1998). Duerden and Kuhn state "Through the 1990s, there has been a veritable explosion of interest in TEK in Canada . . . " (Duerden and Kuhn 1998, p.31).

In October 1986 the Boreal Institute for Northern Studies held its 25th Anniversary conference entitled "Knowing the North: Integrating Tradition, Science and Technology." This conference marked the launch of a circumpolar network on Traditional Ecological Knowledge (Freeman and Carbyn 1988). The conference proceedings were optimistic about the increasing interest in TEK and TEK's practical usefulness.

At about the same time several international organizations were holding other conferences on TEK. The momentum continued to build and in 1992, at the United Nations Conference on Environment and Development in Rio de Janeiro, TEK received international recognition. Agenda 21 called for research on traditional methods and

indigenous knowledge (IDRC 1993a). The Convention on Biological Diversity (UNEP 1992) included a commitment from the signatories to "respect, preserve and maintain" traditional knowledge.

International conventions, the Arctic Council, Canadian government departments, territorial governments and non-governmental organizations (NGO) have recognized the value of TEK and made recommendations or commitments to use it. A typical example is the following excerpt from the Inuit Circumpolar Conference's *Principles and Elements for a Comprehensive Arctic Policy*:

> "Inuit traditional knowledge and scientific research are both valid systems of knowledge that should be integrated and harmonized within the context of cooperative research. In light of increased resource development and environmental degradation, resource managers must have access to the best possible information relating to terrestrial and marine ecosystems on which to base their decisions."(ICC 1992, p.45)

Much good work has been done and progress has been made, especially over the past decade, but integration remains problematic. The use of TEK as a source of ecological knowledge has lagged far behind the many commitments.

In this thesis I demonstrate that, in spite of its worth, the advocacy of some social scientists and the recommendations of many organizations, the knowledge of the environment held by indigenous peoples is not being considered seriously and is not being used or even studied seriously by the western scientific community. Traditional ecological knowledge remains marginalised by conservation biologists and ecologists in government and academia. While TEK is much written about in social science journals, there remains a gulf between "scientific" and "traditional" ecological knowledge, and it is the exception, rather than the norm, when TEK is included in wildlife management, environmental assessment or other ecosystem management and research.

Additionally, I outline the major barriers that have blocked the integration of TEK with scientific ecological knowledge. These barriers must be recognised if new approaches are to be developed to overcome them.

Structure of the Thesis

In this introductory chapter, the premise and structure of the thesis are outlined. In Chapter Two, the value of traditional ecological knowledge is examined. TEK is defined, its strengths and weaknesses discussed and examples of TEK research are provided.

The results of an original study are provided in Chapter Three. The author collected information on the ecology of eastern Hudson Bay beluga whales from the Inuit of Sanikiluaq. The study provides an example of early TEK research, demonstrating its

value as well as laying the foundation for an analysis of issues involved in TEK field work.

In Chapter Four many of the commitments to use TEK are discussed. Over the past decade organizations, agencies and governments from the United Nations to the government of the Northwest Territories have made commitments to respect and use TEK. In the Canadian Arctic there have been statements from Inuit groups at all levels of organization, territorial governments and federal government departments in support of the use of TEK.

In Chapter Five the gap between commitment and implementation is documented. An examination of the publication record of TEK reveals a lack of acceptance in the biological sciences but a relatively strong record of publication in the social science journals. The record of use of TEK in studies related to environmental assessment and in wildlife management in northern Canada is examined.

In Chapter Six, the major barriers inhibiting the broader acceptance of TEK are analysed. These barriers include the resistance of some biologists, the fact that documenting TEK is not easy nor simple, the problem of elders passing away and lifestyles changing, competition from other technologies and government budget constraints.

In the concluding chapter, the thesis is summarised, recommendations are made, and the conclusion expressed that TEK is marginalised from the mainstream of conservation biology and natural resource management and the barriers described in Chapter Six must be recognised in order to overcome them.

Chapter 2 TEK: A Rich Knowledge Resource

What is Traditional Ecological Knowledge?

The term "Traditional Ecological Knowledge" (or "TEK") is used in Canada to refer to knowledge of the environment held by indigenous peoples. Traditional Ecological Knowledge encompasses all the subject matter that relates to ecosystems. While not as compartmentalised as academic science, TEK can be said to include what is studied in the biological, environmental and earth sciences, such as botany, zoology, anatomy, meteorology, oceanography, and astronomy. TEK is held by a community, both collectively and individually, and is usually transmitted orally. Each community has its own way of collecting, storing, transmitting, using and updating TEK. It has developed over thousands of years within each culture.

In arctic Canada, Inuit knowledge of the environment was respected and documented by early ethnographers such as Boas, Rasmussen and Steffanson, long before the term "Traditional Ecological Knowledge" was coined (Wenzel 1999). Early explorer-scientists also recognized and wrote of the knowledge of the Inuit. For example, Peary, in his quest for the north pole, used the knowledge and technology of Greenland Inuit for travelling, clothing and even architecture (Dick 1991). Many scientists since then have learned from the Inuit, although frequently they have not made reference to this in their published papers.

A new trend in research began with the modern Canadian land claims of the 1970s. Efforts to document land use through map-based interviews were undertaken in several areas (Freeman 1976, Brice-Bennett 1977). Makivik Corporation, the organization representing the Inuit of northern Quebec, began a land use and ecological mapping program in Nunavik (arctic Quebec) in the early 1980s (Kemp and Brooke 1995). Researchers began using the term Traditional Ecological Knowledge in the 1980s (Freeman and Carbyn 1988).

The study of traditional ecological knowledge has grown considerably over the past decade. Presently TEK research is focussed on two major areas, in the context of international development and in the north among aboriginal people. Canadian writers figure prominently in the literature, with books edited by Freeman and Carbyn (1988), Johnson (1992), Inglis (1993), Grenier (1998) and Berkes (1999). These works and many other studies have demonstrated the value and power of TEK.

The Definitions of TEK

Definition

There is no single definition of Traditional Ecological Knowledge, but most of the definitions in the literature cover similar points. For the purposes of this thesis I will use the definition of TEK used by Fikret Berkes at the Natural Resources Institute of the University of Manitoba:

> "a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment. Further, TEK is an attribute of societies with historical continuity in resource use practices; by and large, these are non-industrial or less technologically advanced societies, many of them indigenous or tribal." (Berkes 1993 p.3)

There are many terms and many definitions for similar kinds of knowledge. In the next section I will give some background to some of these terms. There are different ways to consider the knowledge itself – some researchers study the knowledge in order to better understand the culture that creates and sustains it, others focus on what it tells us of how humans think. For this thesis I take the position that TEK is important because of what it tells us about the natural world. It provides an understanding of species, ecosystems and land and waters that is interesting, important and useful.

In considering the terminology issue, the 1996 Seminar on the Documentation and Application of Indigenous Knowledge in Inuvik, Northwest Territories concluded:

> "There are many terms in use to describe the body of expertise and knowledge held in indigenous communities. Among these are indigenous knowledge, traditional ecological knowledge, indigenous science,

> ecological wisdom, and many others. None is wholly adequate or satisfactory. The seminar only addressed this issue in passing, with the chairman's observation that 'indigenous knowledge' may imply that any indigenous person may have this expertise, when in fact personal experience and learning from the elders are more important factors than ancestry. Because they are widely used terms, these recommendations use as synonyms the terms 'indigenous knowledge' and 'traditional ecological knowledge' and the acronym, 'TEK'." (CAFF 1997)

Mailhot discusses the relative merits of various terms such as traditional knowledge or indigenous knowledge of the environment and settles on the use of "traditional ecological knowledge." She then refers to definitions in Johnson (1992, p.4) Wavey (1993, p.13) and Berkes (1993, p.3) and finds them to be incomplete. Her own definition for traditional ecological knowledge is "the sum of the data and ideas acquired by a human group on its environment as a result of the group's use and occupation of a region over very many generations" (Mailhot 1993, p.11).

Other terms for similar knowledge

Among the variety of terms used there are many shades of meaning. Each term has its own history and common usage, and the terms are used in different ways in different regions, and by different academic disciplines and schools of thought. Examining what people know about the environment tells us both about the environment

and about the people, and where the focus is depends on the academic discipline. The variations in terms serve to highlight the diverse emphases the different academic disciplines bring to the subject.

Some writers use the terms "indigenous", "local" or "community" ecological knowledge. Sometimes a specific group name is used as in "Cree ecological knowledge." Often the "ecological" is not used, usually in reference to the broader category of "traditional knowledge" or "indigenous knowledge" referring to knowledge beyond the ecological. While it is in current use in Canada, "Traditional Ecological Knowledge" (TEK) (e.g. Berkes 1993, Freeman 1992) appears to be used less frequently in the context of developing countries. "Indigenous Knowledge" (IK) (e.g. Grenier 1998) appears more frequently in the international journals, used either synonymously with TEK or as a larger entity that includes TEK. "Indigenous Technical Knowledge" (ITK) (e.g. Howes 1980) is close to TEK in meaning but its use has evolved in an agricultural context, where the indigenous people use their understanding of ecological processes to guide and modify their farming techniques.

Recognizing that TEK is integrally linked with the indigenous systems of wildlife, ecosystem or environmental management, the term "Traditional Ecological Knowledge and Management Systems" (TEKMS) was coined at the end of the 1980s (Freeman and Carbyn 1988).

Other terms with similar meaning include various formulations with the prefixes "ethno" or "folk". The terms "Ethnobiology" (e.g. Hunn 1999), "ethnoecology" (e.g. Feit 1978, Gragson and Blount 1999), "ethnobotany" (e.g. Alcorn 1999) and ethnoscience (e.g. Slikkerveer 1999) continue to be current in the anthropological literature. Much of the ethnoecology literature focuses on the analysis of indigenous classification systems in order to understand the indigenous cultural construction of the natural world.

Ethnobotany, a term coined in 1895 by John Harshberger (Davis 1995), is the field with probably the longest history and the greatest number of publications. Today, ethnobotany is defined as the study of "plant-human interrelationships embedded in dynamic ecosystems of natural and social components" (Alcorn 1999 p. 24). It is a very active research area with journals of ethnobotany and of ethnopharmacology. Much of the interest is due to the economic interests of the pharmaceutical industry. "Annual worldwide sales of plant-derived pharmaceuticals currently total over $20 billion, and a great many of these drugs were first discovered by traditional healers in folk contexts" (Davis 1995).

"Folk knowledge" was a term used by anthropologists although its use appears to be being replaced by either "indigenous knowledge" or "local knowledge". Folkbiology as it is now practised focusses on how ordinary people understand biology, and uses the tools of both ethnobiology and cognitive psychology (Medin and Atran 1999).

In the late 1990s, as the field of TEK grew, several more terms have been used. Within Nunavut the term "Inuit Qaujimajatuqangit" (IQ) or "that which are long known by Inuit" is gaining currency as it has been adopted by the Nunavut Social Development Council (NSDC) and the Nunavut government (DSD 1999).

Hipwell (1999) coined the term LO-TEK for local / traditional ecological knowledge. This term is intended to combine many of the above terms, that is, it includes both local and traditional in recognition of "the fact that both indigenous and non-indigenous peoples have developed knowledge about the ecology of their local areas...."

Another recent term, "naturalized knowledge", has appeared in some writing. Naturalized knowledge is defined as:

> "An understanding of the land and interrelationships that comes from a long and intimate association – knowledge that comes from being part of an ecosystem. Naturalized knowledge includes traditional knowledge that is part of Aboriginal communities as well as informal knowledge from ranchers, farmers, fishers and naturalists." (Parks Canada Agency 2000)

Some Definitions of Traditional Knowledge

The government of the Northwest Territories uses this definition for Traditional Knowledge: "knowledge and values which have been acquired through experience,

observation, from the land or from spiritual teachings, and handed down from one generation to another" (GNWT 1997).

The Traditional Knowledge Working Group of the NWT said "*Traditional Knowledge* is knowledge that derives from, or is rooted in the traditional way of life of aboriginal people. Traditional knowledge is the accumulated knowledge and understanding of the human place in relation to the universe. This encompasses spiritual relationships, relationships with the natural environment and the use of natural resources, and, is reflected in language, social organization, values, institutions and laws" (Legat 1991).

As defined by the report of the Royal Commission on Aboriginal Peoples, traditional knowledge is:

> "a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment." (RCAP 1996)

Some Definitions of Indigenous Knowledge

Grenier (1998) says that " .... *indigenous knowledge* (IK) refers to the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area."

The managers of the *Indigenous Knowledge and Development Monitor* (IKDM 1993-) use the following definition:

> "The term 'indigenous knowledge' (IK) is used synonymously with 'traditional' and 'local' knowledge to differentiate the knowledge developed by a given community from knowledge systems generated through universities, government research centres and private industry. IK refers to the knowledge of indigenous peoples or any other defined community." (CIRAN 1997)

DeWalt, writing about local knowledge held by both indigenous and non-indigenous peoples, uses the term "indigenous knowledge" with McClure's (1989) definition:

> "indigenous knowledge systems are learned ways of knowing and looking at the world. They have evolved from years of experience and trial-and-error problem solving by groups of people working to meet the challenges

they face in their local environments, drawing upon the resources they have at hand." (DeWalt 1994, p.129)

The Quality of TEK

As mentioned earlier, the subject matter of TEK encompasses the natural environment. It includes knowledge about wildlife, botany, water, soil, climate and the human interaction with the natural world. Research in TEK covers those areas – the "what is known" – as well as how TEK works. Research in the latter area ventures into the study of learning systems, organizational studies, management systems and classification. Some researchers also work on verifying TEK through parallel research using other methods. Some work on integrating TEK and scientific knowledge, while others would like to see TEK stand on its own merits.

Traditional Ecological Knowledge provides for the identification and classification of ecological components, and contributes to understanding the significance of these elements of the environment. TEK has spatial and temporal components, including for example, knowledge of the location and timing of wildlife migration routes and habitat, ice conditions and berry patches. This knowledge is at many scales, from daily to seasonal and over many years, from very local to over hundreds of kilometres. Observations are cumulative as memories span decades and oral tradition spans generations, and will include understanding of normal variation in place and time of phenomena.

The use of TEK requires an understanding of how people perceive and use the environment. The political, social and cultural context is important. The TEK held by a particular group will usually be limited by that group's traditional land use area, and to what is observable by the people. The knowledge will not be uniformly held by all members of a group - gender, age, class and capability affect the type and quality of knowledge (Nuttall 1998).

An especially difficult issue for an outside researcher to overcome, because it is hard to notice, is that not all of the knowledge is explicit. The implicit knowledge of the informant can make it difficult to understand the parts of TEK that are shared explicitly (Grenier 1998).

TEK and scientific ecological knowledge

Several authors have drawn comparisons between indigenous or traditional ecological knowledge and scientific knowledge (Nakashima 1993, Mailhot 1993, Berkes 1993, Johnson 1992, DeWalt 1994).

There are many similarities between traditional and scientific ecological knowledge. The human mind strives to understand, to impose some order on the world, to pursue objective knowledge. Both TEK and science are made up of logical systems of organized knowledge, based on empirical data. Both use methods of observation,

comparison and classification, and both systems see nature as a system of relationships between organisms and their environment (Mailhot 1993).

The following table, drawn from three writers, summarizes some contrasts commonly drawn between traditional and scientific ecological knowledge.

Traditional Ecological Knowledge	**Scientific Ecological Knowledge**
Collected through observation and experience	Experimental and abstracted from context
Holistic - although individuals have specializations	Specialized and reductionist
Culturally compatible: the knowledge is developed in a social context	Cultural disjunctions - hierarchies and compartments
Oral	Written
Mostly qualitative	More quantitative
Collected by resource users	Collected by specialist researchers
Diachronic - knowledge based on collection over a long time, in a relatively small area	Synchronic: information gathered in a short time, but over a large area (although in some cases Inuit may have a greater geographic range than some scientific studies)
Explanation can be spiritual or magic, cumulative collective experience	Science avoids dealing with the spiritual
Slower to accumulate	Can accumulate quickly
Not equipped to test or verify	Incorporates a system of hypothesis testing
More attention is paid to behaviour in taxonomy	Uses a morphology based taxonomy

Traditional Ecological Knowledge	Scientific Ecological Knowledge
Intuitive - emotional involvement, subjective certainty	Analytical - abstracted, separation of observer and observed

Table 1 Comparison of Traditional and Scientific Ecological Knowledge
(DeWalt 1994, Johnson 1992, Mailhot 1993)

Such comparisons may be misleading, however. Neither the traditional nor the scientific knowledge is well characterised by the comparison drawn. First, the comparison made is between TEK and an ideal of scientific ecological knowledge. This ideal of scientific knowledge has some significant differences from the applied science as practised in the field by wildlife biologists. Applied wildlife biology or wildlife management is less experimental and more observation based than pure science. In some respects applied science is closer to TEK in that it involves both knowing and doing.

Second, the characterization of TEK does it a disservice. Traditional knowledge is more quantitative, analytical and experimental than it is often described (Nuttall 1998, Berkes 1999). The table thus might be said to indicate some tendencies rather than strong contrasts between the two knowledge systems.

More recently, there has been increased recognition of TEK as knowledge systems that deserve examination in scientific fora. Indigenous knowledge was discussed at the 1999 World Conference on Science, jointly sponsored by UNESCO and International Council for Science (ICSU), in Budapest. While there were objections from some

scientists, traditional knowledge remained on the agenda, and was again on the agenda of the ICSU meeting in Cairo later in the year (Nakashima and de Guchteneire 1999).

Another recent recognition of TEK's contribution to science came with the presentation of the Northern Science Award in January 2000 to a group of Inuit elders in Igloolik, Nunavut. These elders had been documenting their environmental knowledge for many years, some independently, some through interviews, and have created a repository of audio tape, maps and transcripts (McKibbon 2000).

Uses of Traditional Ecological Knowledge

The primary uses of TEK must remain the traditional, that is, related to the understanding of the environment of the people to whom the knowledge is traditional. As such it provides the structured information system that allows the people to survive, make their living and make sense of the world. TEK also offers knowledge that can be useful to resource managers, to researchers, to corporations and, potentially, in new ways to the community that holds it.

TEK offers ecological understanding including understanding wildlife interactions and behaviour, memory of past conditions and information on soil properties or plant characteristics. Mailhot (1993) identifies three areas of "practical application" of traditional ecological knowledge: development projects in the third world, management of renewable resources and environmental impact studies. Grenier (1998) cited several

other applications, notably the use of indigenous knowledge to identify medicinally important plants. Grenier also listed four areas of the use of "indigenous knowledge" within Canada: in improving scientific research; providing environmental baseline data; providing a decision making tool in environmental impact assessment; and in monitoring development impacts (Grenier 1998).

Environmental Impact Assessment

In northern Canada it is now common that TEK is considered when preparing an environmental assessment of a major project. Although there were some earlier attempts (e.g. Berger 1977), it is Nakashima's work on the Inuit knowledge about Hudson Bay eiders (Nakashima1991) that provided a model that has been followed and improved upon in subsequent projects (Stevenson 1996).

Mailhot (1993) wrote on TEK as a background paper to the Great Whale Environmental Assessment. The pursuit of diamonds in the latter part of the 1990s in the NWT has led to some intensive work on TEK collection and mapping. The West Kitikmeot Slave Study is collecting many kinds of environmental information, including a significant TEK component, in the area of the Slave Geological Province, a mineral rich area stretching from Great Slave Lake in the NWT to Kugluktuk in Nunavut (WKSSS 1999).

The Environmental Assessment Panel considering the Voisey's Bay Mine and Mill Project was instructed to "give full consideration to traditional ecological knowledge whether presented orally or in writing." Both the Innu Nation and the Labrador Inuit Association were involved. In its report, the Panel stated,

> "When Aboriginal knowledge was presented in technical hearings, the Panel considered it on the same basis as other expert information.... The Panel considers that Aboriginal knowledge was used effectively during the review, both in the technical and community hearings." (EAP 1999, p.10)

While policies require the inclusion of TEK in northern environmental assessments, there is little guidance on how to accomplish this. Usher, a member of the Voisey's Bay Panel, wrote that environmental assessment panels must decide themselves what TEK is and how to use it in their deliberations (Usher 2000). Usher states,

> "Although the general policy requirement is in place, its wording is neither clear nor consistent, and there is virtually no guidance on how to implement it in the public arenas where knowledge claims must be tested." (Usher 2000, p.184)

Issues of integration

It can be said that there are three ways for traditional knowledge to be integrated with scientific knowledge. These relate to the locus of integration – where the integration takes place. The most common situation is where a scientific researcher elicits ecological information from knowledgeable community members. In this case, the integration takes place in the researcher's mind and it is expressed by the researcher – often in a publication. The flip side of this situation is the one where the community acquires information from scientific sources and integrates this into their own knowledge.

A third way is through the agency of a forum, such as a management board or committee, that has members with both kinds of knowledge. Depending on the dynamics of the board or the skills of its members, there may be no individual that integrates the knowledge, and in fact there may be no integration of knowledge sets, but instead the two sets may go in separate streams into an integrated management system. There are advantages and disadvantages to each of the loci of integration.

> "Rather than lobby for the piecemeal adoption of TEK into the dominant western science or law, we could attempt to understand it as a whole. TEK is after all an approach to understanding and action that is culturally and geographically specific." (Doubleday 1993, p. 51)

It is important to understand TEK as a whole, but the use of TEK in a co-management system, a hybrid system, will inevitably require compromises. In order to work with two knowledge systems, the cooperative boards will have to develop enough understanding of both to find appropriate ways to mesh them.

Use of TEK without credit or publication

TEK has a history of use as a guide to scientists. For examples, in the 16th and 17th centuries, Dutch and Portugese botanists relied on the knowledge of indigenous peoples to help them describe and classify south-east Asian species (Ellen and Harris 1999). In the Arctic it is common for biologists to work with Inuit field assistants or guides. Frequently the biologist talks to their assistant and sometimes interviews other Inuit about the subject of their research, informally collecting Inuit TEK (Brewster 1997). In these examples and in many others the contribution of the indigenous knowledge is rarely credited (Ellen and Harris 1999).

In a documented example of this, Finley researched the bowhead whales in the Clyde River and Isabella Bay area on Baffin Island for many years. During that time he interviewed several elders on aspects of bowhead biology, behaviour and seasonal distribution (Finley 1994). In his description of the bowhead population of Isabella Bay for the journal *Arctic* he includes a long summary of the historical material from the whaler times, but he barely mentions the Inuit and makes almost no mention of the information he gathered from them (Finley 1990).

Finley is not unique in using Inuit knowledge to strengthen a biological study. He is one of a small group who has written on the value of that knowledge, albeit in a different publication. There are other, harder to document, instances where information from Inuit was presented in the final report as the observations of the scientist.

Academic work on TEK

The study of TEK crosses several academic disciplines. Because TEK is embedded in culture, it has been a subject of interest to anthropologists, and it continues to be so. Ecology is a subject for biologists and geographers, but academic ecologists have been slower than anthropologists to work with traditional ecological knowledge. The mechanisms of learning and transmitting TEK are of interest to educators, philosophers, psychologists and sociologists.

The interdisciplinary nature of the study of TEK may have discouraged some biologists, but academics with interdisciplinary interests have enjoyed the challenge. Geographers and researchers in environmental studies have been active in TEK study. The study of TEK is much enhanced by partnerships between the biologist and the social scientist (Johannes and Lewis 1993).

Milton Freeman, a biologist turned anthropologist, now at the University of Alberta, wrote:

> "More recently, many scientists have begun to understand that such traditional knowledge extends far beyond what in western science would be called descriptive biology, beyond knowing how to identify different species of animals, or describe their feeding, reproduction, or migratory behaviour. The knowledge possessed by such tradition-based, non-industrial societies is essentially of an "ecological" nature, that is to say, it seeks to understand and explain the workings of ecosystems, or at the very least biological communities, containing many interacting species of animals and often plants, and the determinative role played by certain key biological and physical parameters in influencing the behaviour of the total biological community." (Freeman 1992)

History of TEK research

Ethnographers have long documented the knowledge of indigenous peoples, with varying degrees of respect for the people and their knowledge. As early as the 16th century Portugese physicians were relying on indigenous knowledge to learn of the medicinal properties of plants (Ellen and Harris 1999). In the 19th and early 20th century the strongest research area was in the study of indigenous knowledge of plants as the field

of ethnobotany developed (Davis 1995). In the Arctic, Boas, Rasmussen and Steffanson documented Inuit environmental knowledge (Wenzel 1999).

Clément (1998) provides a useful history of the terms relating to ethnobiology dating back to the 19th century. He defines three periods in the history of ethnobiology: "pre-classical", "classical" and "post-classical". According to Clément, the pre-classical period lasted about a century ending in the mid-1950s. The ethnographer's focus during this period was on aboriginal use of plants and animals. The aboriginal knowledge itself was belittled or discounted. During Clément's "classical period" of the 1960s and 1970s, the focus was on how ethnobiology provided a way to study the aboriginal world view. Aboriginal knowledge, while respected more than previously, was still relegated to "folk-science". The post-classical period followed, with a multiplying of approaches (Clément 1998).

Two major directions in TEK formed in the late 1970s and early 1980s. One concentrated on the knowledge held by foraging cultures in the "developed" world. Prominent were studies involving the Inuit and Cree in Canada and aboriginal groups in Australia. The other direction was the study of the indigenous knowledge of agricultural cultures in developing countries in the tropics and sub-tropics (Healey and Hunn 1993).

While ethnobotany has been studied since the beginning of the 20th century (Davis 1995), Berlin's studies of Mayan taxonomic classification of plants have demonstrated the extent to which indigenous knowledge is systematic (Berlin 1973).

In Canada, the northern land claim process that began in the 1970s led to efforts to document land use through map based interviews. The large scale land use studies in the NWT (Freeman 1976), in Labrador (Brice-Bennett 1977) and in Nunavik (northern Quebec) (Kemp and Brooke 1995) disclosed a trove of related ecological knowledge. Many of the land use researchers continued their careers studying TEK.

In Canada, Feit (e.g. 1978) was one of the first to explicitly study Cree knowledge of their environment and management of wildlife. In the late 1980s researchers began using the term Traditional Ecological Knowledge (Freeman and Carbyn 1988). More attention has been paid to the value of this knowledge as a way to understand the natural world itself, and it is less studied in order to learn about the culture of the people who hold the knowledge.

Nakashima (1991) provided a highly detailed analysis of Inuit knowledge of eider ducks, including taxonomy, anatomy and ecology. Berkes demonstrates, in his continuing work among the Cree of James Bay and internationally, both the intrinsic value of the traditional knowledge, and its use in indigenous management systems (Berkes 1999).

By the late 1990s many researchers and writers were recognizing that TEK was an important body of knowledge that had some advantages over the knowledge otherwise available to the scientific community.

> "The idea that local experts are often better informed than their scientific peers is at last receiving significant acknowledgement beyond the boundaries of anthropology." (Scott 1996, p. 71)

In the late 1990s, the Nunavut Social Development Council (NSDC) developed a Nunavut specific version of Inuit traditional knowledge called "Inuit Qaujimajatuqangit" (IQ). The Nunavut government is attempting to use IQ as a basis for natural resource management (DSD 1999).

Review of Recent Work

Ten to fifteen years ago there was very little research that focussed on TEK (Grenier 1998, personal observation). In the ensuing years the published research has burgeoned. As an illustration of this I examined the reference list in a recent comprehensive book on the subject: *Working with Indigenous Knowledge: A Guide for Researchers* (Grenier 1998). Of 116 references in the book, only five predate 1987. A further six were from the late 1980s, 11 from 1990 to 1992, then 82 references were from 1993 to 1996.

A 1998 search on the Current Contents database resulted in 132 published articles on TEK related subjects over the previous five years. Clearly TEK research is a relatively new and growing field, with more than half of its literature published since 1993. Coupled with this rapid growth in publications, is a growing variety of research directions. Following are some of the major areas of study.

The study of traditional taxonomies is one of the oldest TEK research areas (Berlin 1973) and continues to provide a building block to the understanding of locally specific ecosystems and ecological knowledge (Nakashima 1990, Diamond and Bishop 1999). TEK is providing long term observations of the environment, including wildlife populations (Ferguson *et al.* 1998) and climate (Riedlinger 1999). It is being used in environmental assessment in northern Canada (Nakashima 1990, Sallenave 1994, Stevenson 1996, Sadler and Boothroyd 1994).

Some researchers continue to work on improving survey techniques and community involvement in collecting and using TEK (Martin 1995, Bulmer and Healey 1993, Huntington 1998, Tsuji 1996). Others are examining indigenous community rights to the intellectual property contained within their ecological knowledge (King 1996, Kothari 1997, Grenier 1998, WIPO 1999). Gender and power issues are of interest, as there are variations in the TEK held by different components of society (Appleton and Hill 1995, Ohmagari 1997, Grenier 1998).

Examples of TEK Research in Arctic Canada

Hudson Bay Eider Study

Following his research on the Inuit knowledge of eiders in Ungava Bay and Hudson Strait in the early 1980s (Nakashima 1986), Douglas Nakashima initiated a project to gather extensive ecological knowledge from the Inuit of Hudson Bay. In the mid-1980s, working with Inuit from four communities in eastern Hudson Bay, he collected traditional knowledge related to the common eider (*Somateria mollissima sedentaria*), initially as part of a study relating to the potential environmental impacts of hydro-carbon exploration (Nakashima and Murray 1988), then expanded for his Ph.D. thesis (Nakashima 1991).

This detailed study of the taxonomy, anatomy and ecology of the Hudson Bay eider illustrates the comprehensiveness of TEK. On the Belcher Islands, the Inuit knowledge of eiders is refined, subtle, structured and goes beyond the merely pragmatic. They have an understanding of eiders that is ecological. They understand the eider duck from its anatomy to its relationships with other species and to the rest of its world and to them (Nakashima 1991).

Knowledge of eiders was elucidated through semi-directive interviews, following many lines of enquiry. Inuit have a detailed taxonomy and the taxonomic relationships of the eider were determined. Detailed information on eider anatomy and behaviour was gathered. During the interviews seasonal distributions and relationships with other

environmental factors, including weather, tides, ice conditions and other animals were described and mapped. Inuit also demonstrated many of the products and uses of eiders.

The study illustrates the value inherent in Inuit knowledge, especially as a knowledge source additive to scientific knowledge. It used an effective methodology for gathering TEK and integrating it with other knowledge. It demonstrated the usefulness of mapping, and of cartographic technology such as a geographic information system (GIS), for interviews, analysis and displaying the results. The publication discussed some of the difficulties faced by TEK researchers. Finally, Nakashima found that some biologists badly underestimated and misrepresented TEK (Nakashima 1991).

Baffin Island Caribou

Between 1983 and 1994, Ferguson *et al.* collected Inuit knowledge of caribou (*Rangifer tarandus*) on Baffin Island. Michael Ferguson, the principal researcher, is the regional biologist for the territorial government and has been resident in the eastern Arctic for almost two decades.

This research project involved many interviews with 43 elders and active hunters, over 12 years and in many communities on southern Baffin Island. Through the period of the study, the interview protocol was refined considerably. The project documented variations in caribou populations and distribution over southern Baffin Island for a 100 year period (Ferguson and Messier 1997, Ferguson *et al.* 1998).

The study illustrates the long term nature of traditional ecological knowledge, not only is it a product of years of experience, but it can recall those years in some detail. The oral record is able to recall events from longer ago than that, as is illustrated by the history Inuit were able to recount to Charles Francis Hall about Frobisher's expedition to Baffin Island almost three centuries earlier (Symons 1999).

The study also showed the extent of quantitative data Inuit could provide. From the interview data, population growth rates could be estimated. The shifts in population density were tracked with some precision. The predictive ability of Inuit TEK was also tested, as a 1985 prediction was proven accurate in the ensuing years (Ferguson *et al.* 1998).

One of the purposes of the work was to develop a useful methodology. While they succeeded, the authors had some cautioning words:

> "To successfully adapt and carry out this methodology with other indigenous peoples or for other wildlife species, researchers need a sound understanding of the cultural basis of aboriginal knowledge. Whenever ecologists undertake such efforts, the onus will be on the researchers to conserve the accuracy and precision of aboriginal knowledge, and to understand the assumptions in each culture that could lead to either enlightenment or misunderstanding." (Ferguson and Messier 1997, p.27)

The Hudson Bay TEKMS Study

In the early 1990s the Canadian Arctic Resources Committee and the Environmental Committee of the Municipality of Sanikiluaq launched an ambitious project to study the Hudson Bay bio-region. The Hudson Bay Programme produced eight technical papers on various aspects of the Hudson Bay environment. One of these papers, *Traditional Ecological Knowledge of Environmental Changes in Hudson and James Bays*, is the result of a broad study of Cree and Inuit TEK (Arragutainaq *et al.* 1995). The findings are summarised in *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion* (McDonald *et al.* 1997).

Inuit and Cree in communities in Quebec, Ontario, Manitoba and the Northwest Territories (now Nunavut), at the invitation of the mayor of Sanikiluaq, participated in a large regional study called the Hudson Bay Traditional Ecological Knowledge and Management Systems (TEKMS) Study. The study collected knowledge of ecosystem components and environmental changes of significance to Cree and Inuit over the past 50 years.

Eight communities hosted regional working group meetings between November 1992 and December 1993. 1,800 pages were translated and transcribed from 114 sixty minute audio-cassettes from the meetings and workshops of the study. Over 110 map overlays of the TEK themes were produced, organized in a Geographic Information

System (GIS). In all, there were 140 TEK themes and 433 individual GIS files organized by theme and community group.

The GIS TEK database includes information from nine elements: wildlife locations and movements, coastal features, tides and currents, wind directions, sea ice conditions, culturally important sites, areas affected by hydroelectric development, human activities that are altering environment and forest fires areas (McDonald *et al.* 1997).

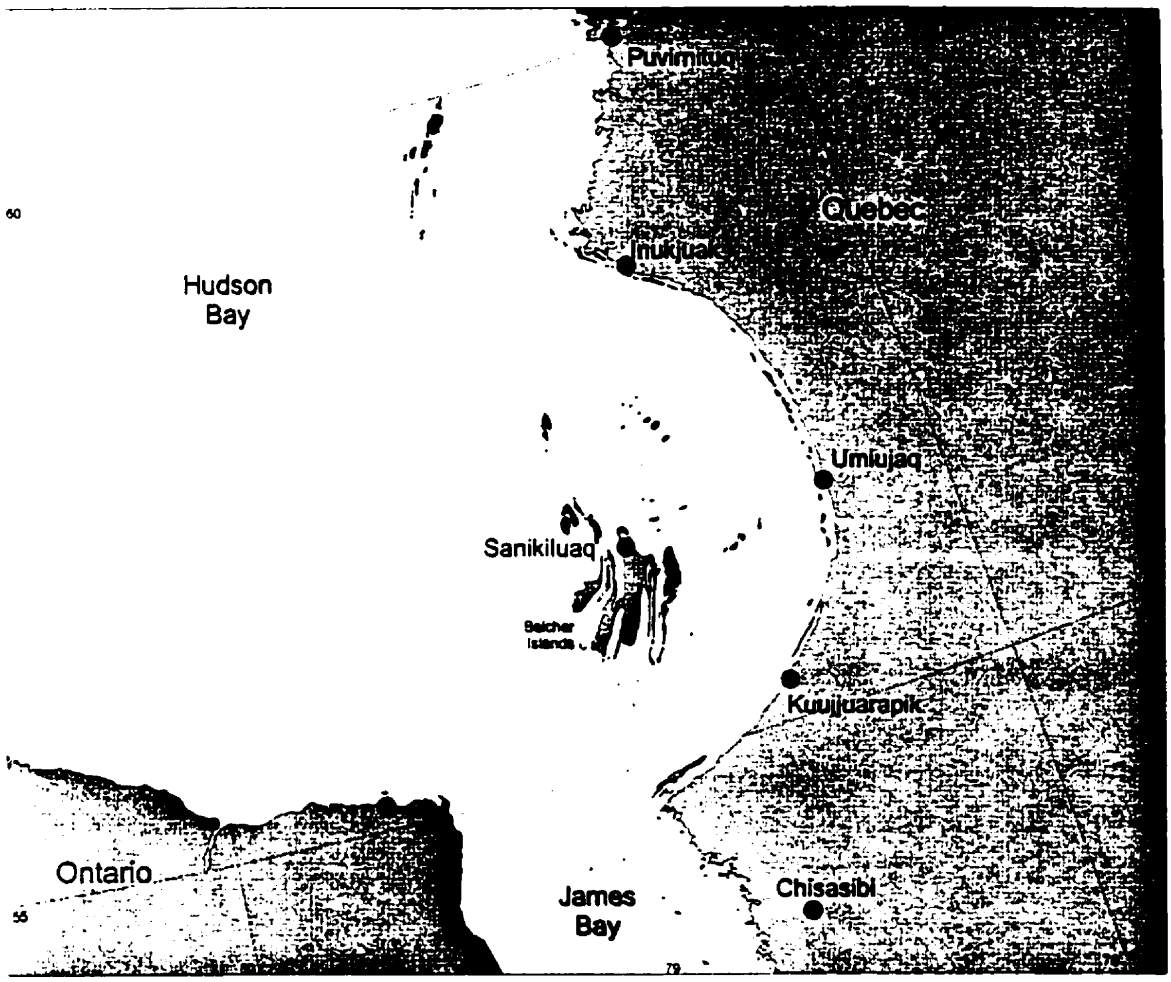
Chapter 3 Ecology of Eastern Hudson Bay Beluga Whales (*Delphinapterus leucas*)

Background

In the previous chapters traditional ecological knowledge was defined and described and some brief examples provided. This chapter provides a specific example of the contribution TEK can make in understanding ecosystems and individual species. In a 1983 project, not previously reported, I collected and summarized some aspects of Inuit knowledge of the ecology of beluga whales in the Belcher Island area of eastern Hudson Bay.

Sanikiluaq, Nunavut, is an Inuit community on the northern end of the Belcher Islands in Hudson Bay. The Inuit of the Belcher Islands have close ties to the Inuit of Nunavik, especially to those in the communities of Kuujjuarapik, Umiujaq and Inukjuak. At the time of the interviews Sanikiluaq was in the Northwest Territories.

The author gathered information on the subject of beluga whales from Inuit hunters in interviews held in Sanikiluaq between 24 November and 6 December, 1983.



Note: The islands of Hudson and James Bays are part of Nunavut Territory.

Illustration 1: The communities of eastern Hudson Bay

Methodology

Inuit hunters' knowledge of beluga whales was elucidated through semi-directive interviews. The interviews were not tape recorded. Information was recorded in handwritten notes and on 1:250,000 scale maps. The interviews were conducted with the aid of an interpreter. Two interpreters worked on the project; the interpreter for several interviews was a young woman, and for the others an older, blind man. The eight elders interviewed were unilingual Inuktitut speaking men. All were experienced beluga whale hunters.

Summary of interview information

Winter

There are few whales in the Belcher Islands area during the winter. It is possible to see a few whales off of the ice edge north of Flaherty Island during the winter. The hunters think that the whales spend the winter to the north of the archipelago, although in some years some whales are blocked by ice conditions and spend the winter in the Belcher Island area. In those years it appears that the whales are stopped by ice in the north, blocking their migration, so they pass through the Belcher Island area going south, presumably to spend the winter somewhere to the south. According to one source there are no whales off the ice edge in January and February. According to another it is in January and February that one is most likely to find whales off the ice edge.

Spring

In May and June more whales are seen off the ice edge, and there are many whales in the Belcher Island area when the ice breaks up in June. The whales follow the cracks in the ice as they appear. They have young with them and they have dirty skins. While there is ice around the whales do not respond when hunters attempt to herd them by shooting into the water. The whales do not stay in the Belcher Island area long in the spring. Once the coastal river mouths are open the whales leave the Belchers going south, heading to the rivers to change their skins.

Summer

Some belugas stay near the ice around the Belchers and shed their skins. They rub on the ice. Some are seen on top of the ice and sometimes calves are seen on the ice floes. After they have changed their skin they rub on the ice or on the bottom to "polish it up". This rubbing is often done in large groups and it looks like a game. Most belugas go to the rivers on the coast to change their skins. They don't leave the rivers until their skin is completely white. In August, after changing their skins, the whales come back to the Belcher Island area. Here they feed, mainly on sculpin, in shallow areas. If there are no sculpin they eat cod. As is the case with other marine mammals, whales do not feed during the moult and they are thin when they come back to the islands. The whales are present throughout the Belcher Islands in late summer and fall, with no strong concentration areas. There are some preferred feeding areas, shallow areas with lots of sculpin.

Autumn

Whales remain around the islands until late October and early November. They usually leave towards the north. In some years small groups of whales get caught in the north ends of bays and get frozen in. The belugas can break through ice up to four inches thick. They use their heads to push against the ice and they use their breath in some cases, blowing on the ice from below to weaken it.

General Observations

In the summer of 1983 there was a Canadian Coast Guard vessel in Eskimo Harbour doing hydrographic work. The presence of this ship was said to be the principal cause of the low numbers of belugas caught that season.

Several of the hunters said that belugas have very good hearing and that the use of outboard motors has caused the whales to avoid the area of the community. The noise is blamed for the lack of whale sightings. It has been noted by the hunters that whales seem to have better hearing than seals. It is also noted that belugas have good eyesight both above and below water.

There is something in the ear of belugas that is harmful to humans. It can cause serious illness. Thus when a whale is killed the ear portion is cut out and discarded.

There are some very large, old male belugas that excrete a green substance from the anal area. The green substance is like paint and the whales are called "minguarutilik", which means whales with paint. They do not respond to gunshots and their flipper ends are bent right up and back toward the body in a 180° curve.

Those hunters with experience both in the Belcher Islands and along the Quebec coast say that there is no difference between the whales in the two areas.

Discussion

An earlier beluga study on the coast of northern Quebec had concluded that the eastern Hudson Bay beluga population was low enough that the level of harvest could be unsustainable (Finley *et al.* 1982). That study was based on an aerial survey along the coast of Quebec and observations from a station at the mouth of the Nastapoka River. It had been assumed that the belugas kept close to the shore and that insignificant numbers of belugas spent time off shore or near the Belcher Islands. Clearly, some of those assumptions were incorrect.

The Inuit information showed that many belugas spent time away from the coast, and that they often stayed near the ice edge. The scientific literature did not recognise the moulting behaviour until several years later. The Inuit of Sanikiluaq provided a wealth of information on belugas that, if it had been sought out before the earlier study, would have significantly changed the study design and would have produced much better results. The

cost of these interviews was much less than the scientific research effort. The Inuit provided significant ecological information that could not have been observed or concluded from an aerial survey and a one season observation camp.

Chapter 4 Calls for the use of traditional ecological knowledge

Support and Commitments to TEK

As academics, governments and non-governmental organizations (NGOs) came to recognize the potential value of traditional ecological knowledge in the 1980s, there have been increasing numbers of statements calling for increased study, understanding, documentation and use of traditional knowledge. Indigenous groups have issued many statements and declarations that have included references to the importance of their knowledge (e.g. see Posey 1999a). Governments and NGOs have issued policy statements regarding the use of TEK, most of which include commitments to respect, integrate or use traditional or indigenous knowledge.

The rise of interest in TEK has roughly parallelled that of the new term "sustainable development", and the two are seen as complementary to each other. Sustainable development requires the consideration of environmental, social and economic factors. TEK provides insight into environmental issues, and recognizing TEK can have the effect of empowering indigenous peoples, contributing to social development initiatives. At international, national and regional levels environmental or sustainable development policy statements include references to the importance of recognizing and using TEK. "The use of traditional knowledge is increasingly recognized as a key to sustainable development." (Davis and Ebbe 1995)

Similarly, TEK is recognized as complementary to biodiversity. TEK is developed by a variety of peoples living within a variety of ecosystems. The development and retention of TEK requires cultural and biological continuity and diversity, and TEK, in turn, may provide the tools to conserve the ecosystems. Posey states:

> "..... the best way to conserve the diversity of cultures and nature is through the empowerment of the people and peoples whose local knowledges and experiences form the foundations that conserve much of the earth's remaining biological and ecological diversity" (Posey 1999b p.549).

Organizations vary in their expressions of support for TEK. In some cases there is a commitment to integrate or harmonize TEK with other sources of knowledge (ICC 1992, CAFF 1997), in others there is a call to respect, preserve, maintain and promote it (UNEP 1992), and in others the commitment is to use TEK in managing natural resources (Canada 1995, DSD 2000). Whether stated explicitly or not, the common theme of the commitments to TEK is one of using it along with scientific ecological knowledge, either integrating the two to form a new knowledge set or using both as inputs to decision making in order to achieve a form of integrated resource management.

International Agreements

The Convention on Biological Diversity

The World Council on Environment and Development recognized the value of indigenous peoples' knowledge, expressed first in "Our Common Future" (WCED 1987) and reiterated in Agenda 21. Agenda 21, section 15.4 (g), called for research on traditional methods and indigenous knowledge (IDRC 1993a). The call for recognition of indigenous knowledge was entrenched in the Convention on Biological Diversity, one of the most significant international environmental agreements, in June 1992.

The commitment to indigenous knowledge is in Article 8 of the Convention on Biological Diversity, entitled "In-situ Conservation". Specifically, Article 8 (j) calls on each of the contracting parties to:

> "Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices" (UNEP 1992).

The Convention on Biological Diversity has generated much interest in and research on IK and TEK. To complement the *Global Biodiversity Assessment* (Heywood 1995), the United Nations Environment Programme (UNEP) published a comprehensive volume entitled *Cultural and Spiritual Values of Biodiversity* (Posey 1999a). This publication documents the connection between cultural and biological diversity, provides context to the issues surrounding the implementation of Article 8(j) of the Convention on Biological Diversity and makes a strong case for greater action to support minority and indigenous cultures.

United Nations Convention to Combat Desertification

This convention incorporates reference to tradition and local knowledge in several areas. Article 18(2) includes the recommendation ".... to protect, promote and use traditional and local technology, knowledge, know-how and practices relevant to combatting desertification and mitigating the effects of drought" (UNCCD 1994).

The Convention on Wetlands, Ramsar

The Convention on Wetlands was signed in Ramsar, Iran in 1971. In May, 1999, at the seventh meeting of the contracting parties to the convention, the conference passed Resolution VII.8 on local communities and indigenous people. Resolution VII.8 encourages the involvement of local communities and indigenous people in wetland management. It recognizes the validity of indigenous knowledge and recommends that planning and management be done cooperatively ".... to ensure that the best available

science and local knowledge are taken into consideration in making decisions." In the annex to that resolution, the parties agree that "local environmental knowledge can make a significant contribution to wetland management strategies, especially when blended with the best available science" (Ramsar 1999).

Canadian Commitments to TEK

Canada is a signatory to several international agreements that include commitments to traditional knowledge. In 1992, Canada was the first country to sign the Convention on Biological Diversity (IDRC 1993b). Canada is also a signatory to the Convention to Combat Desertification and the Ramsar Convention on Wetlands.

The Wildlife Policy for Canada

Even before these international obligations Canada had officially recognized the value of the traditional knowledge of its aboriginal peoples. In 1990 the federal, provincial and territorial government ministers responsible for the management of wildlife met and agreed on a Wildlife Policy for Canada. In that policy they recognized that "Aboriginal peoples have used wildlife sustainably for centuries and possess unique and intimate knowledge of the wild resources on which they depend" (WMCC 1990 p. 16).

In article 5.3 of the Wildlife Policy for Canada the ministers agreed that:

"Governments and aboriginal peoples should work together cooperatively to ensure that the special knowledge and understanding of wildlife that aboriginal people have is reflected in management and education programs." (WMCC 1990 p.17)

And in article 9.4 they agreed that:

"The knowledge of aboriginal peoples and other users of wildlife should be actively sought to complement scientific research." (WMCC 1990 p.25)

Canadian Biodiversity Strategy

Canada's response to the Convention on Biological Diversity, in addition to signing and ratifying it, was to develop its own *Canadian Biodiversity Strategy* (Canada 1995). In its section on Ecological Management the strategy refers to the Convention's article 8(j), and affirms the potential value of traditional knowledge. It also recognizes that "all too often, however, traditional knowledge is inappropriately used or disregarded by policy makers, scientists, resource planners and managers."

Strategic Direction 2.3 of the strategy commits government to: "Identify mechanisms to use traditional knowledge, innovations and practices with the involvement

of the holders of such knowledge, innovations and practices, and encourage the equitable sharing of benefits arising from the utilization of such knowledge, innovations and practices (Canada 1995 p. 49).

In addition, the *Canadian Biodiversity Strategy* includes the section entitled "Indigenous Community Implementation" that relates to the continuing use of resources by indigenous peoples, as per Article 10 of the Convention on Biological Diversity. Within this section the strategy stresses the need for the use of traditional knowledge, and expresses this in the strategic directions, especially in strategic direction 7.1(b): "demonstrating the role of indigenous knowledge and management in the conservation and sustainable use of biodiversity, and establishing opportunities for indigenous communities to share their knowledge of biodiversity and the management of biological resources with non-indigenous communities." (Canada 1995 p.71)

Federal Sustainable Development Strategies

All Canadian federal government departments and agencies prepared Sustainable Development Strategies (SDS) in 1997 in response to an amendment to the Auditor General Act. Several of these SDS included commitments to working with TEK in some form.

Of note is the two-volume SDS for the Department of Indian Affairs and Northern Development (DIAND) which includes a reference to traditional knowledge in its

message from the Department's then-Minister Jane Stewart. This SDS includes references to traditional knowledge and to TEK in the consultations and make commitments to its use in the action plan. DIAND makes a clear link between its commitments and Article 8(j) of the Convention on Biological Diversity (DIAND 1997).

While it is laudable for DIAND to acknowledge a commitment to TEK in its SDS, DIAND has limited responsibility for many of the natural resource management issues within the Territories. DIAND is responsible for land-use management in the Territories and administers the *Territorial Lands Act and Regulations*, several other acts that regulate mining and mineral exploration, the *Yukon Waters Act*, the *NWT Waters Act* and the *Nunavut Waters Act* (DIAND 1998). However, wildlife management is primarily the responsibility of either Environment Canada or territorial governments, and the marine environment is the responsibility of the Department of Fisheries and Oceans (DFO).

In marked contrast to the DIAND, Environment Canada (EC) makes no commitments to working with or respecting traditional knowledge in its SDS. In fact, EC sets a goal of using scientific knowledge in decision-making and to spread the scientific word. The section of the SDS that described the consultation leading to its preparation acknowledged that aboriginal people had expressed the importance of traditional knowledge. However, this did not translate into any commitment in the SDS (Environment Canada 1997).

DFO is another federal department with a significant natural resource management role. Traditional knowledge was recognized in the DFO sustainable development strategy which states, "We have learned that the Fishery for the Future must have a reliable base of scientific, traditional and local knowledge to ensure accurate assessment of fish stocks" (DFO 1997). Within the DFO SDS, listed in the goals section under the goal of "Understanding our oceans and freshwater ecosystems", DFO commits to: "Whenever possible, continue to incorporate information from fishers when assessing fish stocks by conducting sentinel surveys and by increasing use of traditional knowledge." (DFO 1997)

The Canadian International Development Agency, operating in the context of international development, understands the need to know local environments and situations. CIDA's SDS makes reference to its *Guideline to Environmental Assessment and the use of Traditional Knowledge* (CIDA 1997).

CIDA supports the International Development Research Centre (IDRC) which in turn has recognized the value of TEK and supported its incorporation in development projects. The "IDRC also funds a network of environmental action centres in five countries ..... to support research on biodiversity and traditional knowledge." IDRC found ways in which it could contribute to Agenda 21 through the support for traditional or indigenous knowledge (IDRC 1993a). IDRC also published or supported some of the

important work and publications referred to in this thesis (e.g. Johnson 1992, Inglis 1993, Grenier 1998).

Territorial Government Commitments

Northwest Territories

The strongest support for traditional knowledge has come from the Northwest Territories through its Traditional Knowledge Policy 52-06. This policy was first brought into force in 1993 and was amended in 1997. It is the responsibility of the Department of Resources, Wildlife and Economic Development to ensure that the policy is adhered to, but all Territorial government departments are bound by it.

The summary statement of the policy says:

> "The Government of the Northwest Territories recognizes that the aboriginal peoples of the Northwest Territories have acquired a vast store of traditional knowledge through their experience of centuries of living in close harmony with the land. The Government recognizes that aboriginal traditional knowledge is a valid and essential source of information about the natural environment and its resources, the use of natural resources, and the relationship of people to the land and to each other, and will incorporate traditional knowledge into government decisions and actions where appropriate." (GNWT 1997)

Nunavut

The NWT traditional knowledge policy was created before the creation of Nunavut Territory so it applied to both the present NWT and to Nunavut, and until it is replaced it continues to apply in both jurisdictions. The government of Nunavut is presently working to develop a Nunavut specific policy.

The word used for the concept of traditional knowledge in Nunavut is "Inuit Qaujimajatuqangit" (IQ). Pronounced roughly as "Inuit cow ye maya took an geet", IQ means "that which are long known by Inuit". The Nunavut government and the Nunavut Social Development Council (NSDC) are working to develop the concept and to integrate IQ into the operations of the government. Working groups have been formed and the Department of Sustainable Development of the Nunavut government has developed an IQ Framework (DSD 1999).

The vision statement for the Department of Sustainable Development reads:

> "The Department of Sustainable Development .... seeks balanced development, through the integration of environmental stewardship, community economic development, and people in partnerships. Working with Institutions of Public Government, the Department uses monitoring, good science and Inuit Qaujimajatuqangit in the co-management of Nunavut's wildlife and its habitat."(DSD 2000)

The Circumpolar Arctic

Inuit Circumpolar Conference

The Inuit Circumpolar Conference (ICC) represents Inuit from around the Arctic: Greenland, Canada, United States and Russia. It has "permanent participant" status at the Arctic Council. The ICC has long been a proponent of TEK and has urged its use and integration into wildlife and resource management.

Inuit Regional Conservation Strategy

During the 1980s, the ICC developed a conservation strategy for the circumpolar lands inhabited by Inuit, from Greenland to Siberia. The strategy set forth an ambitious program that required significant input of Inuit traditional knowledge. The strategy called for the development of a register of Inuit experts, a manual of Inuit management and a database on arctic resources. The manual and the database were to have used both scientific and traditional sources (Doubleday 1990).

While this effort has been overtaken by other factors, including the settlement of land claims in Canada and the formation of the Arctic Council, several aspects of it have been subsumed into or taken on by other programs. For example, The Nunavut Planning Commission is attempting to develop a database on arctic resources. DIAND administers the "Northern Information Network" on the internet (DIAND 2000). The Nunavut government, through its IQ project, is essentially trying to develop a manual of Inuit management, albeit just for Nunavut. The Joint Secretariat of the Inuvialuit Final

Agreement has undertaken harvest and land use research and maintains a GIS database for the use of the various co-management bodies of the IFA. Makivik Corporation was a pioneer among Canadian land claim organizations to develop GIS technology to manage the land use databases developed in the 1980s (Kemp and Brooke 1995).

Arctic Policy

The Inuit Circumpolar Conference "Principles and Elements for a Comprehensive Arctic Policy" includes guidance on how Inuit traditional knowledge should be used. In the section entitled "Principles and Elements on Renewable Resource Management" the policy states:

> "Inuit Traditional knowledge and scientific research are both valid systems of knowledge that should be integrated and harmonized within the context of cooperative research. In light of increased resource development and environmental degradation, resource managers must have access to the best possible information relating to terrestrial and marine ecosystems on which to base their decisions." (ICC 1992 p.45)

In the section entitled "Principles and Elements on Northern Scientific Research" the policy states:

> "It is recognized that the physical, biological and health sciences, as well as social and behavioural sciences, can all potentially contribute in significant ways to information and knowledge about the Arctic. However, both "scientific" opinion and Inuit knowledge and experience have validity and, therefore, should be utilized. If the objectives of northern research are to be achieved, both types of knowledge must be appropriately integrated within a framework of cooperative research. Effective systems to collect and classify Inuit knowledge, particularly in regard to northern resources, the Arctic environment, and Inuit culture must be further developed." (ICC 1992 p.143)

ICC provides further guidance in various publications and on its website. In its 1998 conference the ICC voted to adopt Resolution 98-04 (ICC 1998) which resolved that:

> "ICC approach organizations for funds to establish a task force to work with Inuit in order to strengthen Inuit systems of management and knowledge"

and that:

> "ICC encourage Inuit to direct their representative organizations to promote and develop Inuit systems of management and knowledge within existing cooperative management structures by advancing culturally appropriate terminology, concepts and procedures that reflect Inuit values, world views and ways of knowing and doing."

The Arctic Environmental Protection Strategy and the Arctic Council

In 1989, the "Finnish Initiative" brought the eight arctic nations – Finland, Sweden, Norway, Denmark, Iceland, Canada, United States and the Soviet Union – together to discuss and work on issues of common interest relating to the arctic environment. One of the products of this collaboration was the Arctic Environmental Protection Strategy (AEPS), adopted in a 1991 agreement signed in Rovaniemi, Finland, in which the eight nations agreed to a process of "consultation, information sharing and scientific cooperation".

The eight nations have taken the AEPS model of cooperation farther with the agreement to form the Arctic Council. The Arctic Council was established in September, 1996 as a high-level intergovernmental forum. The same eight nations are the members of the Arctic Council, although the Soviet Union has been replaced by the Russian

Federation. In addition four indigenous groups have the status of permanent participants, and several other groups come as observers.

As part of the AEPS, and continuing under the Arctic Council, a number of working groups have been set up to work on specific environmental issues. Two of these are the Conservation of Arctic Flora and Fauna working group (CAFF) and the Arctic Monitoring and Assessment Program (AMAP) (Mullen 1994). CAFF has supported seminars on TEK in Iceland and in Inuvik, as well as TEK research on beluga whales (CAFF 1997, Huntington *et al.*1999).

Circumpolar Conference on Sustainable Development in the Arctic

Held in Whitehorse, Yukon in 1998, the conference "Ways Ahead" Arctic Sustainable Development Conference brought together policy makers from around the Arctic to debate and decide on the "Ways Ahead" for the sustainable development of the circumpolar Arctic. Among the recommendations arising from this conference were several that strongly endorsed a role for TEK. Some of the recommendations from the conference include:

- "Integrate cultural diversity, traditional knowledge, scientific and holistic principles, and continuous learning to develop management structures.
- Foster acceptance and recognition of traditional knowledge within the Western scientific community.

- Allow time for scientific and traditional knowledge to meld, and use them both in northern education curricula.
- Encourage the preservation of traditional knowledge at all levels, showing its environmental, cultural and economic benefits.
- Create an Arctic University to develop human resources and use of traditional knowledge."

Conclusions

Over the past decade there have been strong, high-level commitments among most of the organizations involved in managing arctic ecosystems. The organizations use different words, but they all expect some type of integration of traditional ecological knowledge with its scientific equivalent. While the NWT's Traditional Knowledge Policy provides the most detail, none are very specific in how traditional knowledge is to be used.

Chapter 5 TEK Expectations: the gap between hopes, commitments and reality

The Integration Question

In Chapters Two and Three the value and potential applications of traditional ecological knowledge were described and illustrated through examples. In Chapter Four many organizational commitments to the use of TEK were outlined. Given its potential and its political support it could have been expected that by now TEK would be in everyday practical use in natural resource and environmental management. But is it?

There have been a number of initiatives and many studies and publications on TEK over the past 15 years. Some writers have expressed the optimistic opinion that the use of TEK has been well accepted by the scientific community. "Recognition of the invaluable contribution that can be made by "traditional knowledge" has been strengthened by the acceptance of the scientific community of the worth of such knowledge for improving and conserving the natural environment."(IDRC 1993a p.81)

In spite of such statements, the application of TEK has been uneven and incomplete. The *Canadian Biodiversity Strategy* recognizes that "all too often, however, traditional knowledge is inappropriately used or disregarded by policy makers, scientists, resource planners and managers" (Canada 1995).

At the international level, the Global Biodiversity Forum found that even by the time of the fourth meeting of Conference of the Parties (COP4) of the Convention on Biological Diversity in 1998, there remained problems in implementing Article 8(j) in Party countries.

> "Yet the programme of work that is to be presented to COP4 this week fails to address the knowledge, innovations and practices of indigenous peoples and local communities." (GBF 1998)

In the concluding chapter of the UNEP publication *Cultural and Spiritual Values of Biodiversity* Posey states "Traditional Ecological Knowledge is still not recognized for its worth, or taken seriously by the scientific, development and political communities" (Posey 1999b p.549).

Literature Analysis

In order to assess the ways that TEK has been accepted and the barriers that remain I analysed the publication record on TEK and related terms such as traditional knowledge and indigenous knowledge. A general rule of the academic world is that if knowledge has value it is published. If wildlife management textbooks incorporate a discussion of how to work with traditional knowledge, then it can be said that TEK is becoming an accepted way of learning about the natural world. If not, professional wildlife managers will continue to consider TEK an issue that is not pertinent to wildlife

management. Similarly, the type of journals to publish articles relating to TEK indicates the segments of the academic world that are accepting, or at least discussing, TEK.

Textbooks

Because TEK is a relatively new area of interest to natural resource management one might expect that older textbooks do not address TEK issues. On the other hand textbooks written in the last five years could be expected to refer to TEK in some way. There have been relatively few textbooks published in that time. However an examination of five university level textbooks is telling.

Three of these are wildlife management texts for students in the biological sciences (Bolen and Robinson 1999, Caughley and Gunn 1996, Caughley and Sinclair 1994). The fourth is a text on integrating the social sciences with ecosystem management (Cordell and Bergstrom 1999). The last of these five textbooks is on resource and environmental management and is used in geography and environmental studies classes (Mitchell 1997).

The three wildlife management texts (Bolen and Robinson 1999, Caughley and Gunn 1996, Caughley and Sinclair 1994) made no mention of TEK. Even the text on integrating the social sciences with ecosystem management (Cordell and Bergstrom 1999) included no mention of traditional ecological knowledge, and barely a recognition that local people could provide insight into ecological questions in its 330 pages. On the

other hand, the text by Mitchell (1997), *"Resource and Environment Management"*, devotes an entire chapter to "Local Knowledge Systems".

Journals

Publication searches

A 1998 search of the "Current Contents" database of recent publications turned up 132 journal articles on TEK themes, including Traditional Ecological Knowledge, Traditional Ecological Paradigm, Indigenous Conservation, Indigenous Ecological Knowledge, Indigenous Historic Resource Management, Indigenous Knowledge, Indigenous Knowledge Systems, Indigenous Land Management, Indigenous Land-use Practices, Indigenous Natural Resource Management, Ethnobiology, Ethnobiological Notes, Ethnobotanical Approach and Ethnobotany. The use of the term "traditional ecological knowledge" is a minority used in seven of the 132 articles. "Indigenous knowledge" was used in 37 articles. About three quarters of the articles were on ethnobotany.

Cambridge Scientific Abstracts (http://www.csa2.com) provides an index and search function for journal articles in several fields of biology and ecology. Under the heading "Biological and Medical Sciences" there are several options. Searches were done in the "Biological Sciences", "Conference papers", "Biological Digest" and "Plant Science" data bases, in January 2000. An ecology subset of the Biological sciences data

base was also searched. The search results in the ecology abstracts were more rewarding and closer to the subject matter of interest to this thesis.

Ecology abstracts

The Ecology subset of the biological sciences data base was searched for articles that had appeared in journals since 1980 with the phrase "traditional knowledge", traditional ecological knowledge" or "indigenous knowledge". Another search sought articles containing both the words "indigenous" and "knowledge".

Seven articles were found with references to "traditional ecological knowledge", five of which were in the journal *Arctic*. These were all published between 1997 and 1999.

Sixteen articles referring to "traditional knowledge" were found, four of which were in *Arctic*. Two of the *Arctic* articles were also listed in the "traditional ecological knowledge" search results.

The search for "indigenous knowledge" produced 11 articles, one of which was from *Arctic* and that also showed up in the "traditional knowledge" search results. No other article in this group was in the previous two result groups. Thus 31 articles included at least one of the three phrases.

As a check, a search for articles containing both "indigenous" and "knowledge" but not necessarily in order found 52 articles. Of these, 10 were in the "indigenous knowledge" results group (one of the 11 in the "indigenous knowledge" group was a "recent" article that somehow was missed in this search). Four of the articles were also listed in the Traditional Knowledge group, one of which was in both the Traditional Knowledge and Indigenous Knowledge groups. 27 of the articles had no connection to the subject. These articles pertained to such subjects as, for example, "scientific **knowledge** of **indigenous** species".

The boolean search for "indigenous" AND "knowledge" turned up a total of 12 new articles. Thus 43 articles relating to TEK were found in the ecological abstracts indexed by Cambridge Scientific Abstracts. More thorough search techniques should find more articles, but this provides a fairly good estimate of the publications in the journals.

Relatively few of the 43 articles are in the "hard" biology journals. Almost half (19) were published in just four interdisciplinary regional journals; eight of the articles were in *Arctic*, six in *Human Ecology*, three in *Geojournal* and two in the *Journal of Arid Environments*.

Eleven articles were published in the six journals that are more specialized in ecology, zoology and science: three in *Biodiversity and Conservation*, two in

Environmental Conservation, two in *Journal of Environmental Management*, one in *Ecological Applications*, two in *Ambio* and one in the *Journal of Zoology*. The remaining 13 articles were found in 12 other miscellaneous journals.

Biological Sciences Abstracts

The Biological Sciences Abstracts were searched for all three search terms at once, using the boolean statement: traditional ecological knowledge OR traditional knowledge OR indigenous knowledge. I did not perform the search for "indigenous" AND "knowledge". The result was a list of 70 articles in 50 journals. The relatively low number of publications contrasts markedly with the results of literature searches on the same terms outside of the biological sciences.

Arctic Science and Technology Information System

The Arctic Science and Technology Information System is a database maintained and made available on the internet by the Arctic Institute of North America and the Canadian Polar Commission (http://www.aina.ucalgary.ca/astis/). It indexes publications and reports pertaining to all aspects of the Arctic, not only those in science and technology as its name might suggest. Under the subject heading of "traditional knowledge" ASTIS recorded 73 references, but under "indigenous knowledge" there were 1,158 references. Some of these were not actually publications, however, so a refined search was conducted. This search revealed that there were 777 publications on the subject of indigenous knowledge between 1980 and 1999 indexed in ASTIS. A further

search for publications on the subject of indigenous knowledge that were found in the "Ecology" subject area of ASTIS revealed 242 references.

The ASTIS database is focussed on arctic material, and it is therefore a small subset of all that is being published on TEK. Clearly a lot is being written about indigenous knowledge. It is also clear however, that of the many references, relatively little of the indigenous knowledge research is being published by the biology journals.

Publication problems

With a few exceptions, the specialist biology and ecology journals have not published TEK articles. Similarly science journals, even relatively popular ones such as *New Scientist* have rarely mentioned TEK. After years of ignoring it, *New Scientist* published two TEK based reports in 1998 (Mulvaney 1998, Edwards 1998). There are some biologists doing TEK research and writing about it, but biologists who wish to publish research based on traditional ecological knowledge generally find a multi-disciplinary journal, such as *Arctic*, to publish in or downplay the TEK portion of their research.

There are several examples of biologists working in TEK publishing their TEK papers in different journals than their non-TEK papers. Michael Ferguson is a biologist with the Nunavut government. His research on caribou ecology from Inuit sources was published in *Arctic* (Ferguson and Messier 1997, Ferguson *et al.* 1998), but related

articles subsequent to the same research, published in *Geoscience Canada* (Ferguson 1996) and the *Journal of Wildlife Management*, have focussed on statistics, aerial surveys and satellite telemetry (Ferguson 2000). The latter articles referred to Inuit knowledge as predictions that were verified through the field work.

Leonard Tsuji is a biologist at York University. He has published several papers on sharp tailed grouse in science journals such as *Canadian Field-Naturalist* and *Wilson Bulletin* (Tsuji 1994, Tsuji *et al.* 1995, Tsuji *et al.*1996). His work on Cree traditional ecological knowledge of the sharp-tailed grouse was published in the *Canadian Journal of Native Studies* (Tsuji 1996).

One of the rare exceptions to the general rule of scientific publications ignoring TEK was the inclusion of Inuit ecological knowledge of eiders in the Canadian Wildlife Service (CWS) report *Eider Ducks of Canada* (Nakashima 1986). Subsequent CWS species overviews have not included TEK.

Environmental Impact Assessment

The environmental assessment of projects in Canada's north is governed by the *Canadian Environmental Assessment Act* and land claims requirements. Most land claims have provisions for joint screening and assessment through a co-management board and in most cases public involvement in the process is sought. In recent years,

significant progress has been made to incorporate traditional ecological knowledge into the process (DCI 1994, Stevenson 1996, Usher 2000).

For example, in Labrador, the Voisey's Bay nickel mine and mill proposal was subjected to an environmental review, and the Review Panel required the application of traditional knowledge of both the Labrador Innu and Inuit. A significant TEK research effort resulted in an important source of ecological information that informed the decisions of the Panel. The recommendations of the Panel clearly reflect information they received from the Innu and Inuit (EAP 1999).

The environmental assessment for the Ekati diamond mine on Lac de Gras in the NWT made significant use of TEK. Inuit and Dene land use and ecological knowledge was collected and mapped. The original assessment has been enlarged to a regional study that considers the West Kitikmeot region of Nunavut and the Slave geological province of the NWT (north of Great Slave Lake and east of Great Bear Lake). The West Kitikmeot Slave Study works with information from Dene, Inuit and scientists to understand an area with several proposed gold and diamond mines (WKSSS 1999). The use of TEK in the Ekati mine environmental assessment process prompted a public debate as a negative reaction from Howard and Widdowson was responded to by several writers (Howard and Widdowson 1996, 1997, Abele 1997, Berkes and Henley 1997, Stevenson 1997). This debate is discussed briefly in Chapter Six.

Co-management and TEK

One highly touted method to integrate traditional knowledge is the creation of cooperative management regimes. Featuring advisory boards of four, six or more members, with membership from government and Inuit, these regimes are a feature of all the modern land claims in northern Canada. Several writers have proposed that such boards or committees are necessary for the use of TEK (e.g. Nakashima 1991). While co-management boards may indeed be necessary to the appropriate use of TEK, they are not sufficient in and of themselves to appropriately bring forward TEK to the management table.

> "Considerable confusion exists in government agencies about the way in which TEK should be integrated into land-management processes, with many agencies viewing indigenous participation on management boards as constituting adequate use of indigenous knowledge." (Duerden and Kuhn 1998 p.35)

On the other hand, Ken East, a superintendent with Parks Canada writing about the cooperative management regimes of Canada's northern national parks, considers the joint management boards as means of mediating interests. He did not mention the potential for tabling traditional knowledge (East 1991).

The political context, the somewhat adversarial structure and the time constraints of meetings are not conducive to bringing forward detailed and possibly sensitive

knowledge. The members appointed to these boards cannot be knowledgeable about all of the TEK of the communities. In some cases aboriginal members are appointed more for their English language skill or knowledge of government than their environmental knowledge. In recent years, some recognition of these difficulties in addressing TEK has led to new work to collect TEK for the use of the management boards.

Boards in the Inuvialuit Settlement Region and Nunavut

In the Inuvialuit Settlement Region, the area of the Western Arctic (Inuvialuit) Land Claim, there are several such boards: the Wildlife Management Advisory Council (North Slope)(four members), the Wildlife Management Advisory Council (NWT) (six members), the Fisheries Joint Management Committee (six members), the Environmental Impact Screening Committee and the Environmental Impact Review Board. Each of these boards has equal numbers appointed by the Inuvialuit Game Council and by government. In addition to these numbers, a chair is selected jointly (IFA 1984).

In Nunavut the boards are considered "Institutions of Public Government". The Nunavut Wildlife Management Board has nine members, four Inuit, four government and a chair. The Nunavut Water Board and the Nunavut Impact Review Board each have nine members with the same structure as the Nunavut Wildlife Management Board. The number of members of the Nunavut Planning Commission varies with a minimum of four and an equal number of government and Inuit nominations (NLCA 1993).

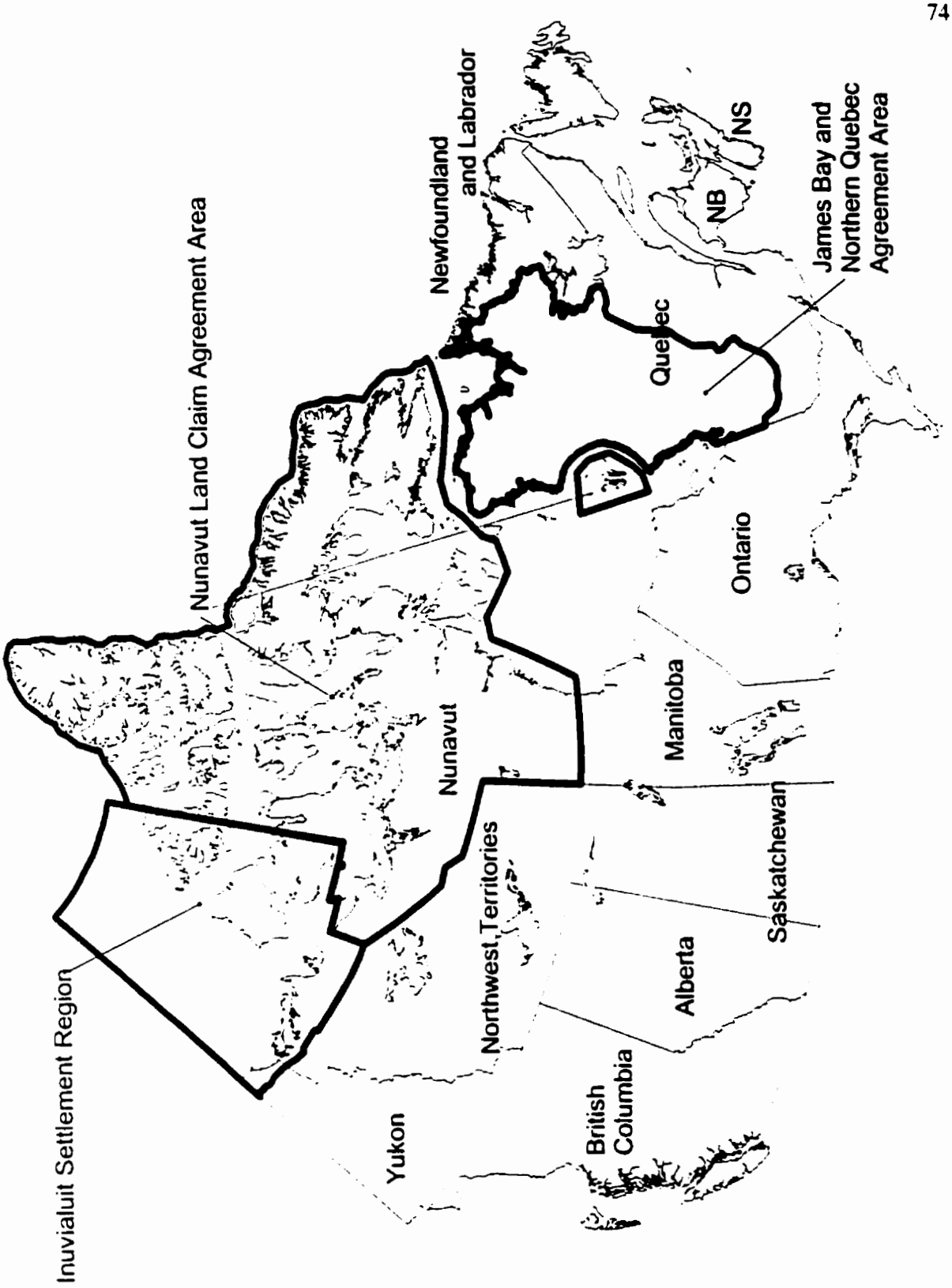


Illustration 2: Three land claim agreement areas involving Inuit in Canada.

Chapter 6 Barriers: Why is TEK still underutilised?

There appear to be six major barriers to the development of TEK and its integration and its use. The first of these is the resistance of the scientists to TEK as a source of knowledge. The second is that TEK is not an easy subject to conduct research on. It can be expensive and time consuming, and it demands special skills. In addition to that, the third barrier comes from the political issues encountered when working in TEK. These issues include intellectual property rights and who is the appropriate broker of TEK. The fourth barrier is also an incentive to work quickly – many indigenous cultures are changing so quickly that traditional knowledge is being lost. The fifth barrier, the development of powerful technologies that increase the range of what can be known leaving the impression that TEK is quaint and old fashioned, can provide a potential opportunity – some of the technologies can aid in recording TEK. The final barrier is that of budget constraints. While all research is subject to budgetary pressures, the recognition of TEK has come at a time of more significant budgetary restraint than was the case in the decades prior.

Reason 1: Resistance of Biologists

Passive Resistance and lip service

The repeated statements of value and the commitments to work with TEK seem to be hollow promises as there remain problems in integrating TEK with science. In certain academic and government circles the support for TEK is more in words than in action or

budget. "For example, Mary Simon notes that indigenous peoples' knowledge gets 'a lot of lip service'." (Tennberg 1996 p. 27)

There are several barriers to acceptance of TEK by biologists. Scientists are skeptical about information from "non-scientific" sources. There are cultural and language barriers and biologists are often untrained and unprepared for working in a cross-cultural context. Many scientists do not respect TEK (Nakashima 1991).

Most often the resistance to TEK is subtle and difficult to document. It is evidenced more by omission than active challenge. As shown in Chapter Four the publishing record indicates that there is relatively little interest in the biological community in researching or publishing TEK. While TEK articles are being published in greater numbers and more frequently outside of the anthropology journals, the articles are most often in multi-disciplinary or regional journals. The biology journals have rarely published TEK based articles.

Active Resistance

No prominent biologist working in the Canadian Arctic has published articles opposing traditional knowledge, and several have written of the value of TEK as a source of good information (e.g. Welch 1995, Gunn *et al.* 1988, Ferguson and Messier 1997, Ferguson *et al.* 1998). In 1996, however, there was a spirited attack on the NWT's Traditional Knowledge Policy in the pages of *Policy Options* (Howard and Widdowson

1996, 1997). The authors are of the view that traditional knowledge poses a threat to environmental assessment because it is "based on spirituality". Their analysis shows a marked lack of understanding or familiarity with TK, and was criticised strongly (Abele 1997, Berkes and Henley 1997, Stevenson 1997), but the article may reflect some of the unwritten attitudes that continue to exist in the scientific and government communities.

Reason 2: TEK is Hard to Document

Time and money

Freeman (1979) suggested that TEK could provide quality wildlife monitoring at a fraction of the cost of the scientific techniques. While subsequent studies have proven the quality of TEK, the cost of collecting useable TEK is much higher than Freeman had anticipated.

The process of collecting and documenting TEK takes time and can be expensive. Ferguson *et al.* spent over 200 hours in interviews, up to 800 person-hours in translating and transcribing and at least a person year in data analysis and interpretation (Ferguson *et al.* 1998). In addition, there were other costs, such as the logistical efforts of communicating with the community, arranging the interviews and travelling between communities. Huntington, working on belugas in Alaska, does not summarize the research effort or cost of his, but clearly significant time and energy went into it. Five weeks were spent on the original interviews, almost a year in analysis and a second round of visits to each community (Huntington *et al.*1999).

The Hudson Bay eider study by Nakashima similarly required many weeks of interviews, data analysis and review. The study entailed over 80 interviews, with over 50 individuals, with over 200 hours of interview time. There were five trips to Sanikiluaq, two to Inukjuak and one to Kuujjuarapik (Nakashima 1991).

My own research in Sanikiluaq, even though it was a relatively small scale study with only eight informants, required almost two weeks in Sanikiluaq and months afterwards working with the information. In addition, it required more than a week for the interpreters and several hours for each informant. The costs of the multi-year region research programs such as the Hudson Bay TEKMS programme and the West Kitikmeot Slave Study are in the millions of dollars (McDonald *et al.* 1997, WKSSS 1999).

The cost of conventional scientific fieldwork is also very high. It is difficult to compare costs due to the differences in information gathered, but it is not hard to argue that TEK is good value. On the other hand, organizations must be prepared to make a significant investment if they intend to collect TEK.

The Ethnobiologist's Dilemma(s)

The process of acquisition of knowledge is an incremental one. To learn a new fact one needs a prepared mind and to ask a useful question an interviewer must be informed. In addition, the informant must feel that their information will be both

respected and understood. In any attempt to draw information from an informant, it is necessary for the interviewer to demonstrate an understanding of the subject matter.

This principle was dubbed the ethnobiologist's dilemma by Jared Diamond in an article in *Natural History* (1989). In that article, Diamond describes how his auto mechanic cut short his detailed description of a car's mechanical problem upon noting his client's incomprehension. His subsequent very cursory explanation serves as an example of how informants are less likely to share information with those unlikely to understand. Diamond continues with an example from New Guinea where indigenous people were willing to share information about birds with an ornithologist, but were not willing to share information about rocks, given that the ornithologist had not demonstrated any knowledge of rocks. When these people met a geologist who did show knowledge of rocks, they quickly demonstrated their own knowledge.

In another example from New Guinea, Diamond and Bishop write of the Foré people's knowledge of mushrooms that they had not previously demonstrated because "they had seen for themselves that Diamond knew a lot about birds but that he was ignorant about mushrooms, so they considered it a waste of time to go to the effort of giving him information he was incapable of understanding." (Diamond and Bishop 1999 p.19)

A related dilemma arises from the fact that the mix of skills that TEK research requires is not generally taught in universities. The subject matter of TEK research requires a knowledge of ecology. In addition, the interviewer will require interview, cross-cultural and interpersonal skills and training and, in many cases, an understanding of the language of the informant. In other words, the researcher must be an ecologist with anthropological training, linguistic ability and an adaptive personality. One solution to this dilemma can be to take a team approach, with ethnographer and ecologist working together with the community (Johannes and Lewis 1993).

Validation problems

For an outside researcher, it can be difficult to determine how much weight or trust to put in an individual's information.

> "Intellectual ability, observational powers, curiosity, memory and ability to communicate vary widely between people in all societies. One or two individuals may know more about a particular subject of interest than the rest of the community combined. (Johannes and Lewis 1993. p.106)

Methods of validating information differ between knowledge systems. In the scientific world, knowledge is shared at conferences and through refereed publications where the sources of information, the methods of research and the writer's credibility are generally known. Sources and methods are published along with the research paper. For

a scientist, TEK is problematic when it comes without some of that "meta-data". Simple observations related by an observer are more readily accepted than more interpreted information.

There are methods for validating traditional knowledge. Some of these include determining community respect for the informant, obtaining multiple corroborating observations and testing the informant through asking questions to which the answer is known (Johannes 1993, Grenier 1998).

Informant fatigue

An issue that has begun to crop up in some communities may be seen as a sign of growing interest in TEK. Some elders are being subjected to repeat interviews on various subjects and are beginning to be reluctant to provide more information. There are a few exacerbating issues: interviewers who ask questions in a manner that is disconcerting, inconsiderate or exhibiting a lack of understanding; interviews that take a lot of time with no recompense; lines of inquiry that have political implications; and inquiries into subjects considered to be confidential in some way.

Another factor relates to the ethnobiologist's dilemma. Not only does an informed interviewer elucidate better information, but the informant is happier to give the information and is more likely to participate in future interviews. Uninformed questions and TEK projects that are thought to be unproductive will reduce informant motivation.

Reason 3: Complexity: or More Issues than Had Been Thought

TEK as a system

Over the past decades, TEK researchers have obtained a greater appreciation for TEK as a system of knowledge. TEK is more than just a set of information. It structures the information and connects it to the life of the community. The analogy that TEK is a storehouse holding ".... as much understanding of nature as is stored in the libraries of modern science" (Durning 1992) may give the impression that its environmental information can be treated like a commodity. This would be a mistake.

> "If the sharing of knowledge were to be reduced to a skimming-off by Western specialists of indigenous empirical insights, and their insertion into existing Western paradigms, then it would be an impoverished and failed exchange that would ultimately contribute to undermining indigenous societies and cultures." (Scott 1996 p.71)

> "Of course, if indigenous knowledge is conceived as just another information set from which data can be extracted to plug into scientific frameworks of understanding, then we do not trouble the scientific worldview. However, this practical approach—that of the pharmaceutical industry or of conservation ecologists who validate traditional information and use it to attain pre-defined ends—may threaten the integrity of traditional knowledge systems. On the other hand, if science is seen as

> one knowledge system among many, then scientists must reflect on the relativity of their knowledge and their interpretations of 'reality'. For the survival of traditional knowledge as a dynamic, living and culturally meaningful system, this debate cannot be avoided." (Nakashima and de Guchteneire 1999)

However, recognising that traditional knowledge must be treated as a system, TEK research can become daunting. For a researcher trained in biology, and willing to respect information from local or aboriginal informants, the added effort of trying to understand the traditional knowledge system might be beyond their abilities or interest.

Power relations

> "*The question of indigenous knowledge concerns power: demanding the use of indigenous knowledge is a demand that the power base be shared.*" (Tennberg 1996 p.26)

In Canada the demands for the recognition of traditional ecological knowledge started in a highly political context, the negotiation of land claims, and land claim based organizations continue to advocate the role of TEK. The call for the use of TEK is often part of the call for co-management, a sharing of the "power base". While, it may be true that co-management is necessary for the appropriate use of TEK, it is not sufficient. TEK

is more than the knowledge of a representative or two on a board or committee, and it requires other means to work with it.

> "In the current situation within the AEPS (Arctic Environmental Protection Strategy), the institutional aspect of knowledge is dominant. The institutional dimension means that representatives of indigenous peoples' organizations are considered experts whose knowledge and expertise can and will be used in the AEPS. By claiming the knowledge is 'indigenous' the basis for using this knowledge is political." (Tennberg 1996 p.26)

The use of TEK is fraught with the issue of who has a right to know and to use the TEK of a community. Community representatives, land claim organizations and co-management bodies may be able to negotiate as to how the knowledge is to be interpreted and used. In the absence of such organizations, and where they are not consulted, the collection and use of TEK might not be beneficial to the community (Dutfield 1999, Agrawal 1999). Gathering and publishing TEK may "protect" the knowledge from loss in an absolute way, but it is not necessarily protected in a way useful to the community. In some cases the result can be more knowledge appropriation than knowledge protection. The involvement of the community is important for context, for political appropriateness and to recognize the ownership of the intellectual property (Agrawal 1999). The issue of

intellectual property is discussed further in the following sections. The debate over TEK has at times focussed on the knowledge at the expense of the community.

> "Indigenous participants in the workshop on **Traditional Knowledge and Article 8(j)** characterized the present discussion around protecting and maintaining the knowledge, innovations and practices of indigenous peoples and local communities as one that has blurred the distinction between the legitimate owner of a house and someone who has broken into the house to rob it." (GBF 1998)

Problems with the proponents

Some of the distrust of TEK seems to arise from a reaction to the tone of the rhetoric of its supporters. "This literature has often been ignored by agricultural scientists because of the sometimes missionary fervor with which proponents preach the virtues of indigenous knowledge systems." (DeWalt 1994 p.123)

As well, it has been cast as politically correct or expedient, implying that the interest in it is more for political motives than for any real validity to the knowledge. An example of this disparaging attitude is found in a review of Agenda 21 for the International Development Research Centre (IDRC):

> "The document contains a liberal sprinkling of politically correct rhetoric about consulting with indigenous people, learning from traditional methods of biodiversity conservation and sustainable biological resource use, and recognizing the particular role of women." (IDRC 1993a, p.112)

Intellectual Property Issues

In the late 1970s, some providers of TEK were concerned about whether their information would remain confidential. For example in some cases there was apprehension that maps of animal habitat might be used by outsiders to exploit resources such as fishing areas. At the time the issue was confidentiality. In the 1990s the question was recast as one of ownership of intellectual property. Intellectual property issues are now a significant area of TEK work (Grenier 1998, WIPO 1999, Dutfield 1999).

Pharmaceutical companies use TEK to aid in "bio-prospecting" to develop commercial products from plants and animals. To this end, biologists enlist the aid of indigenous people in finding and exploiting potentially valuable species. This ethnobotanical knowledge is therefore valuable, and while it is a form of intellectual property, it has been problematic to use existing intellectual property legislation to ensure appropriate compensation is awarded for its use. TEK is held by communities, while intellectual property laws assume individual ownership (WIPO 1999). Several researchers are involved in the study of indigenous rights to intellectual property within TEK (King 1996, Posey and Dutfield 1996, Kothari 1997, Grenier 1998, WIPO 1999).

Reason 4: Erosion of the Source — Elders and Lifestyles Passing

"*When a knowledgeable old person dies, a whole library disappears.*" (An old African proverb quoted in Grenier 1998 p.1)

The world is facing a loss of cultural diversity that is possibly greater than that of biological diversity. Indigenous cultures are in a period of extreme change, traditional lifestyles are being abandoned and indigenous languages are being forgotten. Krauss estimates that 3000 out of the total of 6000 languages in use in the world today will pass out of use with the passing of the present generation of adults (Krauss 1992, in Zent 1999). Many writers mention this loss as the most serious threat to traditional knowledge (Zent 1999, Grenier 1998).

Grenier cites some of the factors that contribute to the loss of indigenous knowledge as population growth and migration, market orientations, new products, deforestation, disruption of oral communication, rapid change in an oral culture, traditional network disruption (Grenier 1998). Zent refers to the number of writers calling for the study and preservation of indigenous "ecological wisdom" and coins the term the "Ethnoecological Imperative" to express the urgent need to document and conserve traditional or local environmental knowledge and management systems before they are gone forever (Zent 1999).

Nakashima (1991) however, argues that the loss of traditional knowledge is a myth or at least a "serious distortion of reality" that is based on the misplaced notion of aboriginal society as static, and on the failure to recognize that traditional knowledge is not just accumulated and held by individuals, but is shared and transmitted. Aboriginal society has always been faced with change, and the knowledge of the society has changed through time – has evolved to meet the challenges of the new situations. While an elder's life store of knowledge is unique, many of the parts of it will have been shared within the community. The most important aspects will be held within the community when the elder dies.

Nakashima notes that the myth of the "Last Elder and the Demise of Tradition" has outlived several generations of elders and once again today's elders are seen as the last representatives of the old way of life. "Ironically, each generation of scientists finds its own group of "last" elders to fret over." (Nakashima 1991 p. 249)

It is possible that the pressures on Inuit traditional knowledge, where Nakashima was working, are less than those on the indigenous knowledge of the peoples of the tropics, where Zent, Grenier and many other writers have more experience. Zent's own study of the erosion of ethnoecological knowledge among the Piaroa people of Venezuela provided ".... at least tentative support to the hypothesis that ethnobotanical knowledge is declining in the acculturated environment." Clearly, the question bears closer scrutiny,

for as Zent notes, ".... surprisingly few studies have focused explicitly on knowledge loss ...." (Zent 1999).

In this discussion, however, we have missed the primary point – does the potential loss of traditional knowledge pose a barrier to its use? It should not. If anything, the potential of loss of a knowledge source should be an incentive to act quickly to learn from it.

Reason 5: Competing Technologies

The growing recognition of TEK has been over the same period as growth in technology-driven knowledge. New technologies have allowed research and management programs to develop in some new directions. TEK as a knowledge source is competing for attention and budget with technological sources of information such as remote sensing, satellite tracking, genetic typing and trace chemical analyses. Up to the 1950s the indigenous peoples' techniques of observation were similar to those of the visiting scientists, as both used the body's senses and personal experience. The new technologies allow new kinds of observations and consequently have led to the devaluing of experience-based knowledge. In addition, information technology influences the data types and formats collected. For example, computer hardware and software now allow increasingly complex statistical models. These models require data in certain formats, and TEK is marginalised when it does not provide them.

The technological revolution has another effect though. It has provided some tools that have enabled communities to more effectively document and store information based on traditional knowledge. Geographical information systems are used by many Canadian aboriginal organizations to manage their TEK databases (Poole 1995, Kemp and Brooke 1995). Mass communication tools have enabled some groups to get the message of their knowledge to a global audience (Brosius 1997).

Reason 6: Budget Constraints

For Canadian federal and provincial governments, and many of the world's governments, the 1980s and 1990s were times of economic restraint. The broader recognition of TEK came at a time of reduced government funding for ecological research and management. Thus, TEK proponents have had to compete for funds from a shrinking pool. In a time of new money for new initiatives, management agencies welcome new ideas, but biologists and wildlife managers faced with reduced budgets have been reluctant to cut back farther on their ongoing programs in order to launch new initiatives, especially when their expectations for the success of a TEK project are low.

Chapter 7 Conclusion

Summary

The predictions that traditional ecological knowledge is on the verge of becoming important – that TEK will transform the understanding of ecological systems and management of natural resources – continue to be made. It seems that every few years there is another breakthrough, another call to action and another commitment by a government agency to respect and integrate TEK. However, the lesson of the past twenty years tells us that it will not be fast and it will not be simple.

In recent years, TEK has gone from being largely unrecognized to something of a *cause célèbre*. Governments have made commitments to use and respect TEK. It has received endorsement from international, national and regional organizations. It is recognized as having an important role in global sustainable development.

In the same period, significant research projects have revealed the value of TEK. From single species such as caribou or eider ducks, to the ecosystems of Hudson and James Bay, the potential contribution of traditional knowledge has been documented. Similarly, TEK is making contributions to environmental assessment.

The numbers of articles published on TEK has grown quickly. There is a dedicated journal, the *Indigenous Knowledge and Development Monitor* (IKDM 1993-), available by subscription or on the internet, and TEK based research is being published

more and more frequently in interdisciplinary journals. On the other hand, the publication record still shows that TEK is not important to the environmental and natural resource management sciences, and is less frequently published in those journals.

The barriers to the understanding and use of TEK are not trivial. Perhaps the most significant barrier is that biologists resist the inclusion of TEK in their work. There may have to be a "changing of the guard" before TEK becomes more widely accepted in that community. The other barriers, while difficult, might be overcome in a shorter time. Documenting and applying TEK requires significant time and financial resources and specific skill sets. There are many issues tied up in TEK research, including power relations and intellectual property rights. There are problems in some areas as rapid culture changes may be attenuating some groups' knowledge. Competing technologies and budget constraints limit the funding for work with TEK.

> "While these barriers are real, there is a growing interest in overcoming them among scientists and policy makers as well as Aboriginal people involved in economic development planning, environmental protection and wildlife management." (Sallenave 1994)

Unfortunately, although there is growing interest, progress is slow. After twenty years of hard work and optimism of some dedicated researchers and policy makers, TEK is still on the margins, on the verge of the mainstream. TEK has not been accepted yet as

a valued source of environmental information, awareness and understanding – not by most biologists and ecologists, and not by publishers of scientific texts and journals. TEK is rarely published in the core conservation biology and ecology journals. TEK has made inroads but its use in natural resource management decision making is relatively minor.

The majority of academic interest in TEK is in anthropology and ethnology, not biology and natural resource management. With a few exceptions, TEK continues to be marginalised by conservation biologists and ecologists in government and academia. While there is little outright criticism, there is also very little research involving, or respect for, other peoples' ecological knowledge. The academic consideration of TEK is taking place outside of the biology and wildlife management departments and journals.

The situation is not a simple polarization with the biologists on one side and the anthropologists on the other. There is middle ground between the biology and anthropology camps. Interdisciplinary studies, such as geography and environmental studies and regional journals, such as *Arctic*, are now providing fora for serious consideration of TEK as important environmental information. It appears as though an intellectual cross-fertilization may be taking place, and that greater understanding of TEK is diffusing from the social to the environmental sciences.

Recommendations

Train TEK researchers

It is important to have more biologists and ecologists working, in partnership with communities, on TEK projects. For this to happen, biologists must develop a better appreciation and understanding of the value and complexity of TEK and its related issues. In an effort to develop such understanding, university biology departments could offer courses in TEK related subjects or develop biology major programs that combine courses in other departments, such as geography and anthropology.

According to the Society for Economic Botany, there are presently 90 universities in the world that offer undergraduate level classes in ethnobiology (SEB 2000). These courses should be expanded in biology, wildlife management and environmental studies departments.

Publish TEK

Further publications could encourage the understanding of TEK as a source of environmental knowledge. The *Indigenous Knowledge and Development Monitor* (IKDM 1993-) is an important resource, but it reaches only those already interested in traditional knowledge. In addition, it covers a very broad range of subjects, beyond the ecological. The *Journal of Ethnobiology* (JOE 1980-) has been published by the Society of Ethnobiology since 1980 and often prints articles on TEK, but its focus is more on culture than ecological knowledge.

Certainly it is important that interdisciplinary journals, such as *Arctic*, continue to publish TEK articles. It would be refreshing if the conservation biology and ecology journals were to begin publishing such articles as well.

Perhaps there is enough interest and enough work deserving publication to support a journal of "environmental knowledge". It would be a vehicle for presenting environmental information, knowledge and wisdom from many traditions.

Pursue ecological research based on TEK

Good, basic documentation of TEK on many subjects is lacking. TEK based research can provide understanding of the range of ecological components such as climate, tide, soil properties, plant characteristics, species interactions and wildlife behaviour. Documentation of traditional ecological knowledge on a variety of subjects must continue. TEK-based wildlife studies, such as the caribou research of Chapter Two (Ferguson and Messier 1997, Ferguson *et al.* 1998), will help to validate TEK to the wildlife biology community at the same time as they increase the share of ecological knowledge. Similarly, ecological inventories of areas, such as national parks or conservation areas, cannot be considered complete without the input of local people's TEK.

In addition to such basic research, work can be done to reduce some of the barriers mentioned in Chapter Six. It is especially important to continue to work to understand

the complexity of working with TEK. Better understanding of the barriers to the use of TEK should provide the basis for more realistic expectations and allow for the development of tools and strategies to overcome some of the problems.

Outlook

Traditional ecological knowledge continues to be used in its original context as local and Aboriginal people apply and recreate their knowledge of the environment in their daily lives. Their information and insight will continue to be valuable to them. The question remains: to what extent will the larger society respect, use and support TEK?

Recent signs of growing acceptance of TEK, including its inclusion at the World Conference on Science (Nakashima and de Guchteneire 1999), publications in *Arctic* (e.g. Ferguson *et al.* 1998) and Nunavut's Inuit Qaujimajatuqangit program (DSD 2000), give cause for hope. However, there have been many such apparent breakthroughs over the past 20 years. Progress is undeniable, but it continues to be slow. The management of natural resources involves traditional ecological knowledge to a greater extent where political forces have mandated it, such as the areas of settled land claims and in Canada's Territories, but even in these places, TEK is usually marginalised.

While there is room for some optimism there remains the fact, demonstrated in this thesis, that TEK is marginalised from the mainstream of conservation biology and

natural resource management. The barriers described in Chapter Six are significant and must be recognised before they can be overcome.

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